The Digital Workshop in collaborative learning

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Abstract

The Digital Workshop is a MediaWiki based computer supported collaborative learning environment. It is used in several courses given at the Radboud University in Nijmegen. It was introduced as an open digital environment where students can create assignments. If such assignments are made by a group then making such assignments can result in collaborative learning. Collaborative learning is often used to refer to situations where both collaboration and learning take place. Collaboration can help trigger more learning mechanisms, which should result in more effective learning. Since the Digital Workshop is also used for group assignments, it can also function as computer supported collaborative learning environment.

This research looks at the role of the Digital Workshop plays in the Research & Development 1 course. The main assignment in this course is a large research & development project. The students will make most of this project in the Digital Workshop. First, this research will look at the functionality of the Digital Workshop. This functionality will be evaluated on the basis of theory on collaborative learning. This evaluation will be used to make a theoretical analysis of the Digital Workshop.

This research will also analyze the activity in the Digital Workshop and the communication of three groups working on this project. The communication functions as the most important indicator for collaborative learning. The history files of the Digital Workshop will be analyzed to study the use of the Digital Workshop. Interviews will be used to study the communication outside the Digital Workshop.

The results of these studies are used to evaluate the Digital Workshop as a computer supported collaborative learning environment. The functionality of the Digital Workshop suggests that the Digital Workshop's primary function is that of both an online document repository and an online text editor. The research will confirm this. However, the Digital Workshop does play a role in the communication of the students. But this role is limited. This is because the Digital Workshop only facilitates asynchronous communication. The exchange of viewpoints, central in collaborative learning([17]), requires fluid communication, which requires synchronous media. The open nature of the Digital Workshop facilitates internalization, a form of collaboration. This research concludes that the Digital Workshop does play a role in the collaborative learning of the students. It also concludes that the course setup plays an at least equally significant role. This research also suggests several improvements that could help improve the Digital Workshop on several fronts.

Introduction

Problem Area

There is a great interest for collaboration in the field of education. In many courses students have to work together on projects . They have to communicate, schedule, organize etc.. These are all valuable skills that will be critical in their professional lives. *Pierre Dillenbourg*([16]) But can the project be designed in such a way that the students actually "learn" together? This means that the students won't only learn the skills required to work together. They will also learn more effectively than when they would be learning alone. This is what "collaborative learning" concerns itself with. It tries to determine the optimal conditions for learning tasks that involve group work. ([17], pg. 4) It looks at many factors like group size, location but also at the task itself. ([17], [16]) The aim is find out when collaborative learning results into more effective learning than individual learning and how a learning task should look like to assure collaborative learning.

But collaboration isn't only interesting to the field of education. People collaborate with other people because a group can do more than an individual. The whole concept of an organization is based on this idea. ([15], [1]) The IT field acknowledges the importance of collaboration by creating software to support collaboration or by enabling collaboration over distance. ([40], pg. 148) This is done by creating software that allows multiple people to work on the object and enables people to communicate about the project and their work. The software allows people to work together more effectively. They can share and access information on a faster pace. But it also allows people to work together over distance.

Modern communication technology like software have been used in education for quite some time. It can be used to teach in a more effective way, without a tutor or over distance. It can also be used as course material in courses about such technology. Collaborative learning can also benefit from communication technology. ([24]) The difference is that such technology has to support multiple

people working together. Collaboration software is already being used in organizations to support the collaboration in these organizations. However, this software must be adjusted to support the learning task. This software and its use is referred to as Computer Supported Collaborative Learning. Many Computer Supported Collaborative Learning environments (CSCL) have already been developed and are being used right now. Some CSCL's are applied in distance education situations while others are applied in conventional classrooms. Much research has been done to determine what types of approaches there are to collaborative learning and CSCL's and which approaches are the most effective in specific situations.

This research will look into one particular CSCL. The Digital Workshop is a MediaWiki based CSCL used for in several informatics and information science courses at the Radboud University Nijmegen. The open nature of this CSCL and the fact that it is used in a course given in a classroom make this CSCL different from most CSCLs studied in previous researches. This research will try to determine the educational value of this Digital Workshop in the Research & Development 1 course.

Motivation

Collaboration is central to work in organizations. To prepare students for their professional live they have to learn to collaborate. Therefore students often have to work together in projects. But Collaborative Learning tells us that working together might do more than just learn students how to work together effectively. It may also let the students learn the course material more effectively. This makes collaborative learning an interesting approach in education.

ICT is used in a variety of ways in education. Apart from the many programs that students use on their own initiative there are several programs educational institutes can use to make learning more effective. What programs may be used depends on the characteristics of the educational institutes. Institutes that facilitate distance education often rely heavily on ICT technologies while classroom based education can often do with less ICT. Certain courses require that the students use software to perform their learning tasks. An example of such courses is a programming course were students need a programming environment to practice programming. Collaboration software may be used in courses were collaborative learning takes place.

Collaboration software aims to support collaboration by allowing people to share information faster and more efficiently. It can also enable people to work together while physically apart. In educational settings such software can be used to support collaborative learning. If such software is used, it is called Computer Supported Collaborative Learning or CSCL. Collaborative learning itself should already help students learn more efficiently. Collaborative software might help the students even more because they can share information faster and share more information. They also don´t always have to be together to work together.

The Digital Workshop is a CSCL in use in the informatics and information science department of the Radboud University. It is a CSCL implemented in a MediaWiki environment and primarily functions as a project workplace for students. What characterizes this system is that it is, just like MediaWiki, open and flexible. Students and tutor have great liberty in changing the pages in the system and, on default, everything is open and accessible. The Radboud University doesn't give education over distance, so this didn´t play a role when the system was implemented. The system was implemented because it could make collaborative learning easier for both students and teachers. What also plays a role is the general interest in IT systems and their use in both departments since this is what they

teach about. How does the students use this system and what exactly is its value? Exploring this will help better understand this system and how students use such systems in general.

Relevance

Scientific Relevance

There are many ICT environments that aim to support collaborative learning and many have already been studied. The primary goal of such studies is to determine whether these environments improve the learning of students. And most of the researchers conclude that the use of ICT to support collaborative learning does improve learning.([25], pg. 24) However, what is still lacking is evidence that the same results can be achieved in a normal classroom. ([25], pg. 24) Furthermore no research has been done on CSCL based in a MediaWiki environment. One characteristic of this software environment that is unique is the openness of the environment. All students can look and comment at each other's work. So not only can the students communicate and collaborate within their group but they can also collaborate outside their own group. Furthermore most research only looks at the communication in the CSCL environment. Little attention is paid to the produced solution itself([40], pg. 150)

This research differs from previous research on three areas. First, this research will not only look at the communication in the Digital Workshop but it will also look at the final product. It will not evaluate the quality of the final product and whether all relevant course material is represented in the final product. But it will look at the process of making the product. All additions and changes to the documents that represent the product will be analyzed together with the communication that surrounds these changes. This will give new insights into how students create such a product and helps better explore the relation between communication about the product and the creation of the product itself.

The second area in which this research differs from previous research is the nature of the CSCL environment. Because MediaWiki is such an open environment and the restrictions placed on the use of this environment in the course are limited students have great freedom in how they use the environment. They can choose if they use the Digital Workshop to communicate about the product or they can only create the product in the Digital Workshop and communicate outside the Digital Workshop. They can not only look, communicate and even change their own work but also the work of others. Few, if not none, of the previously studied CSCL environments allow such freedom.

Finally, most previous researches looked at CSCLs when they were used in a course given trough distance learning. But this CSCL is used in a course that is given in a classroom. In most distance learning course, digital communication is required since the participants are physically apart. It takes too much time to work together in one location. But in a classroom course, participants can meet face-to-face. Thus the CSCL has to compete with the most natural form of communication, face-to-face communication.

Studying the use of the Digital Workshop might not only give insight into the value of the system itself but it might also give new insights into how communication about the product and the actual production relate with each other. It may also give new insights into the effects of such freedom on the students work. Both of these areas have the potential to result into new insights about collaboration in CSCL environments and collaboration in general.

Societal Relevance

The Digital Workshop has been used for quite some time in some Informatics and Information Science courses of the Radboud University. No study of this size has been done into how the Digital Workshop is used. Though the Digital Workshop allows great flexibility and the system can look different for each course this research should help tell something about the value of this system. If the results are positive it might prove worthwhile to use the Digital Workshop in more educations and courses. Then the Digital Workshop will help make learning more efficient and effective for many more students.

But the value of this study isn't just potential promotion for the Digital Workshop. It also helps give tutors who use the system better understanding of how their students use the Digital Workshop. The tutors may see room for improvement or might conclude that the Digital Workshop didn't result into the change they expected and changes into the Digital Workshop might be required.

Furthermore studying the Digital Workshop and its unique characteristics will help better understand collaborative learning in general. New insights can result into new knowledge which will allow society to produce better collaborative software and CSCL environments. It may also give new insights into collaborative learning in general. For instance, it might prove that letting students look into the work of other groups doesn't have to result in the stealing of work and might help students give different ideas about possible solutions to their problem.

Theoretical Framework

Introduction

In this research the use of a computer supported collaborative learning environment or CSCL environment will be studied. The CSCL environment that will be evaluated is the Digital Workshop. It is a Media Wiki based interactive website that is used in several courses of the Computer Science and Information Science educations of the Radboud University Nijmegen. The use of the CSCL environment will be studied by monitoring the activity of three groups of students in the Digital Workshop while they are working on the main assignment of the Research and Development 1 course.

This theoretical framework will present the theoretical background for this research. The Digital Workshop has been classified as an computer supported collaborative learning environment. The section "What is collaborative learning?" will discuss what the computers actually support in collaborative learning. If we know what collaborative learning is, we can discuss what computer supported collaborative learning would look like. This will be discussed in the "Computer Supported Collaborative Learning" section. "The effectiveness of collaborative learning" will discuss the academic consensus about the effectiveness of collaborative learning. It will also look at the studies done to determine the effectiveness of collaborative learning. This research lacks a control group, so it will be difficult to do a study into the effectiveness of collaborative learning of our own. However, there might be indicators in the theory about the effectiveness collaborative learning. These indicators might help discover if collaborative learning is actually taking place in the Digital Workshop and whether this collaborative learning can be effective. The section named "Communication Types" will discuss the relevant theory and will list the indicators that have been found in the theory. Finally, the section "User Satisfaction Breakdown" will discuss the measure of user satisfaction which is often

used to measure the quality of software. Though this research will not do a direct study into user satisfaction, looking at user satisfaction might help find aspects of software that determine its effectiveness that do not directly relate to collaborative learning and CSCL environments. This theory might help explain possible behavior of the students that are being followed. These sections should result in a theoretical framework that will support the rest of the research.

Collaborative Learning

What is collaborative learning?

The Digital Workshop is a computer supported collaborative learning environment. These environments aim to support collaborative learning. Before we can discuss computer supported collaborative learning environments we need to know what collaborative learning is. The name reveals that collaborative learning is about "learning" and "collaboration". The article of *Pierre Dillenbourg*([16]) states that the broadest definition of collaborative learning is "a situation in which two or more people learn or attempt to learn something together." However, *Dillenbourg* also states that this definition is rather unsatisfactory and that it is difficult to come to a more specific definition looking at the interested fields. He continues to explain how each element in this definition can be interpreted in different ways.

- *"Two or more" may be interpreted as a pair. a small group (3-5 subjects), a class (20-30 subjects), a community (a few hundreds or thousands of people), a society (several thousands or millions of people)… and all intermediate levels.*([17], pg.1)
- *"Learning something" may be interpreted as "follow a course", "study course material", "perform learning activities such as problem solving", "learn from lifelong work practice", ….* ([17], pg.2)
- *"together" may be interpreted as different forms of interaction: face-to-face or computer-mediated, synchronous or not, frequent in time or not, whether it is a truly joint effort or whether the labour is divided in a systematic way.*([17], pg.2)

These three elements of the definition define the space of what is encountered under the label of "collaborative learning", according to *Dillenbourg* ([17], pg.3) But the variety within this space appears to be quite large. ([16], [17]). This leads to much confusion and debate. According *to Karel Kreijns, Paul A. Kirschner,* and *Wim Jochems*, ([16]) there seems to be an almost irresolvable discussion as to what "collaborative" and "cooperative learning" are and what their differences/commonalities are. ([16], pg. 336) *Panitz* ([18]) sees collaboration as a philosophy of interaction and personal lifestyle and cooperation as a structure of interaction designed to facilitate accomplishment of an end product or goal trough working together in groups.([16], pg. 336) *Slavin*([19]) associates cooperative learning with well-structured knowledge domains and collaborative learning with ill-structured knowledge domains .([16], pg. 337) The debate dealing with differences between cooperative and collaborative learning is still going on. However, there are far more similarities than differences between them. Kirschner([20]) notes that : ([16], pg. 337)

- learning is active
- the teacher is usually more a facilitator than a "sage on the stage"
- teaching and learning are shared experiences
- students participate in small-group activities

- students must take responsibility for learning
- students are stimulated to reflect on their own assumptions and thought processes
- social and team skills are developed trough the give-and-take of consensus building

In their paper *Karel Kreijns, Paul A. Kirschner,* and *Wim Jochems*([16]) consider both terms equivalent and choose to use the term "collaborative" because of the large amount of similarities. ([16], pg. 337) *Pierre Dillenbourg*([17]) acknowledges the difference between collaborative and cooperative and finds that, though not everyone makes this distinction, those that do make the distinction base it on the division of labour in the group. ([17], pg.8) It is clear that the difference between cooperative and collaborative learning revolves around the division of labour in the group. But where this division of labour should come from and how formal or rigid it must be remains unclear. There always is a division of labour when people are working together. However, this can be anything from an ad-hoc division of a temporary nature to a formal, long turn division in a formal organization([1], pg. 4) The difference between cooperative and collaborative learning should revolve around a certain point between these two ends. But what this point should be is still up to debate. Therefore it seems save to choose the term "collaborative learning" because it doesn't demand anything from the division of labour. The term "cooperative learning" should always come with a strong definition of what the user of the term means with it in comparison with collaborative learning. Theory that uses the term "cooperative learning" should be carefully studied to find out whether it actually is relevant to this research. It could be about situations that are far more structured than the situations this research studies.

As mentioned by *Dillenbourg*([17]) there is a great variety of scale in the variables that define collaborative learning. This creates a great variety in the research subjects for research into collaborative learning. The amount of subjects can vary from 2 to 30 or, if possible, even more. The time the study takes can vary from a short study of 20 minutes to a long term study of 1 year. ([17], pg. 2) According to *Dillenbourg*([17]) most empirical studies on the effectiveness of collaborative learning focus on 2 to 5 subjects working together for about an hour. However, most research into "computer-supported collaborative learning" is often applied to situations were up to 40 subjects are studies for the duration of an entire course, which could be one year. But the notion of scale doesn't stop at the amount of subjects. Time is also a major factor. Most empirical research on the effectiveness of collaborative learning study a group of about 2 to 5 people that collaborate for about an hour. But most research that studies "computer-supported collaborative learning" takes place in situations where groups of 40 people taking part in a course are studied for about one year. ([17], pg.2) This shows that collaborative learning can involve a great variety of group sizes and can take place over a great variety of time. *Dillenbourg*([17]) does show that, in the eighties, many of the boundaries that depended on scale were crossed. Cognitive theory that applied to the individual was being applied to groups and theory about culture, that deals with communities and societies, was applied to the interaction between peers. ([17], pg.2) However, during the transfer across different scales, these concepts undergo deformation. For instance, the notion of group memory has not been elaborated as much as the notion of individual memory. In CSCL (computer-supported collaborative learning) group memory is often reduced to a working memory. If one talks about culture built by two subjects in a matter of hours the term 'culture' acquires a more functional flavour rather than its traditional historical flavour. ([17], pg. 3) The scale of research subjects can change transform the meaning of various terms. This makes scale an important factor in research into collaborative learning.

Despite the fact that many of these factors influence the potential effectiveness of collaborative learning they all have one element in common: social interaction. ([16], pg.338) *Hiltz*([21]) states that "the nature of intra-group cooperation is potentially of greater importance than group composition per se"([16], pg.338) It can be said that many researchers support the notion that social interaction is important in learning. ([16], pg.338) Social learning also appears to be key to collaboration. If there is collaboration than social interaction can be found in it, and vice versa, if there is no social interaction then there is no collaboration. ([16], pg. 338) So social interaction is critical in both collaboration and learning. Then it isn't a surprise that social interaction is critical in collaborative learning.

Collaborative learning is a term that's made up out of two elements. "Collaborative" has already been discussed above where it became clear that the definition of the term isn't as clear as one may like it to be. But what does learning exactly mean? According to *Dillenbourg*([17]) there is a broad acceptance of what is put under the umbrella of learning in research literature dealing with collaborative learning.([17], pg. 4) *Dillenbourg*([17]) lists four ways in which studies about collaborative learning deal with the term learning: ([17], pg. 4)

- For some scholars, it includes more or less any collaborative activity within an educational context, such as studying course material or sharing course assignments.
- In other studies the activity is joint problem solving, and learning is expected to occur as a side-effect of problem solving. This is measured by the elicitation of new knowledge or by the improvement of problem solving performance. This understanding is also dominant in multi-agent learning.
- Within some theories collaborative learning is addressed from a developmental perspective, as a biological/cultural process that takes place over years.
- This spectrum also includes learning from collaborative work, which refers to the lifelong acquisition of expertise within a professional community.

The common denominator in the learning situation in this list is more the word "collaborative" than "learning". According to *Dillenbourg* the variety of use of the word "learning" reflects two distinct understandings of "collaborative learning": Is it a pedagogical method or a psychological process? The pedagogical sense is prescriptive: one asks two or more people to work together because it is expected that they will thereby learn efficiently. The psychological sense is descriptive: one observes two or more people have learned and collaboration is viewed as the mechanism that caused learning. ([17], pg. 4) This shows that collaborative learning can be viewed in two ways. One can view it as a method to facilitate efficient learning or as a mechanism that facilitates learning in situations in which people collaborate. *Dillenbourg*([17]) states that this results in confusion which leads to overstatements about the effectiveness of collaborative learning. ([17], pg.5) He argues that collaborative learning is neither a method nor a mechanism:

- Collaborative learning is not one single mechanism: if one talks about "learning from collaboration", one should also talk about "learning from being alone". Individual cognitive systems do not learn because they are individual, but because they perform some activities (reading, building, predicting, ...) which trigger some learning mechanisms (induction, deduction, compilation,...). Similarly, peers do not learn because they are two, but because they perform some activities which trigger specific learning mechanisms. This includes the activities/mechanisms performed individually, since individual cognition is not suppressed in

peer interaction. But, in addition, the interaction among subjects generates extra activities (explanation, disagreement, mutual regulation, ...) which trigger extra cognitive mechanisms (knowledge elicitation, internalization, reduced cognitive load, ...). The field of collaborative learning is precisely about these activities and mechanisms. These may occur more frequently in collaborative learning than in individual condition. However, on one hand, there is no guarantee that those mechanisms occur in any collaborative interactions. On the other hand, they do not occur only during collaboration. At some level of description - at least the neuron level-, the mechanisms potentially involved in collaborative learning are the same as those potentially involved in individual cognition. ([17], pg. 5)

- Collaborative learning is not a method because of the low predictability of specific types of interactions. Basically, collaborative learning takes the form of instructions to subjects (e.g."You have to work together"), a physical setting (e.g. "Team mates work on the same table") and other institutional constraints (e.g. "Each group member will receive the mark given to the group project"). Hence, the 'collaborative' situation is a kind of social contract, either between the peers or between the peers and the teacher (then it is a didactic contract). This contract specifies conditions under which some types of interactions may occur, there is no guarantee they will occur. For instance, the 'collaboration' contract implicitly implies that both learners contribute to the solution, but this is often not the case. Conversely, reciprocal tutoring (*Palincsar* and *Brown* ([22])) could be called 'a method', because subjects follow a scenario in which they have to perform particular types of interaction at particular times. ([17], pg. 5)

In short collaborative learning is not a single mechanism because it triggers the same cognitive mechanisms as individual learning. It only causes certain cognitive mechanism to occur more frequently, especially those that deal with interaction. Collaborative learning is not a method because it only facilitates certain interactions but doesn't guarantee them.

According to *Dillenbourg* ([17]) collaborative learning describes a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms. Thus collaborative learning creates a situation that facilitates certain learning mechanisms but it doesn't guarantee them. ([17], pg. 5)

According to *Kreijns, Kirschner* and *Jochems* ([16]) just placing students in groups doesn't guarantee collaboration. A complex of simultaneously applied instructional approaches, each reinforcing and and/or complementing the other, can enhance collaborative learning and social interaction amongst group members. ([16], pg. 338) *Dillenbourg* ([17]) states that the research on collaborative learning should focus on finding ways to increase the occurrence of interactions that facilitate learning. ([17], pg. 5) The design of tasks and approaches in the collaborative learning settings should facilitate interaction that stimulates learning. This increases the likeliness of learning to occur in the collaborative setting that has been created.]) identify three approaches to these instructions: ([16], pg. 338/339)

- Cognitive Approach: The cognitive approach is aimed at specific activities in the learning task that promote "epistemic fluency". "Epistemic fluency" can be defined as: "The ability to identify and use different ways of knowing, to understand their different forms of expression and evaluation, and to take perspective of others who are operating in a different epistemic

framework (*Morrison* and *Collins* ([23])). This can be achieved by applying a set of epistemic tasks within the group learning tasks like describing, explaining, predicting, arguing, critiquing, evaluating, explicating and defining, all within the context of the discourse.

- Direct Approach: The direct approach involves the use of specific collaborative techniques that structure a task specific learning activity (e.g. writing a report). These are very specific and well designed techniques that teachers can learn and apply quickly and are often focused on specific subject areas and grade levels.
- Conceptual Approach: The conceptual approach involves tailoring a general conceptual model of collaborative learning to the desired/chosen circumstances. This way specific types of collaboration can be created and/or enforced. Conceptual methods are not easily learned, can be used in any subject area for any age student, and are highly adaptable to changing conditions. The conceptual approach usually makes use of:
    - Positive interdependence: Team members are linked to each other in such a way that each team member cannot succeed unless the other succeeds and they work to benefit each other's work.
    - Promotive interaction: Individuals encourage and promote each other's activities to achieve the common goals.
    - Individual accountability: All group members are held accountable for doing their share of work and mastery of all the materials to be learned.
    - Interpersonal and small-group skills: specific skills are needed when learners are learning within a group.
    - Group processing: The group determines which behaviors should continue or change for maximizing success based upon reflection on how the group has performed so far.

Although the conditions are listed separately, they are highly related to each other. For instance, if some conditions are met, other conditions should occur as a result. Not only does this approach promote the positive effects, it also negated the negative effects usually present in non-collaborative groups such as the free rider or hitchhiking effect. This effect occurs when a member feels that the group already does enough to achieve the goals so that he, as a member, doesn't need to contribute anything. ([16], pg. 339) The member chooses not to collaborate because he doesn't see the need of his contribution. This of course goes against the idea of collaboration where everyone needs to contribute. Conditions like individual accountability help prevent this kind of behavior.

Dillenbourg ([17]) also identifies several approaches to collaborative learning in the literature on this subject. As mentioned above, *Dillenbourg* ([17]) also believes that approaches to collaborative learning should try and increase the probability that certain types of interaction occur. The four types of approaches identified by *Dillenbourg* ([17]) are ([17], pg. 5/6)

- The first type of approach identified by *Dillenbourg* ([17]) involves setting up initial conditions. This involves carefully designing the situation in which the collaborative learning should take place. The most frequently asked questions are: What is the optimal group size? Should I select group members with respect to some criteria or let them make their group themselves? Can boys and girls be together in a group? Is it better to have group members that have the same viewpoint or not, the same general level of development or not, the same amount of knowledge with respect to the task at hand or

not? Is it better to put them face-to-face or side-by-side? If the interaction is mediated trough a network, what should be the main features of the groupware to be used? Which tasks are suitable for collaborative processes? These questions have inspired a large body of empirical research on collaborative learning. However, beyond a few main results, it appeared that these conditions interact with each other in a complex way. Because of these complex interactions, it becomes very difficult to setup initial conditions which guarantee an effective collaboration.

- The second type approach involves over-specifying a collaboration contract with a scenario based on roles. This is an approach that tends to turn collaborative learning into a method. Several methods that fit this category are based on setting up systematic differences among learners: asking subjects to play a specific role in an argument, even if the expressed viewpoint isn't their personal viewpoint, giving different visual viewpoints to subjects, controlling data access in such a way that group members have access to different data. Another method which fits this type but is more cognition oriented involves defining initial conditions for a task in which one kind of knowledge isn't sufficient to solve the problem at hand. This forces the learners to integrate their knowledge. The other types all involve forcing people to work together while performing in conflicting roles.
- The third type of approach involves creating productive interaction by introducing interaction rules. The teacher may specify interaction rules for face-to-face interaction, such as "Everybody in the group should give his or her opinion." In CSCL "Computer Supported Collaborative Learning" such rules can be enforced by the design of the system. For instance, various research projects concern "semi-structured" interfaces i.e. interfaces in which the user communicates with a set of pre-defined buttons. Buttons either form a complete utterance (e.g. "Do you agree? ") or an open sentence (e.g. "I propose to...") to be completed with free text. These research projects yielded interesting results: the peers focused more on the task and produced fewer off-task comments with semi-structured interfaces. However, research shows that the interface constitutes a tool that goes beyond the simple facilitation/inhibition of certain types of interaction. How strongly or flexibly the interface should shape the interaction process remains an open issue.
- The last type of approach involves monitoring and regulating interaction. In this approach the teacher retains a role in the success of collaborative learning. This role becomes more important as the size of the group increases. This role is often named "facilitator" instead of "tutor" because the point is not to provide the right answer but to perform a minimal pedagogical intervention in order to redirect group work in the right direction or to monitor which members are left out of the interaction. In the context of CSCL, the facilitator needs extra tools to monitor all interaction occurring. This approach is more reactive in nature, relying on intervention rather than designed conditions.

Dillenbourg ([17]) and *Kreijns, Kirschner* and *Jochems* ([16]) identify several approaches to collaborative learning. Though there are definitely similarities between these approaches (for instance, the cognitive approach identified by *Kreijns, Kirschner* and *Jochems*([16]) can be grouped among the third approach identified by *Dillenbourg*([17]) since the cognitive approach introduces several tasks to make sure that certain types of interaction occur.) But none of the approaches are

exactly the same. This shows that there is little academic agreement on how to approach collaborative learning. There is still much debate about what collaborative learning exactly is. Up till now the discussion has primarily been about what a good approach to collaborative learning is. But what exactly is collaboration and how does it concern learning? According to *Dillenbourg* ([17]) collaboration concerns four aspects of learning: ([17], pg. 6)

- A *situation* can be characterized as more or less collaborative. (e.g. collaboration is more likely to occur between people with a similar status than between a boss and her employee or between a teacher and her pupil)
- The *interactions* which do take place between the group members can be more or less collaborative. (e.g. negotiation has a stronger collaborative flavor than giving instructions)
- Some learning *mechanisms* are more intrinsically collaborative, (e.g. grounding has a stronger collaborative flavor than induction), even if, at a very fine level of analysis, learning mechanisms must be similar to those triggered in individual learning.
- The fourth element concerns the effects of collaborative learning, not because this element is used to define collaboration itself, but because the divergent views concerning how to measure the effects of collaborative learning participate in the terminological wilderness of this field.

So the situation, the interactions, the mechanisms and the measure of the effects are all concerned with collaboration. According to *Dillenbourg* ([17]) it would be intuitive to term a situation "collaborative" if peers are more or less at the same level, can perform the same actions, have a common goal and work together. ([17], pg. 7) The two first concerns the degree of symmetry in the interaction. This symmetry can have various forms. It can be about the extent to which all agents can perform the same range of actions. It can be about the equality of knowledge and skills of the agents. It can be about the equality of the status each agent has in the community and there are other aspects that can have certain symmetry. What is important is that complete symmetry is never possible. No one person has the exact same knowledge as another. Symmetry can also change over time. For instance, people can address sub-tasks for which one peer might have particular skills. ([17], pg. 7) In that situation the knowledge symmetry becomes less.

The second criterion concerns the expected common goal. Common goals are important for a common grounding. Actions cannot be interpreted without referring to (shared) goals, and goal discrepancies are often revealed trough disagreement about certain actions. It is important to note that no person has exactly the same goals. ([17], pg. 7) For instance, all students might have the goal to complete the course but one student might be satisfied with a sufficient grade while another student might want to achieve a higher grade. Through the negotiation of goals, agents do not only develop shared goals, but also become mutually aware of their shared goals. ([17], pg. 7) In a way, symmetry also concerns the goals of the agents in a group, since certain symmetry in goals is required to make collaboration feasible.

The third criterion is division of labor. The role of division of labor has been mentioned before when discussing the difference between collaboration and cooperation. In collaboration partners do the work "together". There is no division of labor in advance. ([17], pg. 8) Some spontaneous division of labor might occur, even when two people really do work together. For instance, one partner can take responsibility of the lower aspects of the task while the other partner focuses on the strategic

aspects. ([48]) *Dillenbourg* ([17]) argues that a horizontal division of labor is possible in collaboration. A horizontal division of labor can mean that one partner does the task-level while the other partner does the meta-level. This leads to a horizontal division of labor into reasoning layers. A vertical division of labor is a division in subtasks. The difference between such a horizontal and vertical division of labor is that in such a horizontal division of labor the layers have to be highly interwoven. This requires communication. And the second difference is that, in collaboration, such a division must be unstable. The roles of partners must shift. ([17], pg. 8)

But there is another way to identify collaboration. One can identify collaboration by stating that people interact in a collaborative way. A first intuitive criterion is that a situation should be quite interactive. In this case, the degree of interactivity is determined by the influence these interactions have on a peers' cognitive process, not by the frequency of interactions. A second criterion is that "doing something together" implies rather synchronous communication. The technical definition of synchronous and asynchronous does not suffice in this situation. E-mail is classified as asynchronous communication but in certain situations the delivery of an e-mail can be only 20 seconds. ([17], pg. 9) In this case synchronous communication isn't a technical issue but a social rule. The speaker expects that the listener will wait for the message and will process the message as soon as it is delivered. And if the medium breaks the conversational rules established for another medium, users create new ways of maintaining this subjective feeling of synchronicity of reasoning. ([17], pg. 9)

Another feature of collaborative interactions is that they are negotiable. A main difference between collaborative interactions and a hierarchical situation is that one partner will not impose his view on the sole basis of his authority, but will, to some extent, argue for his standpoint, justify, negotiate, attempt to convince. ([17], pg. 9)

As mentioned above, the mechanisms in collaborative learning aren't any different from individual learning. However, certain mechanisms might occur more frequently in collaborative learning. But what are these mechanisms and how do they benefit from collaborative learning? *Dillenbourg* ([17]) lists the following mechanisms: ([17], pg. 10/11)

- Induction: Pairs draw more abstract representations of the problem at hand because their joint drawing had to integrate what was common to the representation built by each individual. The basic underlying process is inductive. The features that are relevant to both individuals are kept.
- Cognitive load: In collaboration, the horizontal division into, for instance, task-level and strategy-level tasks, reduced the amount of processing performed by each individual. Reduced cognitive load may explain why regulating one's partner processes is easier than self-regulation and therefore why group members improve their regulatory skills. Conversely, the interaction with other group members increases the cognitive load, which is not detrimental in itself. So collaboration can help reduce the cognitive load. But it can also increase the cognitive load, though such increases are rarely a waste.
- (Self-) explanation: The case of explanation is different from the previous examples. The concept of explanation is, in itself, related to social situations, but it has been imported into studies of individual cognition. Explanation helps better understand and comes more natural in collaboration.

- Conflict: The concept of conflict concerns both the intra-individual and inter-individual planes. A discrepancy between the knowledge or viewpoints of two peers leads to conflicting statements or positions with respect to the task at hand. Such conflicts must be resolved in collaboration and resolving conflicts can improve the knowledge of each other's viewpoints.
- Internalization: This is specific to collaborative learning. This process has been more studied in asynchronous situations (parent-child). It involves the transfer of tools from the social plane to the inner plane. For instance, an adult can introduce a concept when solving a task with a child and later the child might utilize this concept by itself.
- Appropriation: Appropriation means that an agent reinterprets his own actions or utterances under the light of what his partner does or says next.

This list presents several mechanisms that perform better (or only) in collaborative situations. All these mechanisms require communication between the partners. The exchanging of viewpoints help improve the knowledge of all involved partners and there are several situations in which an exchange of viewpoints might occur. Furthermore working together can help reduce the cognitive load and can teach partners how to effectively reduce the cognitive load in collaboration.

As mentioned by *Dillenbourg* ([17]) collaborative learning isn't a specific type of learning. It is nothing more than a term used to refer to learning in a collaborative environment. The mechanisms that trigger learning in this collaborative environment are no different from the learning mechanisms triggered in individual learning. However, certain learning mechanisms are more likely to be triggered when collaboration takes place. Collaboration is more than just people working together. It makes several demands to the way people work together that set it apart from other ways of working together, most notably cooperative learning. The most notable requirements for collaboration are certain symmetry of skills and goals between all participants and little division of labor. There can be some division of labor in collaboration but all participants should understand and be able to perform all work being done in the collaborative setting. Several elements of collaboration help trigger certain learning mechanisms. Explaining and sharing viewpoints are probably the most important elements. This can involve relatively calm conversations but also more heated discussions resulting from conflict. Looking at the solutions of other people also helps trigger additional learning mechanisms. The skills needed to organize a project in which people work together are also viewed as valuable skills learned in collaborative learning. Many approaches to collaborative learning focus on learning task that involve the discussion of work. This should help trigger the related learning mechanisms. Other task help ensure that all members participate. Full participation of all members is viewed as important, since members who don't participate can disrupt relations within the group.

Computer Supported Collaborative Learning

How can CSCL's support collaborative learning?

Now that we know what collaborative learning looks like we can discuss the role computers can play in supporting collaborative learning. This is what we call Computer Supported Collaborative Learning or CSCL and a CSCL system is revered to as a Computer Supported Collaborative Learning environment or CSCL environment. Computer supported collaborative learning can be used to support the collaboration of remote groups or to support the collaboration of individuals working side by side. ([40], pg. 148) Since the CSCL environment that will be studied for this research supports

the collaboration of individuals working side by side and does not aim to support remote groups we will pay little attention to theory about long distance collaboration.

The difference between CSCL over long distances and CSCL that supports collaboration of individuals working side by side is that groups working over distance need the computers to communicate since they are always physically apart. Students working side by side can choose to use the computers and can even work together behind one computer. When CSCL is used in distance learning it simply enables collaborative learning. When it is used in situations where students collaborate side by side it aims to improve collaborative learning. This is challenging, since face-to-face communication allows for much richer communication then digital communication. ([42], pg. 320) Therefore digital communication often occurs less frequently than face-to-face communication when participants have the choice. ([42], pg. 320) When creating CSCL environments it is important to realize this. Digital environments do not support the interaction we see in the classroom in the same way as face-to-face communication does. ([31], pg. 47) Digital communication simply isn't as rich as face-to-face communication. This is something designers should realize when creating a CSCL environment. Since this research looks at students who study together in one location, the advantage of distance communication becomes less important. The CSCL loses an important advantage against face-to-face communication. Thus the other advantages of the CSCL become more important. But how should designers develop a CSCL environment? *Kirschner* ([30]) presents a 6-stage model for interaction design of environments:

1. Determine what learners actually do: Watch the students interact, observe collaborating groups interacting to solve problems, observe users interacting with software, and so forth, and do this before designing and developing.
2. Determine what can be done to support those learners: Determine, based on stage 1, what actually needs to be supported or afforded and then proceed.
3. Determine the constraints of the learner, learning situation and learning environment and the conventions that already exist: Look further than the technological constraints and conventions and take into account the educational and social constraints and conventions that play a role in collaborative environments.
4. Determine how learners perceive and experience the support provided: There is a world of difference between (good) intentions and user perception thereof. Research and design must be carried out as iterative, interacting processes. New products must be tried out with intended users at stages in their development where physical and conceptual changes can still be made.
5. Determine how the user actually uses the support provided: Analogous to stage 1 and following up the more formative evaluations carried out in stage 4 determine if the learner actually does what is hoped or expected.
6. Determine what has been learned: The goal of education is learning. There are three standards to determine the success of any interaction design:
    a. its effectiveness
    b. its efficiency
    c. its ability to satisfy those using it, in the case of CSCL environments either those learning or those teaching.

    An increase in one or more of the standards without a concomitant decrease in any others means success.

These six stages provide a general approach to interaction design of instructional CSCL environments. However, a good interaction design alone isn't enough to guarantee that the social interaction that supports competency building actually occurs. The discussion about collaborative learning in general presents mechanisms to guarantee the occurrence of the right social interaction. ([31], pg. 54) Though generic software development methods may also give insights into how to develop a CSCL environment the model above quickly sums up an approach specific to developing CSCL environments.

How can a CSCL environment be characterized?

Analyzing a CSCL environment on the basis of theory about other CSCL environments is risky. The new CSCL environments might differ from the studied environments in a significant way. It is better to use a method that can be used to analyze software in general. This guarantees that the method can be used to analyze the CSCL environment as a whole. Then the theory about collaborative learning and CSCL environments can be used to make statements about the CSCL environment.
The method that will be used to analyze the Digital Workshop is the Use Cases method. Use cases are a tool that was originally intended to be used for gathering requirements in software development. In the context of software development, a requirement is something that a computer application must do for its users. It is a specific function, feature, quality or principle that the system must provide for it to merit its existence. ([10], pg.5/6) One subtype of requirements are the functional requirements. Functional requirements are what the user needs for the system to work. They are the functions and features of the system. Use cases are a way of documenting functional requirements. ([10], pg.9)
Though functional requirements are part of the design of a system and not part of the final product, they do give a prediction of what the system might enable the user to do. The functions are the abilities that a system can grant a user, from the systems perspective. If you know the functions of a system, you know what any user can do with the system. Thus functions are well suited for describing the capabilities of a system, or rather, the capabilities the system grants to the user.

Users view computer systems as black boxes. They are only concerned with what goes in and what comes out. When we talk about "going in" and "coming out", were talking about interactions. Interactions between the user and the computer system are what really matters in requirements gathering. These interactions only represent the "what" of the system and not the "how". ([10], pg. 25) Use cases are a tool that examines the interactions between the system and its environment: what goes in and what comes out. ([10], pg. 35) Use cases only represent the "what" of the system, not the "how". ([10], pg.26) Use cases are meant to show the interactions between the system and external entities. These external entities can be users, other computer systems or external events. Each interaction documented should provide something of value to the external entity or to an external entity that does not directly interact with the system. ([10], pg. 36) The language used to represent these interactions is natural language. One should avoid using any implementation-specific terms, like names of people or departments, pseudo code or assumptions about where the work is being done physically. Use cases should be written in the user's vocabulary. All data terms and interactions should be termed and phrased using the same language that the users use to describe their job. ([10], pg.36)

Use cases are written in a template. These are often in the form of a table. *Daryl Kuland and Eamonn Guiney*([10]) present the following table as a use case template: ([10], pg. 43 t/m pg. 46)

Use Case Name:	
Iteration:	
Summary:	
Basic Course of Events:	
Alternative Paths:	
Exception Paths:	
Extension Points:	
Triggers:	
Assumptions:	
Preconditions:	
Post conditions:	
Related Business Rules:	
Author:	
Date:	

- The use case name provides a unique identification. A unique identifier that is written in natural language is preferred. Long ID numbers tent to turn off users.
- The iteration relates to each of the three stages a use case goes trough during software development. These stages are façade, filled and focused. Each use case progresses to these iterations at its own pace.
- The summary should be used to describe the interaction that occurs in a use case in one or two sentences. A summary should not regurgitate the basic course of events. The summary section may provide some context that other sections don't contain.
- The basic course of events is the most important part of the use cases. They describe the steps that the actors, like users, and the system go trough to accomplish the goal of the use case. The actor always takes the first step and the system responds. The basic course of events represents the "simple, correct path" trough the use case. This means that no errors or missteps occur and it means that the basic course of events show the most common path taken.
- The alternative paths section shows the less common paths that need to be addressed. They include situations in which unusual types of processing occur. Each alternative path should indicate which
- step in the basic course of events is its starting point.
- Exception paths are similar to alternative paths. However, exception paths show the interaction that occurs when an error happens.
- The extend relationship exists between two use cases when one use case provides an optional sequence of events that is included in the other use case. The extension points show the steps in the use case from which the extending use cases extend.
- Triggers describe the entry criteria for the use case. They are a list of the conditions that you expect to be true when an actor begins a use case. Triggers answer the question "When or why will the actor enter this use case? ".
- The assumptions of a use case are the things that you assume to be true in a use case, but might not be true.

- Preconditions are the things that must be in place before the interaction can occur. Preconditions relate to the conditions outside the scope of the computer system being developed. An example of a precondition is that a ledger exists for the incoming transactions.
- Post conditions are part of the contract between the use case and the outside world. After the use case has been completed successfully, the post conditions should be satisfied.
- The business rules are the written and unwritten rules that dictate how a company conducts its business.
- The author and date section of the use cases hold the author of the use case and the date at which the use case was made.

Use cases cannot tell the whole story. They are not highly detailed, and there are not many of them. To focus on detailed interactions, a different tool is required: scenarios. A scenario is a realization of a use case. It shows a possible path of the use case, including the specific data. It is one specific instance of a use case. Scenarios can be used to give an example of what specific set of interactions would belong to a use case. ([10], pg. 47.48)

As mentioned above, the functions of a system are the abilities that a system has. Those functions that require user interactions are the abilities that are granted to the user via the system. Use cases represent the interaction of a specific function of the system from an actor's perspective. All use cases that have the user as an actor represent the functions of a system that require a user. These functions are the abilities that the system grants the user. Therefore use cases can be used to describe the capabilities that the system grants the user.

CSCL environments support collaborative learning. They do not facilitate collaborative learning. The course, the project and the assignment that need to be made in a group determine which actions the students have to take. And these actions will trigger the learning mechanisms. CSCL environments can only aim to support these actions. The most significant contribution of CSCL environments is enabling collaborative learning over distance. But this research studies a course given in one university on one location. Distance isn't an issue. Thus the Digital Workshop will have to support collaborative learning in different ways. How this can be done greatly depends on the course setup. This is why the focus of this theoretical framework lays upon methods used to analyze the functionality of a system. Looking back at studies of other CSCL's does not guarantee that sufficient relevant theory will be gathered to analyze the Digital Workshop. Instead the Use Cases method is the method that will be used to analyze the functionality of the Digital Workshop. This method was developed to support the development of software. Applying this method in reverse order will help describe the functionality of the Digital Workshop. The results of this description can be analyzed using the theory about collaborative learning in general.

The effectiveness of Collaborative Learning

One of the more important questions that arise when discussing collaborative learning is whether collaborative learning actually is more effective than individual learning. If collaborative learning isn't more effective than individual learning then it makes little sense to put a lot of effort into applying collaborative learning in practice. Thus it is important to find out how the effectiveness of collaborative learning can be measured. And any studies into the effectiveness of an approach to collaborative learning in practice are also valuable. Such studies should help determine if the

computer supported collaborative learning environment and its utilization that will be studied in this research actually results in more (then individual learning) effective learning.

The research of *Anuradha A. Gokhale* ([23]) studies the effectiveness of collaborative learning by comparing if students working in groups perform better in their learning tasks than students working alone. ([24], pg.23) Two groups of 24 students were given a common lecture at the same time. Next, both groups were randomly divided into an individual learning group and a group learning group. These groups would work in separate classrooms. The assignments existed out of drill-and-practice items and critical thinking items regarding the application of Ohm's and Watt's law. ([23], pg.24) The students who worked together in groups were encouraged to explain their believes. It was insisted that every group member voiced his opinion to prevent the loudest member from dominating the group. The groups were formed by self-selection and consisted of four members. It is argued that small groups lack diversity whereas large groups have problems with full participation of all members. Therefore a group size of four is chosen. ([23], pg.25) Before and after the assignments the students did a test. These pre- and post tests tested the students knowledge of the topic the assignments dealt with. These tests would be used to evaluate the increase in knowledge of the students when performing the assignment. The research aims to answer the research question by comparing the increase of knowledge of students learning alone and the students learning in a group. ([23], pg. 25/26)

The mean grade for the pre-test of the students who would study individually were not significantly different from the mean grade for the students who would study in a group. The differences among treatment groups were not significant. ([23], pg. 27) For the drill-and-practice tasks the post-test scores for the students who studied collaboratively were slightly higher than the scores for the students who studied alone. (13.56 vs. 11.89) Statistically this difference proved insignificant. For the critical thinking task the scores for the students who studied collaboratively were also higher than the scores of the students who studied alone. (12.21 vs. 8.63) This difference was statistically significant. ([23], pg.27) This study shows that collaborative learning results in significantly better learning than individual learning for critical thinking tasks. Other studies report similar findings.

A study of *Totten, Sills, Digby & Russ* ([24]) reports that there is persuasive evidence that cooperative teams achieve higher levels of thought and retain information longer than students who work quietly as individuals. ([24], pg.22) Large meta-analysis on the effectiveness of computer supported collaborative learning have shown that in the majority of experiments the use of technology has markedly improved learning effectiveness. ([25], pg. 24, [26], [27], [28], [29]) However, none of these studies did differentiate on the basis of pedagogical ideas on how computers can be implemented. ([25], pg. 24) Other studies were done that look into the effectiveness of some well-known CSCL environments like CSILE and Belvedere. These studies proved that these environments were helpful for higher level social interaction and for better learning in terms of deep understanding. ([30], [32]) However, these studies do not give any evidence that similar results could be achieved in a classroom. ([25], pg. 24) There also have been some studies into the negative effects of CSCL. General passivity and uneven distribution of participation are negative effects that are often noted. ([33], [34]) However, there has been no thorough analysis of these issues. ([25], pg. 25) In the end, a collection of studies confirms the hypothesis that collaborative learning, possibly supported by information and communication technology, would improve student learning. Collaborative learning does indeed result in better learning than individual learning. ([25], pg. 28) This means that

collaborative learning is a worthwhile subject for research. Unfortunately the setup of this research does not allow for a study into the effectiveness of collaborative learning. This research lacks the necessary control group(s). However, the theory about collaborative learning combined with the knowledge that collaborative learning is effective should be sufficient to determine whether effective learning is taking place in the learning assignment being studied.

Communication Types

People need to communicate if they want to collaborate. They need to create a planning, divide work, discuss solutions to problems, evaluate the work of group members and there are many other things they can communicate about. Much of the triggering of learning mechanisms in collaborative learning is triggered by forms of communication. Discussions, conflicts, the exchanging of viewpoints all have to be done trough communication. Internalization is the only mechanism that does not require communication. Thus communication is central to collaboration. And communication can be observed. We can listen to conversations, study text messages or look at logs. Most other forms of knowledge transfer are not that visible. Internalization, for instance, cannot be observed directly. Since communication is that important in collaborative learning and since it can be observed it becomes one of the most important indicators for collaborative learning.

To better understand the communication that is being analyzed a way is needed to separate one kind of communication from the other. Categories are required that refer to certain types of communication. This way some structure can be brought to the great variety in communication. This enables researches to compare communication in different settings or groups and make statements about elements of communication. But how can you separate communication in different categories? What are characteristics of communication that allow it to be separated into categories? This information is required to make a proper division of communication into categories.

In "*Is All Communication Created Equal?: An Investigation into the Effects of Communication Mode on Perceived Information Quality* "by *Eliot Maltz* ([43]) three dimensions are presented that can help develop a typology of communication. These dimensions refer to aspects of the communication channel. They deal with how communication can be transmitted from sender to receiver and back. The way in which communication is received and how the receiver can reply to this communication influences the interpretation of this information by the receiver. The characteristics of the channel also influence how well the sender can transmit his intended message to the receiver. ([43], pg. 112) These are the three dimensions presented in the article: ([43], pg. 112/113)

- Richness refers to the degree to which the mode of communication is able to provide instantaneous feedback for the receiver, and to the number of cues that can be used by the receiver to interpret the information being communicated. Face-to-face is the richest mode since it provides immediate feedback and a variety of cues. (e.g., body language, tone of voice, etc.)
- Spontaneity of communication refers to whether the receiver has advance notice of the communication encounter. A number of scholars have suggested that novel or surprising information tends to be discounted as unreliable when sent to regular channels because it conflicts with the receiver's mental world of how the world works. However, in spontaneous communication participants are more likely to ask for more clarification and are more open to new ideas. Pre-planned communication gives people more time to verify whether the

information is accurate as well as improve the presentation format tin order to increase the clarity of the message. ([44]) Spontaneous communication often lacks verifiability.

- Speed refers to the degree to which the sender can transmit information instantaneously. Greater speed allows for faster communication. It also allows for more feedback and current allowing for more accurate information being sent.

As mentioned above, the characteristics of the channel can influence the perception of the information by the receiver. A simple e-mail might look less formal than a nice looking, water marked letter, despite that the content might be the same. But the perceived information quality isn't only influenced by the channel. *Eliot Maltz* identifies four factors that influence the perceived information quality or PIQ: ([43] pg. 114)

- Credibility refers to the notion of accuracy of the information by the receiver.
- Comprehensibility refers to the perceived clarity of the information received.
- Relevance refers to the degree to which the information is appropriate for the user's task or application.
- Timeliness refers to whether information is transmitted quickly enough to be utilized. It is formally defined as the degree to which information is perceived as current and actionable.

The article of *Angela Graveline, Cheryl Geisler* and *Michael Danchak* ([47]) also present a list of dimensions that deal with the media richness of a communication channel: ([47], pg. 381)

- Feedback Capability refers to how quickly communication participants can ask for and receive clarification.
- Availability of Multiple Cues refers to the number of various communication channels available to the communication participants.
- Language Variety refers to the use of different types of language. For instance, numbers convey precision and natural language conveys understanding of a broader set of concepts and ideas. Written or typed media afford more precise, textual language. Oral media afford more natural language.
- Personal Focus refers to the levels of individual attention and socio-emotional content a message contains.

These factors and dimensions are important to take into account when you want the receiver to take your message seriously. But these factors still deal with the makeup of the communication and not the content. Nor are they actual categories. The ideal communication would satisfy all the dimensions and factors of the lists above. It is not the intent of these dimensions or factors to categorize types of communication. Instead they help evaluate and characterize communication channels. Still, this information is important since it helps better understand types of communication and their potential value.

The article of *Abbie Griffin* and *John R. Hauser* ([45]) presents several diagrams either out of other's literature or out of their own research that show several ways to categorize types of communication. The first diagram shows a division of communication into categories on the basis of the topic of the communication. It shows how great a percentage dealt with a certain topic. The data came from a research into marketing. The categories of topics identified were: ([46])

- Product Use
- Politics
- Needs
- Delivery
- Segments
- Competition
- Marketing
- Prices
- Physical

This shows that communication can be categorized on the type of topic it deals with. It is hard to make general comments about such a division since the type of topics that may be discussed greatly depend on the setting of the communication. It is unlikely that such categories will be needed in this research. But this example shows that it can be done. Another diagram in the article of *Abbie Griffin* and *John R. Hauser* ([45]) shows another categorization of communication on the basis of topic. This categorization came from research into the relation between product development and marketing. It is similar to the list above but still different. The identified categories were: ([45], pg. 370)

- Planning
- Design
- Customer Needs
- Market Information

Another way of categorizing communication was also presented in the article of *Abbie Griffin* and *John R. Hauser* ([45]). A diagram shows how great a percentage of communication occurred in what functional locations in an organization. They categories were: ([45], pg. 369/370)

- Total
- Within Functions
- Between Functions
- To Management

This type of categories shows a division on the basis of location. These types of locations are a somewhat different from the general idea of a physical location since they deal with organizational structure and the division of functions. But one can visualize such a structure as a map and this categorization is based on the location on the map were communication occurs. So communication can also be categorized on the basis of location. Just like a categorization on the basis of topic the categories greatly depend on the setting of the communication. In this case, the setting is an organization but it can also be based on geographical locations.

According to *Angela Graveline, Cheryl Geisler, and Michael Danchak* ([47]) the theory on Media Richness defines a categorization for communication on the basis of communication situations. It defines three situations in which communication can take place: ([47], pg. 383/384)

- Equivocal situations are ambiguous situations. They exist of an exchange of subjective viewpoints. Often with multiple and possibly confliction viewpoints of the situation will be shared. Unequivocal situations are the opposite of equivocal situations. The situation is

unambiguous and it is primarily objective information that is exchanged, often with close viewpoints derived from common references.

- Uncertain situations are characterized by an absence of information. They often deal with an attempt to acquire information to end this uncertainty. Certain situations are the opposite of uncertain situations. They have all the information needed and they serve to solve uncertain situations.
- Messages can be socio-emotional or interpersonal in nature. This kind of communication deals with the relations between people. This is often informal communication which can be charged with an emotional load. Media Richness Theory claims that socio-emotional content is best communicated using rich media since humans are sensitive to such communication and need all their communication abilities to fully express themselves.

These categories of communication situations help define what media richness is required for each type of communication to occur effectively. Each situation has its own characteristics and requires its own approach. The final type of categorization of communication found in literature deals with types of communication that occur in teamwork. These categories define certain aspects of teamwork and what communication occurs. These are the categories presented: ([47], pg. 384)

- Interpersonal communications are the social glue that keep the group coherent. They include greetings and side conversations like small talk and jokes. They help members relate to one another and serve to bolster group identity and moral.
- Group management, on the other hand, is structural, organizational glue that keeps a group functioning. These communications include interactions about when and where the group will meet, whatever happened to so-and-so member and who is going to do what and do they have all the materials required.
- Task Work communications are communications that directly work on the task at hand. These communications include brainstorming, presenting individual work, deciding on and compelling ideas, and discussing the nature of what needs to be done.
- Tool/media communications are somewhat special to this communication environment. This category of communication refers to communication about the tools to be used. If the tools are new, a good deal of communication could be of this nature.

This list of categories is the most important for the research since this research deals with analyzing collaboration in teamwork occurring in a CSCL. This list of categories will help categorize the communication that occurs. This will help separate different messages and help determine what types of communication take place in the Digital Workshop.

User Satisfaction Breakdown

Most of the theory discussed up till now deals with collaborative learning and computer supported collaborative learning in particular. But the effectiveness of the Digital Workshop is not only affected by its characteristics as a CSCL environment but also by its characteristics as a piece of software. Software is often evaluated by measuring user satisfaction. At the end the user has to use the system and if he doesn't like it, the software will never be successful. Thus it won't hurt to look into a commonly used method of determining software quality.

Measuring user satisfaction is one of the most used ways to measure software quality. It has been concluded that user satisfaction is one of the most critical criterions in measuring the computer systems success and failure. ([12], pg. 530) User satisfaction measures how satisfied the end users are with the software product. It is based on the assumption that the user is the one who knows what is good and bad. User satisfactions assumes that good software does what the user expects it to do. ([7], pg. 417)

However, these is an issue with measuring user satisfaction. From the perspective of the exact sciences, it can be argued that is impossible to get a true measure of user satisfaction. A measure can be seen as an empirical objective assignment of a number (or symbol) to an entity to characterize a specific attribute. User satisfaction is based on the user's opinion. And opinions are subjective, which makes it impossible to have a true objective measure for user satisfaction. ([7], pg. 418) Of course, most scientific fields which deal with human behavior have to study variables that can never truly be measured objectively. But this hasn't stopped these fields of science from doing research and making major achievements. Still, the field of informatics has tried to find more objective measures for user satisfaction. Multi-level measurements like the factors-criteria-metrics or FCM model were designed to achieve a more objective measurement. The FCM model works by dividing its measurement in three levels. The first level consists of quality characteristics called factors. The second level consists out of criteria decomposing the first level and the third level consists out of metrics being used to meet the criteria. This way the objective metrics help compose a measurement for the quality characteristics. Similar models were presented but all, including the FCM model, fail to combine all these metrics into a global measure that nears the user's opinion. ([7], pg.418) Surveys that directly measure the user's opinion are still the best method to measure perceived software quality. They manage to match the users opinion much better than the proposed more objective measures. ([7], pg.418) Still, measuring software quality trough user satisfaction suffers from several issues: ([7], pg.418)

- The subjectivity of the measurements,
- The difficulty of statistically analyzing the results,
- The lack of a weighting technique for different subjects,
- The frequency of errors that can occur in these measurements.

Solutions must be thought of to minimize these problems. The paper of M. Xenos and D. Christodoulakis present a guideline for minimizing these effects. ([7], pg.419) This includes some basic rules for setting up the survey such that subjects have a good understanding of what they should. It also helps make questions allow the subjects to do what is expected from them. It also recommends the use of an interval scale when using statistics. This is the most accurate survey based results and allows the use of statistics. They also propose weighing the customer's opinion on the basis of the customer's qualification and other factors dependant on the organization setting. This is done because they argue that not every customer's opinion is equally important. The paper also provide ways to try and prevent or identify any errors that could be in the results. ([7], pg.419) The exact details of these methods aren't relevant for this theoretical framework. If it proves necessary, they will discuss together with the research methods.

The paper of Prashant C. Palvia ([8]) presents another model for measuring user satisfaction. This model focuses on small businesses. They feel this is necessary because most methods measuring user

satisfaction focus on medium and large businesses. The paper defined small businesses as any business with less than 100 employees.([8], pg. 152) It argues that small businesses are different from large and medium businesses because small businesses have limited resources and therefore the owner/manager often also becomes the specialist in various faces of IS. He/she has to deal with all aspects of IS in the company because he can't afford to hire other people to do the job. ([8], pg.152) This results into a lack of IT experts among the businesses staff. And the people who have to manage IT in the organization also deal with other aspects of the business. This makes measuring user satisfaction in small business different from measuring user satisfaction in large and medium businesses. Employees often have less expertise in each specific field but they have to deal with a greater variation of fields. ([8], pg.153) Therefore a new model was presented that tests all aspects of IS on user satisfaction.

The exact details of this model are not interesting for this paper since the students only have to use the system. Technical maintenance and other tasks are done by other people. What is interesting about this model is that it has a quite complete list of indicators for user satisfaction. Because owners of IS in small businesses often have to manage everything themselves user satisfaction measurements have to consider all possible IS related aspects that might affect the users satisfaction. The list includes 13 indicators: ([8], pg.160)

- Hardware adequacy asks if hardware meets personal/corporate needs.
- Software adequacy does the same, only for software.
- Information content asks if enough/the right information is available.
- Information accuracy asks if the information supplied is accurate and correct.
- Information format asks if the information is presented in a clear and usable manner. Ease of use asks if the IS is easy to use and accessible.
- Timeliness asks if information available is available on time and up to date.
- Security and integrity deals with security related issues and with the question how the IS deals with errors.
- Productivity asks if the IS actually improves productivity.
- Documentation ask how good and complete the documentation regarding the IS is.
- Vendor Support asks how well the vendors of the IS support their product and how this affects the users experience.
- Training and education asks if training and education were good and how much was required to use the IS system.
- Overall evaluation asks for a general opinion about the IS system.

Each of these indicators deal with an aspect of IS which could influence the user's opinion about the IS. The total of these indicators can be broken up into 48 separate items.

The paper of Moshe Zviran and Zippy Erlich ([13]) gives an overview of research done on user satisfaction. Here the measurement presented by Bailey and Pearson is valued as one of the most important contributions to the measurement of user satisfaction and is one of the most widely used tools for measuring user satisfaction. ([13], pg. 85) They also present a table with several methods for measuring user satisfaction developed over the years.

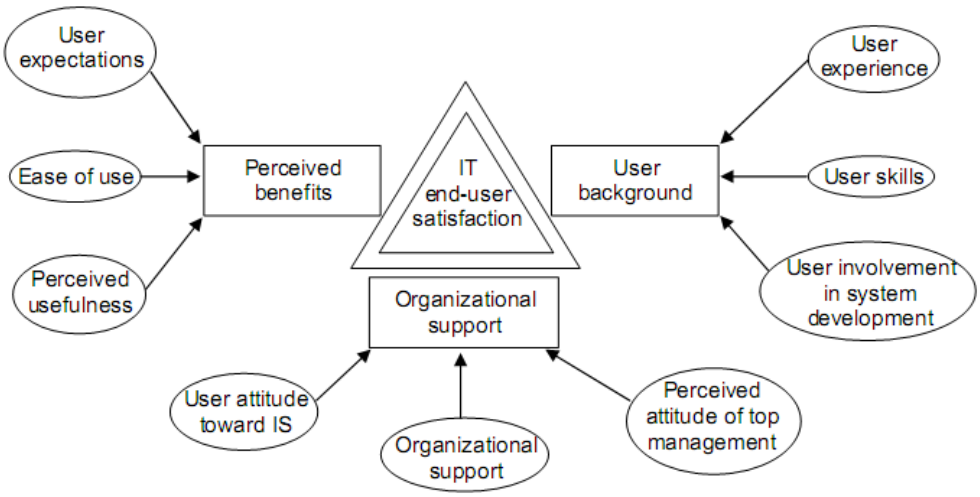
Table 1. Major User Satisfaction Constructs

Construct Reference	No. of items	Construction method	System to be assessed
Bailey & Pearson [1983]	39	Literature, interviews, empirical	IS function
Ives, Olson & Baroudi [1983]	13	Literature, empirical	IS function
Miller & Doyle [1987]	38	Literature, empirical	IS function
Guimaraes & Gupta [1988]	19	Interviews, empirical	IS department
Doll & Torkzadeh [1988]	12	Literature, interviews,empirical	IS application
Etezadi-Amoli & Farhoomand [1996]	31	Literature, interviews,empirical	IS application

The paper of Moshe Zviran and Zippy Erlich also lists five principal factors for measuring user satisfaction that were identified in literature. The five principal factors are: ([13], pg. 88)

- Relation between the organization's management and the information system
- Relation between the users and the information system
- Information received from the system
- Information system's features
- Information system's service provider

These five factors are the principal factors for measuring user satisfaction, according to the literate analyzed in the paper of Moshe Zviran and Zippy Erlich. The paper also presents a model made by Mahmoud et al. which presents three factors principal to user satisfaction. ([13], pg. 95)



The model is composed of three major factors, Perceived benefits, User background and Organizational support. These three factors each consist of three variables as shown in the model. When looking at the potential conflict between formal and informal organization 'Perceived Benefits' is probably the most important factor. If the IT does not match with the informal organization it is likely that users find that the IT does not 'fit' in their work environment. Because the work environment that the IT represents doesn't match, the users will likely find that the IT doesn't meet their expectations because it doesn't reflect their perception of the organization. They will also find it

difficult to use and will doubt its usefulness because the IT doesn't match with how the user is used to work in the organization.

This model might not be as extensive as the model presented by Prashant C. Palvia. But it is more structured and more generic than the model list of indicators presented by Prashant C. Palvia. The list of Prashant C. Palvia puts more emphasis on the different aspects of the IS system and the users position towards these aspects. The model of Mahmoud et al puts more emphasis on factors effecting the user's expectations. The model of Mahmoud et al seems more comprehensive whereas the model of Prashant C. Palvia gives a better insight in the different aspects of IT that could affect the user's satisfaction. Both are useful, though the more structured model of Mahmoud et el seems to be the best starting point because it gives the most comprehensive image.

In the field of psychology Wanous and Lawler ([12], pg. 531) proposed variations on two basic models for measuring satisfaction. The applicable definition of satisfaction is the sum of the user's weighted reactions to a set of factors,

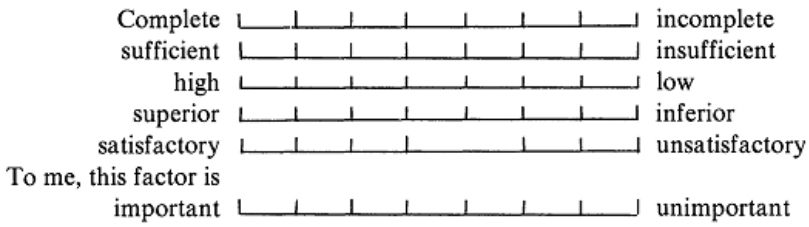
$$S_i = \sum_{j=1}^{n} R_{ij} W_{ij}$$

where:
R_{ij} = The reaction to factor j by individual i.
W_{ij} = The importance of factor j to individual i.

This model suggests that satisfaction is the sum of one's positive and negative reactions to a set of factors. And in this model, the individuals feeling must be situated between 'most positive' and 'most negative'. In order to used this model a set of factors compromising the domain of satisfaction must be identified. After that, a vehicle for scaling an individual's reaction to these factors must be found. ([12], pg. 531) The set of factors could be based on the list presented by Prashan C. Palvia.

The paper of James E. Bailey and Sammy W. Pearson presents a vehicle for measuring user satisfaction on the basis of the semantic differential technique developed by Osgood, Suci and Tannenboum. ([12], pg. 533) The technique is based on the use of adjectives to describe the characteristics of concepts and objects. The measurement of one's perception involves the rating of four bipolar adjective pairs ranging from a negative to a positive feeling. The evaluation of one's feeling is done with a seven interval scale. The figure below is an example of such a measurement for measuring one factor. ([12], pg. 533)

Degree of EDP training provided to users: The amount of specialized instruction and practice that is afforded to the user to increase the user's proficiency in utilizing the computer capability that is available.



As shown in the figure, the factor 'Degree of EDP training provided to users' is measured with five adjectives, each to be evaluated with a seven interval scale. Finally, the subject must indicate how important he finds this factor is for his measure of satisfaction. This allows for a way of measuring user satisfaction. In the paper of James E. Bailey and Sammy W. Pearson 38 factors were found and measured. After the measurement had been done a correction had to be made to the results to compensate for potential errors. Because there was no way to measure and detect errors this was done on the basis of statistics. ([12], pg. 535 This measure shows a way to formulate questions per factor to measure user satisfaction in a way understandable to the subject.

The models of Mahmoud et al and Prashant C. Palvia can be used to determine the indicators. The vehicle of James. E Bailey and Sammy W. Pearson can be used to formulate questions for the survey. The model of Lawler can then be used to calculate a score for user satisfaction, using the results of the surveys. It is unlikely that this research will include a full study into user satisfaction. This research concerns itself with the use of the system by its users, not with the user's opinion of the system. However, the user's opinion of the system likely influences the way he uses the system. If the opinion of the user is negative, the user is more likely to look for alternatives. It is possible that the users might reveal their opinion of the system in an interview. And the research will include a small survey that tries to get some information about the user's opinion of the system. This theory can when designing that survey.

Research Method

Research Question and division

Research Question

What educational value does the use of the Digital Workshop (CSCL) have?

Sub questions

- How does the Digital Workshop compare to other CSCL's and the theory about these CSCL's?
- What is the expected value of the Digital Workshop?
- How and do the groups of students use the CSCL in their work?
- How does the actual use of the CSCL in relate to the expected use?

Methods

Introduction

The primary method of this research will rely on studying how three different groups of students use the CSCL. Multiple groups will be studied to prevent that the atypical behavior of one group will dominate the results. It is possible that different groups will behave differently. People still prefer face-to-face communication to digital communication. ([42], pg. 320) So the students will likely only use digital means of communication if they have to. Groups who have trouble meeting face-to-face might use more digital communication than the other groups. This is one factor that can influence the behavior of a group. But groups will not be selected on any characteristics, like how much time the group members can spend together in one location. The groups will be selected on the basis of their performance only. The students should actively work on their project. And they should continue to work on their project during the research. The work the students already did will be evaluated and

a first selection will be made on the basis of this evaluation. This first selection will be discussed with the tutor(s) of the course and a final selection will be made on the basis of their advice.

Studying the functionality of the system

This research will consist out of a conceptual research and an actual research. The study of the functionality of the system will be the basis of the conceptual research. The results of this conceptual research will be discussed in a separate chapter.

The functionality of the relevant course section of the Digital Workshop has to be documented. If available, using design documents would be the best sources for this task. If these are available it will make documenting the functionality a lot easier. Depending on the format of the design document it either can be adopted directly or has to be translated to a language/method better representing functionality.

If there are no design documents available the system will have to be analyzed and a description of the functionality will have to be made on the basis of this analysis. . The method Use Cases could help with this task. The method Use Cases is used to design a system by describing the functionality. This methods lends itself for reverse engineering. Scenarios are a final product of the method Use Cases. They are specific instances of use cases, which describe a functionality of the system. ([10]) Scenarios could be created by trying out the system step by step and writing the steps down. Then these scenarios would have to be translated to use cases. These use cases would be generic versions of the scenarios, describing a functionality. It is likely that directly translating scenarios into use cases will result in too many similar use cases. These use cases will have to be refined. Such an approach would require the following steps:

- Study the Digital Workshop and list all the functions, as in links and buttons etc.
- Try out all different options and report about the tryouts in the scenarios.
- Create use cases out of the scenarios by generalizing.
- Merge use cases that are quite similar in functionality. This shouldn't go as far as the generalization process goes in development with use cases because the relation between the use cases and functions (links, buttons etc.) should remain clear.
- Document the relations between the different use cases and create a use case diagram.

This should result in a list of use cases which represent the functionalities of the system. It will require great attention to make sure that all potential functionality of the system is documented in scenarios. However if this is done thoroughly this method should result in a complete and well structured representation of the functionality of the system.

The result of this study should be a document that explains what the functionality of the system is. But if a conclusion about the effectiveness of the system is made the intention of the system must also be known. ([39], pg. 3) Therefore an interview with the designer(s) of the Digital Workshop and the project workspace must be held. This interview should ask about the intention these designers had when they made the system. If the intention is known, a conclusion can be made about whether the system achieved what it should have achieved.

Activity in the Digital Workshop

Gathering the information about the activity of students and tutors in the Digital Workshop won't be difficult. The Digital Workshop logs all activity in the system. So the system has already gathered the necessary information. If access to these logs is available acquiring information will be pretty straight forward. What still could be done is restructuring this information in a timeline, showing all activity of one group in chronological order. The Digital Workshop even supports this because it can show older versions of documents and compare the differences between versions automatically. What rests is to categorize the information that can be gathered from the logs. However, these history logs do have one problem. They list an author for each edit that has been made. These authors correspond to the user accounts. But there is no guarantee that an user account is only used by its owner. Multiple people can work together behind one computer. Then it is likely that only one user account is used, even though multiple people worked on that edit. This means that the edits are not the most accurate source when studying the division of work in a group. However, this information is accurate in that it does not require any interpretation. Thus the authors for each edit will still be studied. But the results of this study should be combined with results from other studies when making conclusions.

There are two main categories of information that can be found in the Digital Workshop. One category includes all information that has been added to the to-be-created product. The other category includes all communication about the project, be it between team members or with outsiders (Tutors, members of other teams) Both of these types can be divided up in many more categories. The necessary categories depend on the project setting, in this case, creating documents existing out of text, formulas and possibly images, like diagrams. Communication can occur between team members, with tutors or with members of other teams. A list will have to be made of all categories. The possible categories of additions depend on the functionality of the system. The categories of communication are more general. The fact that a tutor is involved does introduce additional categories. It is likely that this list will prove incomplete while performing the study; since making complete predictions is difficult, so new categories might be added. Literature about communication in teamwork presents four main categories of communication. ([47], pg. 384):

- "Interpersonal" communication is the social glue that keeps the group coherent. This category includes greetings and side conversations like small talk and jokes. This kind of communication helps member relate to one another and serves to bolster group morale. Interpersonal communication is of an informal nature and much of the informal communication in organizations is actually interpersonal communication.
- "Group management", on the other hand, is the structural, organizational glue that keeps a group functioning. These communications include interactions about when and where the group will meet, whatever happened to a certain group member and who is going to do what when and are all the necessary materials/information available.
- The "Task Work" communications category refers to all communication that directly relates to the task at hand. This includes brainstorming, presenting individual work, deciding on and compelling ideas, and discussing the nature of what needs to be done as well as discussing the work that has been done.
- Tool/media communications are special to digital environments. This category of communication refers to communication about the tools to be used. If the tool(s) are

relatively new and the users have little experience with them it is more likely that this kind of communication will occur.

However, the activity in the Digital Workshop isn't limited to communication related to the project. The project itself will be created in the Digital Workshop. The actions that result into the documents that constitute the final product must also be registered and fit in categories. This will give a full picture of the use of the Digital Workshop by the students. The documents in the pages of the Digital Workshop consist of two elements: Content and structure. The structure is represented by headers defining different sections while the content is defined by text, diagrams, pictures or formulas in the sections themselves. The users can either insert a new instance of such elements or change an existing element. Users can also correct small mistakes they made like spelling mistakes. Though these corrections might not be the most interesting element they are likely to occur frequently. Therefore it is a good idea to separate corrections from the other categories. The categories for the additions to the product will be: Content addition, Structural addition, Content adjustment, structural adjustment and correction.

For the communication it the digital workshop we have the four categories presented earlier: Interpersonal communication, Group management communication, Task Work communication and Tool/media communication. Looking at the functionality of the Digital Workshop and the nature of the project a further division of these categories is possible. The Digital Workshop allows users to post message boxes next to sections on the pages. This allows users to comment on content on the pages. Furthermore each consist out of several tabs. Though the main tab is the most important, there also is a discussion tab were discussions can take place.

For interpersonal communication there is no need for additional categories. The Digital Workshop tries to facilitate document development and combines this with feedback and discussion abilities. But there is no place for informal communication. It is expected that little of this kind of communication will take place in the Digital Workshop and no further division can be made on the basis of functionality in the Digital Workshop.

The Digital Workshop does not facilitate Group Management in any special way. Users can create time schedules, agenda's or to-do lists in the existing functionality but the Digital Workshop does not have any special functionality that supports this. However, a division in the Group Management category can be made on the basis of another factor: Timeliness. Group Management communication can consist out of schedules and agenda's which have dates and deadlines or to-do lists which do not have dates. This will be the basis for a separation into two sub categories for Group Management.

The most important category of communication is Task Work communication. All communication that discusses the content on the pages in the Digital Workshop or any other discussions that deal with the project work itself fit this category. Such a large category requires division into several subcategories. One of the functions in the Digital Workshop that supports Task Work communication are the message boxes that can be placed next to sections of the pages. This allows users to communicate about content placed on the page in a direct and clear manner. Users can place comments next to content or questions. Tutors can use this to place short evaluations of sections on the page or give hints to steer the group into the right direction. And questions can be posted using the same functionality. This already brings us to three sub categories: Comments, Questions, and

Tutor Comments. But users can also respond to such comments by adding another message box under the existing message box. This allows users to reply to comments, questions and tutor comments. This brings us to another subcategory, replies. These are either replies to comments and tutor comments or answers to questions. A comment can potentially lead to a discussion in which multiple replies follow each other. Outside of the message boxes a discussion can also take place. It will have to start with a comment or a question on another page and replies may follow. These subcategories fit most communication that can take place on the pages about the task at hand. If other subcategories appear during the research these need to be added. Task Work communication can be divided into four subcategories: Comments, Questions, Tutor Comments and Replies.

The last category presented in the literature was Tool/media communication. It is not unlikely that users might post questions about how to use a certain functionality on the Digital Workshops or comments that another type of functionality could have been used to provide a better solution. The Digital Workshop is based on MediaWiki, and though it isn't a very complicated tool, it does require the use of tags in text unlike the more common WYSIWYG editors like Microsoft Word. Though in this case the users are either informatics or information science students. A better than average knowledge of software in general can be expected. Still, questions and comments about the use of the Digital Workshop could be posted. A division could be made on the basis of questions and comments. This will help better understand which members have difficulty with the technical aspects of the Digital Workshop and which don't. This would result in the subcategories Technical Questions and Technical comments.

List of information categories

- **Additions to product**
    - Content addition: Addition of a new object, like a new section, a diagram, a table or possibly an image. *Indicator: If the previous version did not include the added section, diagram, table etc. it is likely an addition.*
    - Structural addition: Addition of new headers or other structure defining elements to expand the structure of the text. *Indicator: When the addition is a header or other structural elements. Structural elements are well defined in MediaWiki using tags. These tags are indicators for thus.*
    - Content adjustment: The adjustment of an already existing object. An adjustment must have an effect on the content. If it doesn't it is likely a correction. *Indicator: An adjustment can be identified by looking at the previous version. If both versions contain this section but the difference between these sections is more than a single word it is likely an adjustment.*
    - Structural adjustment: An adjustment of headers or other elements that define the structure of the document. *Indicator: If the old and new version both have a structural element defining sections but the location or name of the structural element are different.*
    - Correction: The correction of a spelling mistake or something similar. Should have no effect on content or structure. *Indicator: If the differences between the old and new version are only a few or one letter. The words must be the same, only spelling may change.*

- Delete: When a user deletes a large section of text from the previous version. *Indicator: If the preceding version included content that is not present in a similar form in the new version.*

- **Communication**
  - Interpersonal communication:
    - Interpersonal communication: Communication that doesn't relate to any work in the Digital Workshop or doesn't make any useful contributions. *Indicators: If such communication takes place on the Digital Workshop it will most likely take place on a remote location. Most content on the Digital Workshop is part of the project and therefore formal. If interpersonal communication does occur, it might be deleted quickly.*
  - Group management:
    - To-do: Any comment explaining what still needs to be done in the section it refers to. *Indicator: Any comment that something isn't finished yet could be a to-do if it explains a list of what must be done. Furthermore it is likely that a to-do message will mention that it is a to-do.*
    - Schedule: Any deadline for work or date for a meeting posted on the page. *Indicator: Any dates followed by a location or an action are likely related to scheduling.*
  - Task Work communication:
    - Comment: A comment on content that is part of the project made by a group member or a student from another group. *Indicator: a comment will likely be the first text box added to content since it directly refers to the content of the project. The content of the comment will have to refer to the content of the project work.*
    - Question: A question posted on any of the pages by anyone who has access. *Indicator: A obvious indicator for a question is a question mark. Grammar also indicates whether a sentence is a question or not. It is possible that a question sentence might appear in something else than a question. A question will most likely end with a question sentence.*
    - Tutor comment: A comment made by a tutor which comments on the project itself. *Indicator: The text message has a tutor as author and it follows project work content and not a comment, reply or question.*
    - Reply: A reply on either a comment, question or an evaluation. Replies are responses to remarks on the project. A reply can also be an answer to a question. *Indicator: A reply follows a comment or question and never is the first text box following project content.*
  - Tool/Media Communication:
    - Technical question: A question about a technical aspect of the Digital Workshop. Most likely this will be a question about how to create a certain object in the Digital Workshop. *Indicator: Just like other questions the message should include a sentence that ends with a question mark. The distinction from other questions must be made on the basis of content. Questions like: How do I make… or How do I do … are also possible indicators.*

- Technical comment: A comment on work on the Digital Workplace that remarks that there is another technical solution that might be better. *Indicator: The distinction from other comments will have to be based on content. There are no clear indicators for a Technical Comment.*

This list is as complete as can be foreseen at this moment. It is also important to determine which functionality supports which types of communication. Certain pages could have different functionalities than others and therefore support different types of communication. All communication in the logs will have to be classified. Each addition to the pages will have to be analyzed and categorized. The decision to categorize an addition as a certain type of communication will have to be defended. What is needed are indicators which point towards a certain category. For instance, a question ends with a question mark. So if an addition ends with a question mark it is likely that it is a question. Identifying these indicators and marking them in the messages would be a good and clear way to argument decisions made about categories. Thus, in order to study and analyze the logs in the Digital Workplace the following must be done

- Determine the types of communication that are likely to occur in the project setting.
- Determine what the indicators are for each type of communication.
- Categorize the all the messages in the Digital Workshop. State why a certain message was placed in a certain category if the indicators alone aren't sufficient.
- Note which functionality was used for each of the messages.

This should result in a list of all additions to the relevant pages stating what category of communication it is and what functionality was used for each addition. The list will exist of tables for each page the groups made. These list will state when an edit was made, who made it, what category the addition was and what functionality was used to make the edit. Below is an example of such a table.

Date	Author	Communication Type	Functionality Used
30-04-2010 12:30	2.a	Correction	Editing Window
25-04-2010 21:00	2.c	Structural Addition, Content Addition	Editing Window – add a special object
22-03-2010 10:25	2.b	Content Addition	Editing Window
21-03-2010 16:55	2.a	Structural Addition, Content Addition	Editing Window, Editing Window- add an image

This table holds four variables that can be analyzed. These variables are Date, Author, Communication Type and Functionality Used.

The Date variable is used as an identifier for each listed edit. It is possible that multiple edits will be made at exactly the same date, so this identifier isn't unique. But since each date lists day, month, year, hour and minute it has the most diverse values and is best suited as identifier. The Date variable has little use other than being an identifier. How long it took to create a page, at what frequency a page was edited and other possible information that could be gathered from the Date variable are not relevant to this research.

The Author variable consist of a two digit number. The first digit identifies the group that author belongs to. The second digit is an identifier for a member of that group. Numbers are used so that the author's identity remains anonymous. The values of this variable can be used to determine how many edits each user made in a page, all the pages of one group or the total of edits observed. This information is relevant to the research since an equal division of work is critical to good collaboration.

The Communication Type variable is the most important variable in this table. It's possible values are the communication categories identified above. This variable will identify what role each edit played in the project work. Some edits are mere additions of content to the project work while other edits actually consist of communication towards other group members. This variable can help identify how much of the edits in the Digital Workshop are actual communication. Four main categories of communication have been identified in the list above. The analysis will look at what percentage of the edits fit these main categories. This will help determine what role the Digital Workshop plays in the communication of the group. There are two categories of communication that require special attention. The Tutor Comment type in the Task Work Communication category requires special attention since it is the only type that can reveal the role teachers play in the work on the Digital Workshop. The Question type also requires special attention. A question reveals a request for information from other members rather than a share of information towards other members. This makes it different from other types of Task Work Communication. It is interesting to find out whether students dare to ask questions in the Digital Workshop when they arise.

The last variable deals with the functionalities that have been identified in the analysis of the functionality of the Digital Workshop. Four types of functionality that have been identified are functionalities that are used to edit a page and that can be identified from the information in the history of the Digital Workshop. These are:

- Editing Window
- Editing Window –add an image
- Editing Window- add a special object
- Rename a page

The only relevant question that these values can answer is how often users add images and special objects to a page in relation to the total edits. These functionalities are more complex than the generic edits and looking at their occurrence may help determine how willing the users are to use these more complex functionalities.

Thus the tables will supply the following information:

1. Questions answered by the Author variable:
    a. Edits belonging to a group member.
    b. Edits belonging to a group.
2. Questions answered by the Communication Type variable:
    a. Categorized as communication.
    b. Categorized as Interpersonal communication.
    c. Categorized as Group Management.
    d. Categorized as Task Work communication.

e. Categorized as Tool/Media communication.
f. Categorized as Tutor Comments.
g. Categorized as Questions.
h. Ratio between questions and potential answers. (*The history of the Digital Workshop does not reveal if a specific question was actually answered. However, any answer to a question would be identified as a reply. Therefore replies may be answers to a question. The relation between the amount of replies and questions gives some idea of the amount of questions answered.*)

3. Questions answered by the Functionality Used variable:
    a. How many edits used the Editing Window – add an image or Editing Window – add a special object functionality.

These questions can be answered for a page, all pages of one group and the total of all observed pages. Exceptions are question 1.a and 1b. 1. a. Question 1.a can only be answered for one page or all pages of one group and 1.b can only be answered for the total of all observed pages.

There are three types of pages that require special attention. Part of the assignment of the students is that they create a planning. This planning can be created on one page and a swift study reveals that all observed groups do indeed create this planning on one page. It is interesting to find out if the occurrence of certain categories of communication is different for the planning page than it is for all the groups' pages or the total of all pages. One functionality presented by the Digital Workshop are the discussion pages. They are intended to be used as a place for discussion but they can be used as any other page. It is interesting to determine whether the communication on the discussion pages is different from the communication in general. Finally, the students must give three presentations about their project work. For the second presentation, the students had to explicitly design this presentation in the Digital Workshop. It is interesting to determine whether communication on these pages was any different from the communication on all pages. Thus planning pages, discussion pages and the pages of presentation number 2 must be analyzed separately and compared with the analysis of all the pages.

Communication outside the Digital Workshop

Not all communication between the group members will take place in the Digital Workshop. Students will talk to each other about their work on the project and maybe use an instant messenger to discuss their work. They could create their documents in a word processer and mail these to other project members. The final result then can be published in the Digital Workshop. In order to fully understand how the students collaborate in this new environment we need to know what they do outside the system. After all, this is also part of the collaboration between the students and knowing what the students don't use the system for is just as critical as knowing what they do use it for. There are no easy ways to access this information. It is unlikely that the students will show all their emails and it is impossible to monitor all verbal communication. There are two ways in which this information can be acquired: Ask students to log their activities in a pre designed log and use interviews to ask the students about their activates outside the Digital Workshop in the interviews. The interviews will be used to acquire this information.

When using interviews the following steps must be taken:

- Design the interview:

    - For interviews this means setting up general questions about the different types of communication and technologies that were used outside the Digital Workshop. Designing the interview in full detail makes little sense because one of the advantages of interviews is that they are flexible. The interviewer can choose to go deeper into a certain topic if this topic appears to be more interesting. In this case, this will mean that a certain type of communication appears to be more frequent outside the Digital Workshop.
- Perform the interview.
- Gather and analyze the results:
    - The results of the interview will likely be less structured. It is hard to predict what information will come out of the interviews if you make them flexible. The first priority should be to extract the types of communication and technologies used from the transcripts. A set of indicators for collaborative learning, communication, and media must be determined. These can be used to create questions that will help gather the right information. But the most important use of these indicators is that they can be used to analyze the results.

When using logs the following steps must be taken:

- Design the structure of the log: To ensure that the students log the right information the log must be structured. Structuring the logs can also make the analysis easier. By letting the students log their activities in categories of communication and by asking them to state what technology they used this won't have to be done afterwards during the analysis of the logs.
- Present the logs and monitor their use: The students will have to understand how to use the logs. This must be explained. And the researcher should check if the students are keeping their logs up to date. Else the logs might prove incomplete and potentially useless when the research is done.
- Prepare the results for analysis: If the logs structure has been properly designed this should prove relatively easy. Maybe some work is required to fix some mistakes made by the students. But this must be done with great care because the researcher shouldn't change the actual content of the information. Each change will have to be defended.

The structure of and indicators used in the interviews will be presented in the chapter "Activity outside the Digital Workshop".

Structure of the log

The students will have to log their communication outside the Digital Workshop. The primary interest is in what type of medium the students use for what kind of communication. Therefore the students will have to keep a log in which they indicate when, with what medium and what kind of communication they used outside of the Digital Workshop. Though students should have no trouble listing the date of communication, medium and category will require explanation since these aren't as straightforward as a date. The medium column will require little explanation, since students of informatics and information science should have a good understanding of what media they use. What is required is a list of acceptable categories to standardize the logs. Category will require more extensive explanation since these are new concepts for the students.

Date and Time	Medium	Category
10:03 07-04-2010	E-mail	Publishing of Work
21:35 09-04-2010	E-mail	Reply
21:35 09-04 2010	E-mail	Comment
11:45 10-04 2010	Face-to-Face	Meeting
13:00 10-04 2010	Face-to-Face	Comment

Media

- Face-to-face: Verbal and non-verbal communication without using any electronic devices.
- E-mail: Text messages or files send trough e-mail. SMS messages should also be classified as E-mail, since they have the functionality of a primitive e-mail.
- Chat Messages: The use of instant messengers like MSN or other programs like IRC to chat about the project.
- Telephone: The use of telephone to talk about the project. SMS messages should not be categorized as telephone but as e-mail.
- Webpage: Any message or file posted on a webpage, forum or something similar related to the project.

Categories

It is possible that one message fits multiple categories. These should be listed as separate messages, all with the same date and medium but with a different category.

- Group Management: Any setting of deadlines, scheduling of meetings or other appointments or creating To-do's and planning's.
- Publishing of Work: Any new content that is part of the final products that is published or presented to the other group members or tutors.
- Question: Any question asked trough any of the media.
- Comment: A reaction on content that has been published. This can be anything from a simple remark on a spelling error to well-structured constructive criticism.
- Reply: A reply on a comment. A reply must comment of the content of a comment and not on the content of newly published content. If it does comment on published content it is a comment.
- Meeting: A meeting in which the entire project has been discussed by more than two group members. In a meeting, comments and replies must occur. New content might be published and discussed in a meeting.

Timeline

A combination of both interviews, surveys and the log is required to properly study the activity outside the workplace. The researcher must check if the subjects are keeping their logs. This is especially important in the beginning of the project. The timeline of interviews, surveys and the log would look like this:

- Start: Introduction of the log to all groups. Ask if the subjects understand the log and if they have any questions and stress the importance of keeping an extensive log. Stress that they update their logs frequently.
- First week: Plan an interview late in the week with each group asking questions that will help determine how the students use and intend to use the Digital Workshop.
- Halfway: Hold an interview with each group asking questions that will help determine whether collaborative learning takes place within the group.
- End: Check the results of the activity logs. Check whether an additional interview is needed to explain why certain behavior is shown in or outside the Digital Workshop

Indicators for collaborative learning

Many of these studies into collaborative learning compared the knowledge of students before and after the learning task for both students who learned individually and students who learned in groups. ([17, 23]) But since there are no students learning individually and the theory for each individual project varies greatly such research is impossible in this situation. Therefore we must rely on previously identified indicators to determine whether collaborative learning takes place.

What seems to be critical in collaboration is that there is a certain symmetry between group members. Partners need to have similar rights, capabilities, knowledge, goals and tasks to effectively work together. ([17], pg. 7) Collaboration relies on an equality between the group members so that they can all fully contribute to the task. If this isn't the case, strict and vertical labor divisions are required which changes the collaboration into cooperation. In this case each member will have different tasks and a strongly different learning experience which defeats the purpose of collaborative learning. Therefore symmetry of these criterions is critical and one thing that happens in collaboration is that this symmetry becomes greater because group members learn to understand each other. If there are differences and knowledge or different goals conflicts will arise and if these are to be resolved these differences must be acknowledged and solved. ([17], pg. 7/8)

This brings us to one of the learning mechanisms that occur more frequently in collaborative learning: conflict. Other mechanisms that are related to the exchange of viewpoints are (self-) explanation and induction. Explaining once opinion or thoughts to another person will give that person new insights and helps understand one's own thoughts better. In individual learning only the latter effect of explaining is experienced but in collaboration both benefits are experienced. ([17], pg. 10/11) In case of induction the participants must adjust their different viewpoints to come to one final viewpoint. This requires communication which gives new insights from different viewpoints and helps achieve a higher level of abstraction. ([17], pg. 10/11) Explaining once viewpoint to other group members, discussing these viewpoints in the group and coming to a common viewpoint that can be used to complete the task at hand are factors that help make collaborative learning a more effective way of learning than individual learning. It helps share knowledge and create new knowledge. So ways of sharing and discussing knowledge in the group are indicators for collaborative learning.

Two other learning mechanisms are internalization and appropriation. Simply said, internalization means that if two persons are working solving a problem and one of these persons introduces a concept that is new to the other person that other person might use that concept on its own when solving a problem alone. Appropriation means that a person reflects on his actions or utterances by looking at what his partner does next. Both of these mechanisms rely on observing the behavior of

others. They don't require any verbal communication. It is difficult for the person sharing the new knowledge to find out if such an exchange of knowledge took place. Generally such situations are only observed by the receiver. Indicators for such sharing of knowledge are behaviors that started at one person and silently spread among the group. One can also ask the receiver if he took over certain approaches from other group members. ([17], pg.10/11)

The last mechanism that benefits from collaboration is cognitive load. Doing work together might decrease the workload of an individual. In a learning task this reduces the cognitive load of the individual. However, the sharing of work requires coordination which introduces a new task and increases the cognitive load. This isn't a bad thing since learning to coordinate is a valuable skill. It is believed that the benefits of reducing the cognitive load is what stimulates group members to learn to coordinate when collaborating. ([17], pg. 10/11)

For the mechanisms of internalization and appropriation the indicator is individual behavior that silently becomes group behavior. However, one needs to ask whether such a change in behavior occurred silently. Therefore the best indicator for these learning mechanisms is simply asking the receiver of knowledge whether he silently copied behavior or acquired new concepts from working together.

The reduction of cognitive load is indicated by any division of labor and discussion about the division of labor, both before and after the labor has been divided. Such discussion fit into the category of Group Management. The indicators for this type of communication have already been discussed.

The last set of learning mechanisms rely on the sharing of knowledge by explaining viewpoints, solving conflicts and coming to solution that is acceptable to the whole group. What indicates such mechanisms is any form of discussion related to the project. There is a great variety of activities that facilitate discussion. All these activities are indicators for collaborative learning. *Dillenbourg* ([17]) identifies three approaches to setting up a collaborative learning task. These are the following:

- The cognitive approach is aimed at specific activities in the learning task that promote epistemic fluency. This can be achieved by applying a set of epistemic task in the learning task like describing, explaining, predicting, arguing, critiquing, evaluating, explicating and defining. If the learning task follows this approach, such tasks could be an indication of collaborative learning taking place.
- The direct approach involves the use of specific collaborative techniques that structure a task specific learning task. These are very specific and well designed techniques that teachers can learn and apply. In this case, the design of each individual task must be analyzed to identify the way learning should occur. The intended activities would then be the indicators.
- The conceptual approach involves tailoring a general conceptual model of collaborative learning to the chosen circumstances. The actual elements that should enable learning in a collaborative setting depend on the conceptual approach.

For two of these approaches the activities depend greatly on the design of the task and the chosen conceptual approach. But the first approach gives a set of general activities that help share knowledge. Describing or explaining once work, predicting future problems and future work, arguing about different solutions to the problem, critiquing others solutions, evaluating the work of group members and explicating once thoughts to the group are all activities that help share knowledge

amongst the group members. If we try and categories these activities we can come to the following categories:

- Reflection: By reflecting upon the work of either the group or one individual students might find mistakes of one individual or the group as a whole. Identifying and fixing these mistakes will help gain the whole group or an individual member new knowledge. Part of this process is convincing a person that he made a mistake. This process will also create new insights, either in how to solve a problem or how not to solve a problem.
- Negotiation: One cannot expect all group members to agree about everything. Then the group members need to negotiate a solution that at least everyone can accept. Coming to such a solution requires that everyone understand each other. It requires that the group members share their viewpoints. This might create new insights and helps share knowledge.

Both of these categories deal with the discussion of work. And both categories require that viewpoints are shared and explained. If not, the process hasn't been completed properly and it is unlikely that the solution is understood by everyone. In the end there are four categories of indicators for collaborative learning: Transfer of knowledge by observation (internalization, appropriation), reduction of cognitive load, reflection and negotiation.

Research setup

Units

- The first object to be studied is the Digital Workshop. This is the CSCL that will be used by the groups to be studied. It is the main object of study because the research question deals with the effects of this and similar systems. The technical details of the system aren't interesting for this research. This study is about the effect the system has on its users and how different kind of users use the system. Therefore the study will focus on the functionality of the system. The functionality must be studied to find out how the system can be used and what uses the developers had in mind. If the functionality has been analyzed a prediction can be made of how the system will influence its users.
- The second object of study are the tutors and their role in the Digital Workshop. The tutor uses the system to improve the effectiveness of the course he/she gives. The role of the tutor can be minimal. It is possible that the tutor only designs the final structure of the system and doesn't intervene with the actual work of the student. But there are also many ways in which the tutor can interact with the system. The most obvious example is giving feedback on the students work. But not only the actions of the tutor inside the system affect the way students use the system. Also his behavior outside the system can have an effect on the use of the system. The tutor could stimulate his/her students to use the CSCL or he/she could make use of the system mandatory. This should also be studied to have full understanding of the relation between the tutor and the CSCL.
- The third object of study are the groups of students working on projects in the Digital Workshop. What needs to be studied is collaborate and what role the Digital Workshop plays in their collaboration. A full view of the collaboration in the students group when working on the project is required. So the study shouldn't limit itself to just the Digital Workshop. Just studying the Digital Workshop will reveal the activities the students do undertake in the Digital Workshop but it won't reveal the activities they don't undertake in the Digital

Workshop but could. This study should involve more than one group of students. This way the differences in use can be compared. This might result in new insights into how group characteristics effect the use of CSCL's.

Required Sources

- The first source required is the Digital Workshop, specifically the section for the course in which the groups of students participate and the pages relevant to the groups being studied. As mentioned above, this is the main object of study. Both the functionality of the system and the activity of the subject groups in the system have to be studied.
- The second source (or rather type of source) are the groups of students. Not all activity relevant to the research will take place in the Digital Workshop. It is expected that face-to-face communication will also take place. Especially in the group(s) that have little trouble coming together in one location. E-mail and other forms of digital communication outside the Digital Workshop will also take place. Studying this information probably won't be as straight forward as studying the Digital Workshop. Interviews and surveys will likely be required to get this information.
- The third source is the tutor. This source doesn't differ much from the groups of students when it comes to accessing relevant information. Some information will be in the Digital Workshop and some information won't be directly available. Again interviews and possibly surveys will have to be used to gather this information.

Accuracy of the categorization of the activity in the Digital Workshop

The categorization of the activity in the Digital Workshop will require some interpretation of the researcher. The research will have to determine what categories can be applied to an edit. The indicators have been presented for each category. But the process of applying these categories still relies on human interpretation. Two other researches will categories a part of the edits. Their categorization will be compared to that of the main researcher. The differences between these categorization should help determine how accurate the results of this categorization are.

Multiple categories can be assigned to each edit. There is no statistic for assessing inter-rater agreement in such cases. All statistics require that each rater applies one category per subject. However, it is possible to calculate the rate at which each rater's categorization matches the other. The difference in the categorization of each edit can be calculated by simply dividing the highest number of assigned categories by the number of assigned categories that match. This will help compare the categorization of two raters for one edit. The average of the differences in categorization for all raters can be determined per edit. Then the average of the differences in categorization can be determined for all edits. This calculation will not take into account the chance that two raters assign the same category to an edit by chance. However, such an event seems unlikely since the raters only have to assign one category per edit at minimum.

This calculation is the best measure possible for inter-rater agreement. It is not as accurate as the commonly used statistics like Cohen's Kappa coefficient and Fliess' Kappa coefficient. But this calculation will give a raw indication of the accuracy of the categorization presented in the Research Method.

Measure for inter-rater agreement

n_{ij} *= the number of categories assigned to edit j by rater i*
n_{max} *=* n_{11} *if* $n_{11} \geq n_{21}$ *when comparing the assigned categories of rater 1 and 2 for edit 1*
en_j *= the number of categorizes that were assigned to edit j by both raters.*
$e_{jii} = \frac{en_j}{n_{max}}$ *= the relative agreement between two raters.*
e_j*=the sum of all* e_{jii} *for all combinations of raters (ii) divided by the total number of combinations.*
e = the sum of all e_j *for all edits (j) divided by the total number of edits.*

The complete results of this study can be found in the attachment. A small example of the table used to determine the inter-rater agreement will be presented below:

Author 1	Author 2	n1j	n2j	nmax	enj	ej12
Interpersonal Communication	Interpersonal Communication	1	1	1	1	1
Correction	Correction	1	1	1	1	1
To-do, Comment	Comment	2	1	2	1	0,5
Structural Addition	Content Addition, Structural Adjustment	1	3	3	0	0
Comment	Comment, Reply	1	2	2	1	0,5
Comment	Correction	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Comment	Correction, Comment	1	2	2	1	0,5
Correction	Correction	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Content Addition	Content Addition, Structural Addition	1	2	2	1	0,5
Correction, Content Adjustment	Reply, Comment	3	2	2	0	0

Each row represents an edit, or *j*. n_{1j} and n_{2j}, n_{max} and en_j were determined manually for each edit. e_{j12} was calculated by dividing the enj cell by the nmax cell. In the en the e_j was calculated by determining the average for the e_{j12} row. The resulting e_j's were:

- i.i = 1.2; 0.653333
- i.i = 1.3; 0.807778
- i.i = 2.3; 0.791111

e = (0.653333+0.807778+0.791111)/3 = 0.750741

Thus the inter-rater agreement is around 0.75 or 75%. 3 different raters categorize the edits in the Digital Workshop with an agreement of 75%. This is not a great result. There is a significant amount of disagreement between the different raters. This means that the accuracy of the categorization is not that good. The categorization still requires some interpretation. The results of this study show that the accuracy would be around 75%. This does not mean that the results of this study are useless. The categorization of most edits that do not include any communication are not that important. These will not be analyzed. And the differences between certain categories are small. In the analysis

of the results the categories To-Do and Schedule will be grouped together. Thus cases were one author categorizes an edit as to-do while another categorizes that edit as a schedule have little effect on the results.

It should also be noted that the other sources are also subject to interpretation. The interviews and logs kept by the students are all subject to the interpretation of the students. The accuracy of 75% is not low enough to dismiss the results of the categorization. It does show that the categorization is not an objective measure. This means that this research relies entirely on subjective measures. This is not radically different from other studies who study human behavior.

Definitions

Collaboration: Working together to achieve a common goal

Collaboration over distance: Collaboration that takes place while all people collaboration aren't in the same physical place.

Collaboration software: Software that aims to support collaboration, either by enabling over distance or by supporting a more effective way of collaboration.

Collaborative learning: Students who are working or studying together in a project in which the purpose of working together is learning more effectively than they would alone.

Computer Supported Collaborative Learning (CSCL): Collaboration software that is used in a project where learning takes place. It can be designed as a CSCL or simply as collaboration software but used as a learning environment.

Software: Any set of programmed instructions for a electronic device.

IT/ICT: Any technology that facilitates communication and information sharing. Generally refers to technology that uses computers or devices with similar capabilities. Strictly, it could refer to older communication technologies like radio or television.

Student: A person who takes part in a learning task with the purpose of learning.

Tutor: A person who supports and/or evaluates students.

MediaWiki: A software suite. Wikipedia is based on this software suite and so is the Digital Workshop.

Digital Workshop: The CSCL environment based on MediaWiki used by the information science and computer science departments of the Radboud University Nijmegen. The Dutch and official name is Digitale Digital Workshop. Digital Workshop is a translation from Dutch to English.

Page (in relation to Digital Workshop**):** A single webpage in the Digital Workshop.

Main page (in relation to Digital Workshop**):** A page that should hold the primary content. The project's documentation will be created in this pages. The main page is always the first page in the list of tabs above each page.

Discussion page (in relation to the Digital Workshop**):** The page that can be accessed through the "overleg" tab. Each page has its own discussion page.

Tabs (in relation to the Digital Workshop**):** A list of buttons on top of each page that allow the user to navigate to several different pages or to different views of the main page. The first tab in the list (most left) always brings the user to the main page.

Section (in relation to the Digital Workshop**):** A selection of pages in the Digital Workshop that relate to one course or project. The section is often named after the course or project.

Functionality: A set of actions a user can take in the system to do something. This can involve multiple steps or a single step. An example of a functionality is "opening a file" in Microsoft Word 2007. The steps this involves are: Click the office button, Click open button, Navigate to the file you want to open, Double click the file to open.

Function: A function is an element of the system which allows the user to perform a single action. In the example of Microsoft Word 2007 a function would be the office button or the open button. A user can perform a single action on this element. A function can be used for multiple functionalities.

Functionality of the Digital Workshop

The intention of the developers

As mentioned on ([A] https://lab.cs.ru.nl/algemeen/Werkplaats:Informatie_voor_bezoekers), the Digital Workshop is not a virtual workshop. Most work in computer science and information science manifests itself as text and not as visible or touchable objects. These texts are almost always made on computers. The Digital Workshop allows students and teachers to store these texts on a place that is accessible for all participants of a certain course. These texts don't have to be finished. ([A]) ([C] https://lab.cs.ru.nl/algemeen/De_elektronische_Werkplaats) explains how the concept of the Digital Workshop came to life. The comparison with the medieval guild is often made. One location where teachers and students work and learn together. Everybody can see everything so that everybody can learn from each other. In the medieval guilds, students and teachers developed new techniques and methods together This is what academic learning is about, according to the developers, and this is what has disappeared from modern academic teaching. The Digital Workshop is a collaborative learning environment but it differs greatly from what already exists. ([C])

Then how do students learn in the Digital Workshop? According to ([B] https://lab.cs.ru.nl/algemeen/Hoe_leert_men_hier%3F) learning happens in the following ways:

- By making something: This allows students to practice and contribute to something bigger.
- By looking at how other people work: When students are practicing, they can learn something from looking at how other students solve similar problems. Copying work is stupid since you won't learn anything from that but students can get inspiration for their own solution by looking at the solutions of other students.
- By letting fellow students and teachers look at your work: Not only when you are stuck but always. Fellow students and teachers can look at your work in any stage of development and can comment on it to help you create a good final product.

- By posting questions next to your own work: Questions will surely be answered someone who passes by. This can help you when you are stuck or when you want to know more about something.
- By commenting on the work of someone else without that person asking for it: Both persons can learn something from the reactions to such a comment.
- By starting a discussion on the same place where the content that the discussion is about is: Participants won't have to look far to find what the discussion is about.
- By explaining something to someone else: Explaining what you learned is the best way to check if someone understood something.
- By transforming a word in a text to a link to indicate that more explanation is required: If someone takes the time to create an article behind the link it will help you understand what this word means and help improve the document this word is part of.
- By clicking on a red link and creating a contribution: This way you contribute to the whole of all information by filling up a gap. And if you're addition really needs improvement someone will come by and improve it.
- By contributing to the glossary of a course or the main glossary: Adding information to the glossary will help you reflect on the new things you learned.
- By working together on a project: This should enable collaborative learning.

This list was created by the developers of the Digital Workshop and present their view of how learning happens in the Digital Workshop. ([B])

Courses that are given in the Digital Workshop should consist out of the following elements, according to the developers: ([C])

- They should consist out of theory and practice.
- They should include a large project that involves group work and last the entire semester.
- Weekly assignments should be part of the learning cycle.
- Students should be challenged to practice together.
- Course materials should exist out of customized material, books and relevant articles.
- The course should exist out of lectures, educational learning conversations and response lectures.
- Grading should be well separated from working and practicing.
- Participation is mandatory, but practice assignments will not be graded.
- As much course material as possible is available in the Digital Workshop and everybody can adjust it.
- Course material is adjusted as soon as possible once an adjustment is needed.
- The contributions of the students can be valuable additions to the course materials.

These elements should constitute to a learning environment that motivates students to work and learn out of their own initiative. The students should feel like they are part of the academy, so that they will work as valued members of this academy. The MediaWiki is the environment that will enable such learning to take place electronically. Next certain expansions are required to facilitate the principles of an actual workshop. Some extensions are required to facilitate a menu structure that helps order information and helps create order in chaos. Then all that is still needed are templates and categories to standardize certain pages and make sure that everything has its place.

According to the developer(s) of the Digital Workshop this should result in an electronic environment that is similar to the workshop of the old medieval guild. ([C])

This research will not evaluate this concept directly. We will look at the actual implementation of this concept in the Research & Development 1 course. An evaluation of the functionality of this implementation will help understand what abilities the system grants the students. The use of these functionalities will be evaluated to make an conclusion about their effectiveness and role in collaborative learning. A prediction of the collaborative learning in this system will be made on the basis of the gathered theory and this study of the systems functionality. The whole of this research should help conclude whether the behavior of the students reflects the expectations of the concept presented by the developer(s) of the Digital Workshop.

Generic Functions in the Digital Workshop

The Digital Workshop has been build in a MediaWiki environment. This is an open environment which allows people to create web pages containing links, textual elements, images and structural elements. These structural elements can be used to bring structure into the pages by dividing the pages into visible sections. Each webpage in the Digital Workshop consists out of three elements. To the left of each page is a navigation bar. This consists out of several links and a search dialog. The navigation bar is the same on each page in the Digital Workshop. On top of each page are several links that look like tabs. These tabs are: pagina (page), overleg (discussion), bewerken (edit), geschiedenis (history), hernoemen (rename), volgen (follow), and latex/pdf. Each of these tabs interacts with the third element on each page. This is the main element of the page and makes up most of the page. This element of the page can be freely edited and this is where the students will make their work. The interactions the tabs above have with the main element of the page are:

- Pagina (page): This is the actual page itself. It contains all the content in its final form.
- Overleg (discussion): This bring the user to a separate page which can be used to discuss the contents on the pagina.
- Bewerken (edit): This brings the user to a different view of the pagina which shows the MediaWiki code behind each page. This view allows the users to edit the code which allows the user to change the content on the pagina.
- Geschiedenis (history): This shows the history of all changes to the pagina and allows the users to compare different versions and revert back to older versions of the pagina.
- Hernoemen (rename): This allows the users to rename a page.
- Volgen (follow): Clicking this link will add this page to the user account's follow list which keeps the user updated of changes to this page.
- Latex/pdf: This link allows the user to export the contents of the pagina to a LaTeX or pfd document.

The Digital Workshop also requires users to login. Certain pages need special permission to view them and almost all pages require the user to be logged in to edit them. The user can login in the top right section of the page. When the user is logged in six links will appear. These are "User Name", mijn overleg (my discussions), mijn voorkeuren (my preferences), mijn volglijst (my follow list), mijn bijdragen (my contributions), and afmelden (logout). These links do the following:

- **"**User Name": This link is actually named the same as the user's account. Clicking it brings the user to his personal page where he/she can add personal information.
- Mijn overleg (my discussions): This lists all the contributions the user has made to all the discussions he took part in.
- Mijn voorkeuren (my preferences): This allows the user to change the user specific settings for the Digital Workshop. It also allows the user to change his/her password.
- Mijn volglijst (my follow list): This allows the user to see how many and which page's he/she has added to his/her follow list and shows which page's he/she hasn't looked at yet.
- Mijn bijdragen (my contributions): This lists all the contributions the user has made to the paginas in the Digital Workshop. The user can view these contributions from this list.
- Afmelden (logout): Clicking this link logs out the user.

These are all the generic functionalities in the Digital Workshop. Most of these functionalities aren´t critical in the user´s ability to create and communicate about his project work together with the other group members. The Pagina (Page), Overleg (Discussion) and Bewerken (Edit) tabs on each page are the most important tabs on each page since these allow the user to create and communicate about his project. These tabs will be revisited when the functionality of the Digital Workshop will be discussed in dept.

Structure of the Digital Workshop

When you first go to the Digital Workshop (url: http://lab.cs.ru.nl) you will end up at the Hoofdpagina (main page). This page contains some general information about the Digital Workshop as well as a links to all general pages and all course pages. The general pages of the Digital Workshop aren't interesting for this research since the students won't work as these pages. The same can be said for all the course pages apart from the course page "Research and Development 1". Research and Development 1 is the course which the students that will be followed in this research take part in. The Research and Development 1 page consists out of a small introduction and a section which a yellow background containing a lot of links. These links are divided into three sections: Cursusinformatie (Course information), Projecten (Projects) and Archief (Archive). The Cursusinformatie section exists out of the links Aankondigingen (Announcements), Beoordelingen (Evaluations), and Planning. The Projecten sections contains out of a set of links numbered from 0 to 16. These links lead to the project page of project group 0 to 16. In this research group 2, 5, and 13 will be followed. The archief section contains the links 2007-2008, 2008-2008, beoordeling (evaluation), cursusoverzicht (course overview), and excursie (excursion). These pages contain the following information:

- Cursusinformatie (Course information): Refers to the study guide outside the Digital Workshop for more information.
    - Aankondegingen (Announcements): Contains a table with announcements made by the tutor. The first column of the table contains dates and the second column contains the announcements.
    - Beoordeling (Evaluation): This page explains how the students work in this course will be graded and what the final mark will be based on. When on this page the right yellow section will display a new link named "Pilot" under the Beoordeling link. The Pilot page explains how the Pilot stage of the course will be evaluated. It is expected that more links will appear once the course has progressed further.

    - Planning: This page consists out of a table existing out of four columns. The rows represent the course weeks. The fist column indicates which stage of the course a specific week is in. The second column indicated the number of the week. The third column indicates what the students should be working on and the final column indicated what will be discussed during the classes of that week. Once on the planning page a new list of links will appear. Several links named groepsindeling (group composition) will appear which shows who is in which group for each date on which this composition changed. Multiple links named Intekenlijst will appear which allow students to sign in for a session with the tutor to discuss their project or their results up till now. And finally there is the refereeformulier (referee form) link which brings the user to a page which shows the form that will be used by the tutor to evaluate each report.
- Projecten (Projects): This link bring the user to a page which contains two short tutorials which explain how a user can create a new group and a new project in the group table below. Below is a table consisting out of seven columns and multiple rows. The first column of the table is named Groepsnummber (Group number). This column contains the number of each group. The second column is named link and contains links to each group page. The third column is named Projectnaam (Project name) and contains the name of the project and column four to seven are named auteur 1 … auteur 4 and consist the names of the group members. There is also a similar table below which contains the same information instead that the links refer to the logs of each group instead of their page.
    - Project 0 to project 16: There are sixteen links named project 0 to project 16. Each of these links refers to the project page of the group with the corresponding number. The page of Project 0 is blank.
- Archief (Archive): The page Archief links to is empty.
    - 2007-2008: The page 2007-2008 links to is empty. However, once on this page, in the yellow right section new links will appear named after the project names of 2007-2008. Clicking such a link will bring the user to the project page of that project.
    - 2008-2009: This page functions the same as the 2007-2008 page except that it shows the projects of course year 2008-2009.
    - Beoordeling (evaluation): This page shows an old version of the Beoordeling page.
    - Cursusoverzicht (Course overview): This page shows an old version of the Cursusoverzicht page.
    - Excursie (Excursion): This page is empty.

In principle students can edit all these pages. And there is no objection against fixing spelling errors or starting a discussion on the discussion page on all of these pages. But the students should make their projects only on their project change and they shouldn't change the actual content on any other pages. However, the Digital Workshop does allow students to do this.

The in dept study into the functionality of the Digital Workshop will look at the functionality in the project pages. This research will only follow the activity of the students on these project pages. So only the functionality of these project pages is relevant to this research. However, the functionality of the project pages will be similar to the functionality of the other pages since all pages act similar. Only user imposed restrictions can change or disable certain functionalities for a page.

The main interest of this research will be project page 2, 5 and 13 since these are the pages that belong to the student groups that will be followed in this research. However, students can communicate or comment on the work of other groups in the Digital Workshop so it is possible that this research will look at other project pages as well.

Structure of the project pages for R&D 1

The students need to produce several documents for their project in the Research & Development 1 course. Most of these documents need to be available in the Digital Workshop. As mentioned above, each group of students has its own space in the Digital Workshop. There is no premade structure for these pages. The assignment defines what documents are required. But the students are free to structure these pages in any way they like.

The project itself consist out of several phases. First the students must create a pilot. The students need to think of a project and determine their approach to this project. The students also need to document the information they gathered for their project. This information is needed to determine an approach and to describe the theoretical framework of the project. The students need to write a report about their findings and need to present their findings in a presentation. The second and third phase deal with the actual completion of the project. The students will have to follow their own approach and try and complete the goals they made themselves, which have been discussed and approved by the teacher(s). The second and third phase are separated by an intermediate report and a presentation. There is no difference in the assignment between the second and third pace. At the end of the third phase a final report and a final presentation will follow.

Apart from the actual project documentation the students need to create two other documents. They need to keep a log of their activity. The activity of each individual group member has to be listed. The students also need to create a planning for each stage of the project where they present the milestones for each stage and their deadline.

The students are free to shape their personal project page in any way they want. Here they can work on their project. They submit work, post questions, comment on each other's work and experiment freely. The work on these pages will not be graded. Only the reports and presentation will be graded. The teachers do not demand that any predetermined is used. Students are free to create their own structure. However, the different documents that need to be produced must be easily identified. Project work should be separate from the reports; logs should be separate from the planning etc. This way the students can be sure that the teacher(s) can find the documents that will be graded. And it also helps the students themselves separate the different documents they have to work on. Whether they keep everything on one page and separate it with clear headers or whether they create subpages for each document is up to the students.

Functionality Study

The functionality study will be performed by writing down scenarios of actions that will be performed in the Digital Workshop. These scenarios will be generalized into use cases. The resulting use cases will be analyzed and where possible these use cases will be merged, removed and restructured so that they give a better structured, more efficient representation of the functionality. The relation between these use cases will be visualized in a use case diagram.

Scenarios

1. Editing window - adding text
    a. The user navigates to the relevant section by scrolling in the edit window.
    b. The user enters the text he wishes to enter as plain text.
    c. If wanted, the user enters special icons (formulas etc) by:
        i. Clicking the relevant button in the toolbar.
        ii. Entering the appropriate code for the special icon as plain text.
    d. If wanted, the user makes parts of the text Italic, Bold, Underline or Strikethrough by:
        i. Selecting the text with the mouse and clicking the relevant button in the toolbar above.
        ii. Entering the appropriate tags before and after the text to be changed.

2. Editing window - entering a table or list
    a. The user navigates to the relevant section by scrolling down.
    b. The user enters a table or list by:
        i. Clicking the relevant button in the toolbar.
        ii. Entering the appropriate tags to create a table or list.
    c. The user enters text between the relevant tags to add content to the table or list.

3. Editing a window page - entering structural elements
    a. The user navigates to the relevant section by scrolling down in the edit window.
    b. The user enters the title he/she wants the new section to have.
        i. The user selects the text and clicks the “Increase Heading Levels” button until the desired header level has been achieved.
        ii. The user adds the appropriate header tags before and after the section title.

4. Editing window- entering an image
    a. The user navigates to the relevant section by scrolling down in the edit window.
    b. The user enters the image tags by
        i. Entering them manually.
        ii. Clicking the “Insert Image” button in the toolbar.
    c. The user enters the image location as plain text between the image tags.

5. Editing window – entering an comment
    a. The user navigates to the relevant section by scrolling down in the edit window.
    b. The user adds the begin and end tags and his user name to create a comment box.
    c. The user enters his/her comment in the comment box.

6. Editing window - searching
    a. The user enters his/her search criteria in the search bar.
    b. The user clicks the search button he/she wishes to use. (Find all matches, find previous match, find next match, find the selected text forwards, and find the selected text backwards.)

7. Editing window - replacing

a. The user enters his/her search criteria in the replacement bar.
b. The user clicks the search replace button he/she wishes to use. (replace all matches in whole text or selection, replace previous match, replace next match.)

8. Editing window - Undo – Redo functionality
    a. The user clicks either the undo or redo button.
    b. The last change gets either undone (on undo) or redone (on redo).

9. Editing window - saving changes
    a. Add a description to the update which includes the changes.
    b. Indicate if this is a small update or not.
    c. Indicate whether the user wants to follow this page or not.
    d. Press the save page button.
    e. Register the changes made in the edit window on the real page.

10. Editing window - preview changes
    a. Press the preview button.
    b. Create a preview page that shows the new page but does not save the new page.

11. Accessing the editing window for the whole page
    a. The user clicks the “bewerken” (edit) tab on top of the page.
    b. The user can navigate the whole page in the editing window.

12. Accessing the editing window for a section
    a. The user clicks the “bewerken” (edit) link above a header.
    b. The user can only navigate the relevant section in the editing window.

13. Access the “overleg” (discussion) page.
    a. Click the “overleg” button.
    b. Navigate tot the ‘bewerken” (edit) tab to open the editing window for the “overleg” (discussion) page.

14. Add a comment on the bottom of the “overleg” (discussion) page...
    a. Click the “+” button to open the editing window.
    b. Use the editing window to enter the comment.

15. Compare two versions of the page.
    a. Click the “geschiedenis” (history) tab.
    b. Select two versions of the page by clicking the relevant radio buttons.
    c. Click the “aangevinkte versies vergelijken” (compare selected versions) button.
    d. The system will show a page including the latest version and representation of the differences between both versions.

16. Undo a version of the page
    a. Click the “geschiedenis” (history) tab.

b. Click the “ongedaan maken” (undo) link after each versions name and date.

17. Rename a page
    a. Click the “hernoemen” (rename) tab.
    b. Enter the new name in the “Naar de nieuwe paginanaam” text box.
    c. Enter a reason for changing the name in the “ reden” text box.
    d. *Check the checkbox “subpagina’s hernoemen”(rename subpages) to rename the subpages.
    e. *Check the checkbox “volgen”(follow) to follow the page.

18. Follow a page
    a. Click the “volgen”(follow) tab on top of the page.
    b. System will sent an e-mail to the user when a page that is on the follow list is changed.

19. Export the page as LaTeX or pdf
    a. Click the latex/pdf tab.
    b. Choose a document class (book, report, article) by checkboxes.
    c. Choose what to do with the Templates and Parser functions (Remove, Do not Process, Process) by checkboxes.
    d. Choose a document language from a dropdown box.
    e. Choose a LaTeX template from a dropdown box.
    f. Choose a filetype (Text area, Download tex-files, Download pdf-file) by radio button.
    g. Click “ start export” to start the export.

20. Access the personal page
    a. Click the link named after the username in the right top of the page.

21. Edit the personal page using a form.
    a. Click the “bewerken met een formulier”(edit using a form) tab.
    b. Enter relevant text in any of the text boxes (First name, Prefix surname, Surname, Title pre, Title post, Born, Background-color, Position of image, Image legend, Url homepage, Organization, Url organization, Functions, Education, Contribution, Publications, Important pages, Free text).
    c. Click “pagina opslaan”(save page) to confirm and upload the changes in the form.
    d.

22. Reduce the size of the history list
    a. Enter a year in the “Van jaar (en eerder) “text box.
    b. Select a month from the “Van maand (en eerder)” selection box.
    c. Click the “ok” button to confirm the action.

Use Cases

Use Case Name:	Editing the text on a page
Iteration:	1

Summary:	The user uses the editing window to change or add text to an existing page or create text on a new page.
Basic Course of Events:	1. The user navigates to the relevant section by scrolling in the edit window. 2. The user enters the text he wants to enter as plain text.
Alternative Paths:	1. Enter special icons: during entering plain text. (start after 1, continue with 2) a. The user clicks the appropriate button on the toolbar or enters the appropriate code. 2. Make a section of text Italic: during entering plain text: (start after 2, end) a. The user selects the text he/she wants to make Italic and clicks the Italic button in the toolbar. 3. Make a section of text Bold: during entering plain text: (start after 2, end) a. The user selects the text he/she wants to make Bold and clicks the Bold button in the toolbar. 4. Make a section of text Underlined: during entering plain text: (start after 2, end) a. The user selects the text he/she wants to make Underlined and clicks the Underline button in the toolbar. 5. Make a section of text Strikethrough: during entering plain text: (start after 2, end) a. The user selects the text he/she wants to make Strikethrough and clicks the Strikethrough button in the toolbar.
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists.
Post conditions	1. New text has arrived on the page.

Use Case Name:	Editing the special objects in a page
Iteration:	1
Summary:	The user uses the editing window to change or add a table, list, image or comment to the page.
Basic Course of Events:	1. The user navigates to the relevant section by scrolling in the edit window. 2. The user enters the relevant tags. 3. The user enters text between the tags to add content to the table.
Alternative Paths:	1. Entering an image (start after 2, end) a. The user enters the file address of the image he/she wishes to place on the page between the tags.
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists. • An image has been uploaded to a location.
Post conditions	2. A new special object has arrived on the page or an existing object has been edited.

Use Case Name:	Searching while editing
Iteration:	1
Summary:	The user searches the page in the editing window.
Basic Course of Events:	1. The user enters a search criteria. 2. The user orders a search. (find next match, find previous match, find all matches, find the selected text forwards, find the selected text backwards)
Alternative Paths:	none
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists.
Post conditions	• The editing window has navigated to the location of the search hit and has highlighted the hit.

Use Case Name:	Replacing
Iteration:	1
Summary:	The user replaces a word in the editing window.
Basic Course of Events:	1. The user enters the word to be replaced. 2. The user enters the word that should replace the old word. 3. The user orders a replacement.(replace next match, replace previous match, replace all matches)
Alternative Paths:	none
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists.
Post conditions	• The indicated word(s) on the page have been replaced by the given other word(s).

Use Case Name:	Editing window
Iteration:	1
Summary:	The editing window in which the user can change a page.
Basic Course of Events:	1. The user enters the “bewerken” tab on top of a page. 2. The user edits the page. 3. The user described the edit he made. 4. The user indicates whether it is a small edit. 5. The user indicates if he wants to follow this page. 6. The user saves the changes.
Alternative Paths:	1. Preview the changes (start after 5, end): a. The user previews the pages. b. The user saves the changes. 2. Edit a section: (start at beginning, continue with 2) a. The user clicks the “bewerken” link by a section.
Triggers:	• A link to a page exists.
Pre conditions:	
Post conditions	• The page has been edited.

Use Case Name:	Undo a minor edit in the editing window
Iteration:	1
Summary:	The user undoes a minor edit he made.

Basic Course of Events:	1. The user clicks the undo button.
Alternative Paths:	none
Triggers:	• A minor edit has been made in the editing window.
Pre conditions:	• A page with content exists.
Post conditions	• The changes made by this minor edit are undone

Use Case Name:	Redo a minor edit in the editing window
Iteration:	1
Summary:	The user redoes a minor edit he undid.
Basic Course of Events:	1. The user clicks the redo button.
Alternative Paths:	none
Triggers:	• A minor edit has been undone in the editing window.
Pre conditions:	• A page with content exists.
Post conditions	• The changes that have been undone have been redone.

Use Case Name:	Access the "overleg" page
Iteration:	1
Summary:	The user accesses the "overleg" page and makes a contribution.
Basic Course of Events:	1. The user enters the "overleg" tab
Alternative Paths:	none
Triggers:	• There must be content on the page. • A link to the page must exist.
Pre conditions:	
Post conditions	• The user is on the "overleg" page.

Use Case Name:	Quick edit on the "overleg" page
Iteration:	1
Summary:	The user accesses the editing window for the "overleg" page under the last comment.
Basic Course of Events:	1. The user clicks the "+" button on the bottom of the page.
Alternative Paths:	none
Triggers:	• The user is on the "overleg" page.
Pre conditions:	• There must be content on the page. • A link to the page must exist.
Post conditions	• The editing window has been opened and has navigated to under the last comment.

Use Case Name:	Compare two versions of a page.
Iteration:	1
Summary:	The user compares two versions of a page in the history page.
Basic Course of Events:	1. The user enters the "geschiedenis"(history) tab. 2. The user selects the two versions of the page he wishes to compare 3. The user opens the comparison page.
Alternative Paths:	none
Triggers:	• Two versions of a page exist.

Pre conditions:	
Post conditions	• The user has accessed a view that shows the differences between two versions.

Use Case Name:	Undo a version
Iteration:	1
Summary:	The user undoes the changes of a version update.
Basic Course of Events:	1. The user enters the “geschiedenis”(history) tab. 2. The user orders the version to be undone.
Alternative Paths:	none
Triggers:	• A version of a page exist.
Pre conditions:	
Post conditions	• The changes made by the version that the user chose have been undone. • That version has been removed from the version list.

Use Case Name:	Rename a page
Iteration:	1
Summary:	The user changes the name of the page.
Basic Course of Events:	1. The user enters the “hernoemen”(rename) tab. 2. The user enters a new name for the page. 3. The user gives a reason for changing the name. 4. The user indicates whether he wants to change the suppage’s names. 5. The user indicates whether he wants to follow the page.
Alternative Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• The name of the page has been changed.

Use Case Name:	Follow a page
Iteration:	1
Summary:	The user adds a page to his follow list
Basic Course of Events:	1. The user indicates he wants to follow this page from the pagina.
Alternative Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• The page has been added to the follow list.

Use Case Name:	Export the pagina as LaTeX or pdf
Iteration:	1
Summary:	The user exports the content of a page as a LaTeX or pdf file
Basic Course of Events:	1. Enter the latex/pdf tab. 2. Choose a document class (book, report, article). 3. Choose what to do with the Templates and Parser functions .(Remove, Do not Process, Process)

	4. Choose a document language. 5. Choose a LaTeX template. 6. Choose a filetype (Text area, Download tex-files, Download pdf-file). 7. Start the exporting of the file.
Alternative Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• A file with content that matches the content on the pagina exists.

Use Case Name:	Access the personal page.
Iteration:	1
Summary:	The user accesses his personal page.
Basic Course of Events:	1. The user enters the personal page.
Alternative Paths:	none
Triggers:	• A user account must have been created.
Pre conditions:	
Post conditions	• The user views his user account.

Use Case Name:	Edit the personal page with a special form.
Iteration:	1
Summary:	The user changes the page using the special form instead of the regular editing window.
Basic Course of Events:	1. The user enters the "bewerken met een formulier"(edit using a form) tab. 2. The user fills in the form. 3. The user saves the page.
Alternative Paths:	none
Triggers:	• The user must have accessed his personal page.
Pre conditions:	• A user account must have been created.
Post conditions	• The user has changed the contents on his personal page.

Final Use Cases

The editing window

Use Case Name:	Editing window
Use Case Number	1
Iteration:	2
Summary:	The editing window in which the user can change a page.
Basic Course of Events:	1. The user enters the "bewerken" tab on top of a page. 2. The user edits the page. 3. The user described the edit he made. 4. The user indicates whether it is a small edit. 5. The user indicates if he wants to follow this page. 6. The user saves the changes.

Alternative Paths:	1. Preview the changes (start after 5, end): a. The user previews the pages. b. The user saves the changes. 2. Edit a section: (beginning, continue after 2) a. The user clicks the “bewerken” link by a section. 3. Response Edit in a discussion: (beginning, continue after 2) a. The user clicks the “+” link under the last contribution to the discussion.
Extension Paths	• Extend at step 2, multiple extends may be performed in succession: ○ Use Case 2: Editing the text on a page ○ Use Case 3: Editing the special objects on a page ○ Use Case 4: Replacing ○ Use Case 5: Undo a minor edit in the editing window ○ Use Case 6: Redo a minor edit in the editing window
Triggers:	• A link to a page exists.
Pre conditions:	
Post conditions	• The page has been edited.

Use Case Name:	Editing the text on a page
Use Case Number:	2
Iteration:	2
Summary:	The user uses the editing window to change or add text to an existing page or create text on a new page.
Basic Course of Events:	1. The user navigates to the relevant section by scrolling in the edit window. 2. The user enters the text he wants to enter as plain text. 3. The user places tags around specific sections of text to change their appearance.
Alternative Paths:	none
Extension paths	none
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists
Post conditions	1. New text has arrived on the page.

Use Case Name:	Editing the special objects on a page
Use Case Number:	3
Iteration:	2
Summary:	The user uses the editing window to change or add a table, list, image or comment to the page.
Basic Course of Events:	1. The user navigates to the relevant section by scrolling in the edit window. 2. The user enters the relevant necessary tags for the object the user wants to create. 3. The user enters text between the tags to add content to the table.
Alternative Paths:	1. Entering an image (start after 2, end) a. The user enters the file address of the image he/she wishes to place on the page between the tags.

Extension Paths:	none
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists. • An image has been uploaded to a location.
Post conditions	1. A new special object has arrived on the page or an existing object has been edited.

Use Case Name:	Replacing
Use Case Number:	4
Iteration:	2
Summary:	The user replaces a word in the editing window.
Basic Course of Events:	1. The user enters the word to be replaced. 2. The user enters the word that should replace the old word. 3. The user orders a replacement.(replace next match, replace previous match, replace all matches)
Alternative Paths:	none
Triggers:	• The editing window has been opened.
Pre conditions:	• A link to the page exists.
Post conditions	• The indicated word(s) on the page have been replaced by the given other word(s).

Use Case Name:	Undo a minor edit in the editing window
Use Case Number:	5
Iteration:	2
Summary:	The user undoes a minor edit he made.
Basic Course of Events:	1. The user clicks the undo button.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A minor edit has been made in the editing window. • The editing window has been opened.
Pre conditions:	• A page with content exists.
Post conditions	• The changes made by this minor edit are undone

Use Case Name:	Redo a minor edit in the editing window
Use Case Number:	6
Iteration:	2
Summary:	The user redoes a minor edit he undid.
Basic Course of Events:	1. The user clicks the redo button.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A minor edit has been undone in the editing window. • The editing window has been opened.
Pre conditions:	• A page with context exists.
Post conditions	• The changes that have been undone have been redone.

Other functions

Use Case Name:	Searching while editing
Use Case Number:	7
Iteration:	2
Summary:	The user searches the page in the editing window.
Basic Course of Events:	1. The user enters a search criteria. 2. The user orders a search. (find next match, find previous match, find all matches, find the selected text forwards, find the selected text backwards)
Alternative Paths:	none
Extension Paths:	none
Triggers:	• The user has opened the editing window.
Pre conditions:	• A link to the page exists.
Post conditions	• The editing window has navigated to the location of the search hit and has highlighted the hit.

Use Case Name:	Contribute on the “overleg” page
Use Case Number:	8
Iteration:	2
Summary:	The user accesses the “overleg” page and makes a contribution.
Basic Course of Events:	1. The user enters the “overleg” tab
Alternative Paths:	none
Extension Paths:	• Extend at step 1: ○ Use Case 1: Editing Window
Triggers:	• A link to a page must exist. • There must be content on the page.
Pre conditions:	
Post conditions	• The user is on the “overleg” page. • The content on the “overleg” page may have changed.

Use Case Name:	Compare two versions of a page.
Use Case Number:	9
Iteration:	2
Summary:	The user compares two versions of a page in the history page.
Basic Course of Events:	1. The user enters the “geschiedenis”(history) tab. 2. The user selects the two versions of the page he wishes to compare 3. The user opens the comparison page.
Alternative Paths:	none
Extension Paths:	• Extend at step 1: ○ Use Case 11: Reduce the size of the history list
Triggers:	• Two versions of a page exist.
Pre conditions:	• A history list exists
Post conditions	• The user has accessed a view that shows the differences between two versions.

Use Case Name:	Undo a version of a page
Use Case Number:	10
Iteration:	2
Summary:	The user undoes the changes of a version update.
Basic Course of Events:	1. The user enters the “geschiedenis”(history) tab. 2. The user orders the version to be undone.
Alternative Paths:	none
Extension Paths:	• Extend at step 1: ○ Use Case 11: Reduce the size of the history list
Triggers:	• A version of a page exist.
Pre conditions:	• A history list exists
Post conditions	• The changes made by the version that the user chose have been undone. • That version has been removed from the version list.

Use Case Name:	Reduce the size of the history list
Use Case Number:	11
Iteration:	1
Summary:	The user reduces the size of the history list by setting limits for year and month of contributions.
Basic Course of Events:	1. The user indicates which is the latest year the contributions may be from. 2. The user indicates which is the latest month the contributions may be from. 3. The user confirms the selection.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A history list exists
Pre conditions:	
Post conditions	• The history list only shows contributions that happened in a specified time period.

Use Case Name:	Rename a page
Use Case Number:	12
Iteration:	2
Summary:	The user changes the name of the page.
Basic Course of Events:	1. The user enters the “hernoemen”(rename) tab. 2. The user enters a new name for the page. 3. The user gives a reason for changing the name. 4. The user indicates whether he wants to change the names of the sub pages as well. 6. The user indicates whether he wants to follow the page.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• The name of the page has been changed.

Use Case Name:	Follow a page
Use Case Number:	13
Iteration:	2
Summary:	The user adds a page to his follow list
Basic Course of Events:	1. The user indicates he wants to follow this page from the pagina.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• The page has been added to the follow list.

Use Case Name:	Export the pagina as LaTeX or pdf
Use Case Number:	14
Iteration:	2
Summary:	The user exports the content of a page as a LaTeX or pdf file
Basic Course of Events:	1. The user enters the latex/pdf tab. 2. The user chooses a document class (book, report, article). 3. The user chooses what to do with the Templates and Parser functions . 4. The user chooses a document language. 5. The user chooses a LaTeX template. 6. The user chooses a file type 7. The user confirms the settings and starts the exporting.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• A page with content exists.
Pre conditions:	
Post conditions	• A file with content that matches the content on the pagina exists.

Use Case Name:	Contribute the personal page.
Use Case Number:	15
Iteration:	2
Summary:	The user accesses his personal page.
Basic Course of Events:	1. The user enters the personal page.
Alternative Paths:	none

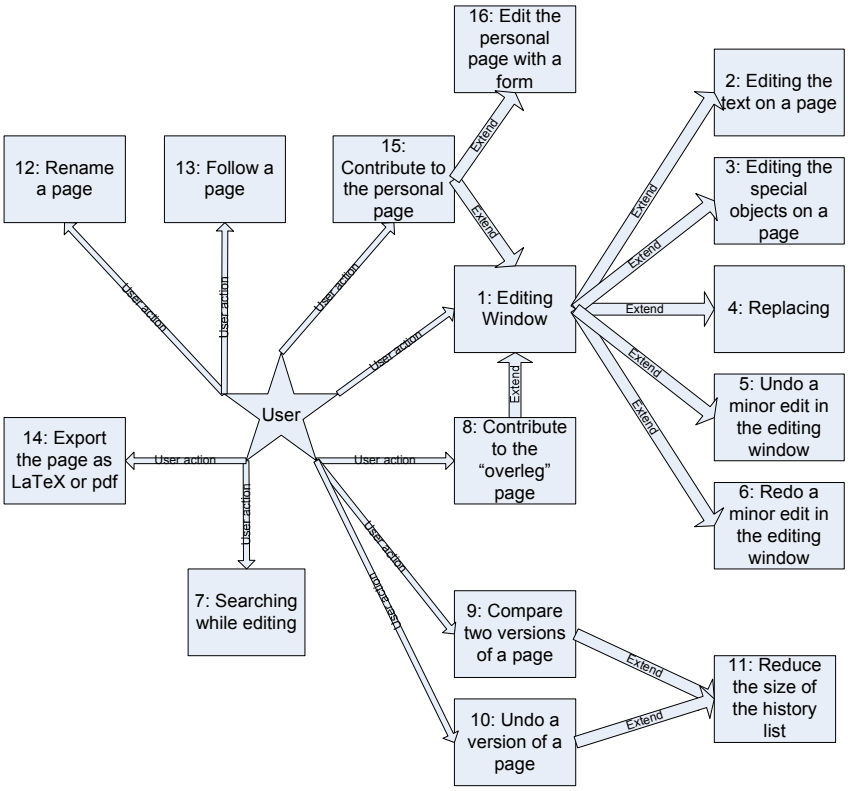
Extension Paths:	• Extend at step 1:
	  ○ Use Case 1: Editing window
	• Extend at step 1:
	  ○ Use Case 16: Edit the personal page with a form

Triggers:	• A user account must have been created.
Pre conditions:	
Post conditions	• The user views his user account.

Use Case Name:	Edit the personal page with a form.
Use Case Number:	16
Iteration:	2

Summary:	The user changes the page using the special form instead of the regular editing window.
Basic Course of Events:	1. The user enters the "bewerken met een formulier"(edit using a form) tab. 2. The user fills in the form. 3. The user saves the page.
Alternative Paths:	none
Extension Paths:	none
Triggers:	• The user must have accessed his personal page
Pre conditions:	• A user account must have been created.
Post conditions	• The user has changed the contents on his personal page.

Use Case Diagram



Analysis of the functionality

Analysis of the use cases

In the analysis of the functionality, the use case diagram will play an important role. It reveals the relations between the different use cases which helps identify the more important use cases that are central to the diagram. The "user action" relation indicates that a user can trigger this use case directly. All of these relations will be between the user and one use case, so the only element that is central to these relations is the user. The "extend" relation indicates which use cases can be triggered once a certain use case already has been triggered. For this relation, centrality is interesting since it can indicate whether one use can result into many other use cases, meaning that that particular use case must be triggered for many of the functionalities.

If you look at the extend relations, there are five use cases that extend into other use cases. These are 15: Contribute to the personal page, 1: Editing Window, 8: Contribute to the “overleg” page, 9: Compare two versions of a page and 10: Undo a version of a page.

- Use case 15 extends to use case 16 and 1. use Case 16 is a single use case, while use case 1 extends into 6 other use cases. use case 15 presents the ability to edit a page that holds personal information about the owner of an user account. Both use cases that use case 15 extends into enable the user to edit that page. Use case 16 allows the user to edit that page via a special form, unique to that page. Use case 1 allows the user to edit that page in the same way that all other pages can be edited. The extends of use case 15 present two ways in which the personal page can be edited. But the functionality of use case 15 including its extends is still limited to editing one type of page, that isn’t intended to hold any project information.
- Use case 1 extends to use case 2, 3, 4 ,5 and 6. Use case 15 and 8 extend into use case 1. Use case 1 represents the ability to open a window for each page that enables the user to edit that page. Use case 2, 3, 4, 5 and 6 are all functionalities for editing a page that are presented in this window. What use case 1 and its extends represent is the group of functionalities that can be used to edit the content on a page. Use case 15 and use case 8 are both use cases that represent the ability to access the editing window for a specific page (15: Personal page, 8: “Overleg” page) in a different way than the generic way described in use case 1. They extend to use case 1 to indicate that once the page has been accessed through these use cases they can be edited as use case 1 describes. Use case 1 has seven relations with other use cases. It extends into 5 use cases and 2 use cases extend into it. Use case 1 has, by far, the most relations of all use cases. This might give an idea about the importance of use case 1. The fact that use case 1 represents the portal that enables the user to edit content on a page in the Digital Workshop, an ability that is crucial to create any work in the Digital Workshop, confirms the importance of use case 1.
- Use case 8 extends into use case 1. As mentioned above, use case 8 represents a special way to edit the contribution page. The editing itself will be done trough use case 1. That is why use case 8 extends into use case 1.
- Use case 9 and use case 10 both extend into use case 11. Use case 9 and 10 are both functionalities that are present on the history page of the Digital Workshop. Use case 9 deals with comparing two versions while use case 10 allows the user to undo the changes that led to one version. Use case 11 its functionality supports both use case 9 and 10 in these actions. It enables the user to reduce the amount of versions viewed on the history page by placing restrictions on date for these versions. Use case 11 doesn’t really extend the functionality of use case 9 and 10. Without use case 11 the user can still compare and undo versions. It makes the work in use case 9 and 10 easier by enabling a way to sort the versions. Because use case 11 doesn’t truly expand the ability of these use cases, but only supports these use cases, it doesn’t really increase the significance of use case 9 and 10. It only makes them more attractive to use.

From this analysis we can conclude that use case 1 is a very important use case. It is far more central than any of the other use cases and it plays a crucial role in the abilities of the user in the Digital Workshop. Any new addition that will be made on the main project page and many other pages will have to be made using the functionality of this use case and its extensions.

Omissions of use cases

Use cases show the different steps of interaction a user has to make with the system for a type of functionality. The resulting use cases give a complete image of the interactions a user can have with the system. This gives an idea of the capability the user has when using this system. However, use cases do not give a full view of the entire system. The interactions described in the use cases do not include any interactions between different elements of the system. Thus use cases do not give any insight in the technical functioning of the system. But this research only looks at the use of the Digital Workshop in the project work of the students and isn't concerned with the technical workings of the Digital Workshop.

Another omission of use cases is any interaction between users. Use cases only describe the interaction between the user and the system. There are no use cases that involve more than one user. However, each use case comes with a short description of its functionality, which should give an idea of its intent, and the relation between use cases can reveal relations between different users. Thus use cases can give an insight in the possible interactions between users facilitated by the system. But this is not their primary goal and they will not give a complete image. This research concerns itself with the use of the Digital Workshop as, amongst other uses, a communication device. Thus it is important to know how users can communicate with other users in the Digital Workshop. One relieve is that all communication possible in the Digital Workshop is asynchronous. The Digital Workshop does not support any synchronous communication channels where two or more people are directly communication with each other, like a telephone or instant messenger does allow([17], pg. 9). The only way students can communicate in the Digital Workshop, as the use cases reveal, is by adding text on a page which refers to text added by another user. There will be no direct interaction between two users. A dialogue between two users would consist of one user posting a message on one of the pages, followed by the other user reading and posting a reply whenever he spots the message and decides to reply on it. The actions of each user are with the system and the other user isn't involved. Thus the use cases do describe the interaction between users as it is, since the system does not facilitate an actual communication channel between two users.

But how do users know what text is part of the document and what text is a comment? The use cases do not present any functionality that allows users to see the difference between text and an actual comment. At least not directly. The use case "Editing the special objects on a page" describes the ability to create or edit special text objects on a page. These special objects are objects like tables or special text sections with a different background color. One of these special text sections should be used to create comments. This special text section has a different background color, unique to each user and a picture of the author, if available. Such a section is created by entering the right tags before and after the text message. Technically, this isn't any different from the other special objects like a table. And the user can use this type of special object for any text message, not just comments. The developer(s) created this type of object with the intention that users will use it to make comments. But the users are free to use this type of special object in any way they want. That is why this functionality is an omission of the use cases. But with this knowledge, we know that we must look at special objects to find comments.

The Digital Workshop as a collaborative learning environment

Introduction

Much research has been done into various collaborative learning methods and CSCL environments. This has resulted in a significant amount of theory about which methods have what effect. This theory can be used to predict the results of a certain approach to collaborative learning and CSCL. This section will try to give such a prediction for the Digital Workshop in the Research & Development 1 course. Though this research will study the use of the Digital Workshop in practice as well this theoretical prediction can help identify unexpected behavior of the students who's activity will be studied.

This theoretical production will combine the results of the study of the functionality of the Digital Workshop with the theory presented in the theoretical framework. The characteristics of the Digital Workshop will be discussed on the basis of the functionality study. Then a list of indicators for student behavior in CSCL environments will be presented. These indicators will be linked to the characteristics of the Digital Workshop so that student behavior may be predicted.

Indicators for student behavior in collaborative learning environments

Collaborative learning should lead to effective learning because it triggers certain learning mechanisms more frequently. ([17], pg. 5) These learning mechanisms are triggered more often under certain conditions. Social interactions play a big role in these conditions. ([17], pg. 6) Two approaches to collaborative learning, identified by *Kreijns, Kirschner* and *Jochems*([16]), help determine what helps trigger the learning mechanisms more often: ([16], pg. 338/339)

These learning mechanisms will be discussed in dept in the theoretical framework. A short summary of the identified mechanisms will be given to help identify these mechanisms in the descriptions of the Digital Workshop.

Describing, explaining, predicting, arguing, critiquing, evaluating, explicating and defining are all activities that help promote epistemic fluency. This helps students understand different ways of knowing and helps understand different perspectives. These activities are utilized in the cognitive approach to collaborative learning. The conceptual approach identifies five other conceptual methods that help promote collaborative learning. ([16], pg. 338/339) These have been discussed in the theoretical framework. If these conditions are met, it should increase the chance that more learning mechanisms are triggered. However, *Dillenbourg*([17]) identifies four conditions that must be met before a situation can be classified as collaborative. If these conditions aren't met, a collaborative situation is unlikely. ([17], pg. 7) These criterions have been discussed in the theoretical framework. Most of them are about the symmetry in capabilities between the different group members. More symmetry is better. These criterions make sure that collaboration takes place. If these criterions are not met, people can still work together. But instead of collaborating they are cooperating. And the participants no longer grow equally since they all do different things and don't fully understand what the others are doing.

In the end, the learning mechanisms that are likely to occur more often in collaborative learning are: ([17], pg. 10/.11) What these learning mechanisms are has been discussed in the theoretical framework.

- Induction
- Cognitive load
- (Self-) explanation
- Conflict
- Internalization
- Appropriation

These learning mechanisms have to be stimulated by the learning assignment and its environment if collaborative learning is to take place in an as effective manner as possible.

Many of these learning mechanisms rely on communication. Communication has been discussed in dept in the theoretical framework. But a short summary of this discussions seems at place. First of all, there is synchronous and asynchronous communication. Synchronous communication is communication were the communication channel is open to both receiver and sender at the same time. Think of a face-to-face conversation or a telephone conversation. But an instant messenger like Microsoft MSN is also a synchronous medium. The receiver can immediately respond to a received message, even interrupt the sender. ([43], [17]) Asynchronous communication is communication where the receiver can only view a completed message once it has arrived. The communication channel is between the sender and a storage space or something similar. Then the sender opens a channel to the storage space and views the message. E-mail and post cards are examples of asynchronous media.

The Course

The assignments of a course can help trigger learning mechanisms. Each assignment requires certain actions from the students to be completed. And these actions trigger learning mechanisms. The course is likely more important for learning than the Digital Workshop, since the assignments of the course actually require students to perform actions while the Digital Workshop only supports these actions. Different assignments of the course and different aspects of these assignments might trigger certain learning mechanisms and might help prevent effects that are negative for collaborative learning.

Course setup

Learning isn't only affected by the electronic environment where it takes place. The assignment that the students have to work on is even more important. After all, the assignment presents the learning tasks to the student that will learn the students something and stimulate them to work together. ([16], [17]) Thus the setup of the course is a great influence on the learning of the students. As mentioned in the description of the functionality of the Digital Workshop, the students have to produce. The course Research & Development 1 tries to teach the students about research and development. Their assignment is a research and development project of the students choice, as long as it is related to ICT technology. This assignment is divided into three stages:

- The first stage is the pilot stage, where the students have to think of a project and determine whether this project can be completed in the duration of the course. The second and third stage of the project both deal with the actual completion of the project. The separation between the second and third stage is artificial. Each stage ends with a report and a

presentation. The produced documents for each stage are the actual project work, a report and a presentation.

- The students also need to create a planning for each stage. They need to indicate what is needed to complete a certain stage and when each element will be completed.
- The third document the students need to produce is a log where the activity of each individual group member is logged. This allows the students and teachers to keep track of the activity of each group member. The log also helps students document their work. Not all the work they do will be in the Digital Workshop but they must describe this work in their reports.

These are the documents that the students need to produced. The actual project work, the planning and the log have to be in the Digital Workshop on the groups personal page. How they structure their own work is up to the students themselves.

There are no demands made to the way the students discuss their work. They are free to choose which medium they use and how often they meet. Project groups can sign up for a meeting with the teacher(s) during certain lecture hours. These lectures are once a week except for the weeks that students have to give presentations. In the end the reports for each stage, the presentations and the group work, evaluated on the basis of the log and planning, will be graded.

The teachers have intermediate discussions with the students. They use these discussions to evaluate the student`s work. They ask the students to reflect upon their work on the basis of this evaluation. This reflection should take place in the intermediate discussions. This helps the teachers steer the reflection in the right direction. Such a discussion requires fluid communication. Therefore the teachers prefer face-to-face discussions. The students also get the opportunity to ask the teachers questions during classes.

Influence of the Course

The log helps achieve individual accountability. This is a conceptual method that is important to collaborative learning. Individual accountability helps guarantee that all group members collaborate. The teacher and students can see what each group member has done. If one group member has done significantly less than the other group members, the other group members can confront this group member with the problem. If this doesn't help or happen the teacher can decide that, by looking at the log, to intervene. The most extreme measure that the teacher can take is giving the student that did less than the other group members a lower grade. Though the log should facilitates individual accountability , it contains information produced by the students themselves. A student might falsify his log by. Since the students can view the logs of other group members, students can act against falsified logs. But it is possible that one group chooses to hide that one member did less. Individual accountability is guaranteed at least when the other group members find one group members contributions to little.

The students also need to create a planning. For each stage of the assignment, the students need to determine what must be done and when it must be finished. This learns the students how to make a planning for a whole group and not just an individual. They need to decide what must be done to finish a stage and what feasible deadlines are as a group. Learning how to plan as a group is a skill that is valuable for group work. Creating a planning teaches the students about interpersonal and

small-group skills. These are all skills that help students learn to effectively reduce the cognitive load of the individual when working together.

The combination of a planning and a log force students to look back at what they have done and determine whether they did what they had planned to do. Once creating the logs, students are also confronted with the work they did and the work other group members did. If the findings of these confrontations are discussed in the group, this helps determine whether the group is on the right track or whether the group needs to change the way they work. This might trigger induction and it also requires an explanation of viewpoints to other group members. However, though the students produce all the necessary information there is no guarantee that they will actually use this information. The students can simply ignore the logs and planning. What does guarantee group processing are the intermediate reports and presentations. There are two intermediate reports and presentations, one after the pilot stage and one after the second page. These deliverables are evaluated by the teacher. This evaluation gives the students an indication of whether they are on the right track. If an evaluation is bad, they know they need to change things or work harder. Since the whole group is evaluated , this helps stimulate group processing. This intermediate feedback enables the group members to evaluate their group process and determine whether they need to improve the way they work.

If the students actually create the planning and log together they must exchange viewpoints and conflict might arise. Furthermore the intermediate evaluations confront the group with their work. This forces group members to look at what they have done. If a discussion arises, this might trigger several learning mechanisms. Students must explain themselves and their actions to other group members. This triggers the learning mechanism of self explanation. Other group members give feedback on this, which triggers appropriation. And conflicts might arise, which triggers the learning mechanisms of conflict. The logs and planning force students to determine what work has to be done and enable them to look back and determine what work has actually been done. The intermediate feedback shows them whether the work they have done was good enough. The combination of these elements stimulates the students to have discussions which should trigger the learning mechanisms mentioned above. But the students are not forced to have such discussions. Thus there is no guarantee that these learning mechanisms will be triggered.

The participants of the course are either computer science or information science students. This means that there is some differentiation between the skills and knowledge of the group members. One of the criterions for collaboration presented in the theoretical framework is that there is a certain degree of symmetry between group members. If there is too little symmetry, the differentiation between skills of different group members might result in clearly defined, well separated tasks for each group member. This goes against collaboration since collaboration requires that all group members understand and can intervene in the work of other group members. The differences between the skills and knowledge of informatics and information science students aren’t that great since several courses are followed by both groups. And the classes of the Research & Development 1 course are followed by all students. Thus most students should be able to understand what other students are doing. But it is possible that a certain project relies on the skills of one individual student. If this student does not share his knowledge, then this could be problematic to collaborative learning.

No part of the assignment explicitly asks the students to share their viewpoints with other group members. The assumption is made that such an exchange of viewpoint comes naturally in group work. There is also no guarantee that every group member is needed to complete the project. There is individual accountability, so each group member must contribute. But whether it is necessary that each group member contributes if the assignment is to be successfully completed remains unclear.

The Digital Workshop

Specification of the Digital Workshop

The Digital Workshop is an interactive website based on the MediaWiki software. It allows its users to create documents trough an universal editor. It also allows it users to create web pages that give the content of the website structure. Like MediaWiki, the Digital Workshop has user accounts and users have access rights. Though the principle of the Digital Workshop is that everybody can view and edit everything, access to certain pages can still be regulated. Generally, only the participants in a course and the course's teacher(s) can access a course's page. But this can vary from page to page.

The most important tool of the Digital Workshop is the editing window. This window allows the user to edit any text element on a page. Text elements can be plain text, headers, links or special text objects like tables and comment sections. Images are also added to pages with the editing window. This is done by entering the image's file address in between image tags. Thus images are also added by a text element. Users can create new pages by adding a link that does not refer to an existing page on a page. Once this link has been added, it turns red and users can click it to create an actual page behind that link. This functionality enables users to place new content on existing pages and enables them create new pages. Headers can be used to add structure to the text on a page, much like in conventional documents. Users can add comments to documents with a special text object. These objects have a special background color for each user and show an portrait of the user, if available. This is the only functionality that was purpose built for comments. The rest of all functionality in the editing window is aimed at document creation.

Apart from the editing window, the other functionalities have little to do with text editing. Most of the functionalities either deal with version control or the following of a page. These are useful tools for an individual but they contribute nothing to communication. One feature that is worth noticing is the presence of a discussion page behind each page. This should function as a page for discussions about content on the main page.

The one feature that allows users to add content to pages and create new pages is the editing window. This feature enables students to make their project on their page of the Digital Workshop. It also supports the only feature of the Digital Workshop that facilitates group communication: The "comment" text object. This is the only feature that enables users to add a message to a page that is targeted to other users. Thus the characteristics of the Digital Workshop can be described as follows:

- The Digital Workshop consists out of a set of web pages structured top down from the main page.
- Access to these pages can be restricted to specific user accounts. User accounts aren't required to access a page.
- Each course has its own page, which generally can only be accessed by teachers and course participants.

- For the R&D 1 course each project group has their own personal page.
- All who have access can edit content on these pages and create new pages.
- Each page has its own special discussion page.
- Users can place messages on a page with the “comment” feature. These are linked to one user account only.

Role of the Digital Workshop

The planning, the log and most of the work must be made in the Digital Workshop. Reports can be made in separate documents, though all the content that is in the reports must be available on the Digital Workshop in some form. Some products the students might produce for their project may not supported by the Digital Workshop. Computer programs are an example of such a product. The code of these programs can be placed in the Digital Workshop as plain text, but programming environments give far better support. And the code can’t ne compiled in the Digital Workshop. If a product is not supported (well) by the Digital Workshop, it doesn’t have to be in the Digital Workshop. Students may upload the final product as a file.

All the work of the groups participating in the course Research & Development 1 should be on the Research & Development 1 page. Anyone who has access to this page, who are teachers and students in this course and some other people, can view and edit almost all the material on this page and its sub pages. This way any person who has access can contribute to the work on the Digital Workshop and communicate with the student groups. This allows for communication between groups and it gives teachers the opportunity to view all activity in the Digital Workshop. Because of this open nature, collaboration can not only take place in groups but also between groups. Thus all learning mechanisms that might be triggered by collaboration with group members may also be triggered by collaboration with members from other groups. However, collaborating or even communicating with members from other groups is not mandatory. This isn’t a part of any assignments in Research & Development 1. How much communication between group members happens is unclear.

Each group’s assignment has its own subject chosen by that group itself. This means that each group will have to gather information and grow knowledge that is related to their project and not shared with other groups. This results in an asymmetry of knowledge between different groups. Thus the criterion of symmetry for collaboration, that is met within a group, will not be met when it comes to collaboration between groups.

But communication isn’t the only aspect of collaborative learning that benefits from the Digital Workshop’s open nature. What is probably most important is that students can look at the work of other students while they are working on their project. This can be the work of students from their own group or from another group. Internalization is one of the more important learning mechanism. It is critical in a child’s development. ([17], pg. 11) Internalization means that you learn something by looking at how someone else solves a similar problem. And since the students can look at the work of any other students in the Digital Workshop, internalization can take place between all students.

In the previous section, the value of keeping a log was mentioned. It helps determine what contributions were made by which group member. It also lets students reflect on what they and other group members did. The problem with these logs was that the students themselves kept them. And a student’s perception of his work is subjective and students might add false information to a

log. But the Digital Workshop keeps an extensive history of each page. Each contribution is listed with date and author. And for each contribution made, a version of that page is stored. These versions can be accessed from the history list. Versions can even be compared with each other. This way one can not only see who made a contribution on what date but they can also see what has been changed by that contribution.

Each page of the Digital Workshop has a discussion page. These "Overleg" page's are separate pages that are linked to another page. The name of these page's suggests that they should be used to hold discussion. However, these "Overleg" pages can be used in the same way as any other pages. The Digital Workshop does support discussions. It has an object specially made for comments that helps separate comments from other text on the main page. This object states the author of each comment and gives each author a different background color. This way users can discuss content on the page itself. These comment objects are the only mechanism of the Digital Workshop that are specially made to support discussion. These should facilitate any communication between group members on the Digital Workshop. This means that this is the only mechanisms that supports the learning mechanisms that rely on communication between group members. Thus these comment objects are the only support the Digital Workshop gives to learning mechanisms like (Self-)explanation, conflict and induction.

The editing window acts as the text editor of the Digital Workshop. As mentioned above, it still shows the actual code of the text when editing. However, the most well known text editors do not show these codes. They only show the final result. Such editors are referred to as WYSIWYG, short for "What you see is what you get". The Digital Workshop does show the code of these special objects. Though it comes with a set of buttons that add the necessary codes for the user, the user still has to work within these codes. The user won't see what the final result will look like until he saves the page or orders a preview. And certain objects don't have a button, which means that the user must learn the code.

The Digital Workshop is an asynchronous medium. Messages can be placed in the Digital Workshop as part of a document or as comments. Then the receiver will have to go to the page and look for the message himself. E-mail notification is possible but this doesn't change the asynchronous nature. The problem with asynchronous communication is that the receiver doesn't directly know when a message has arrived. He has to actively look for it. This means that it can take time until a message is viewed. ([43], [17]) The result is that communication can be slow. Less speed often means less feedback and the current of information will be less. ([43], pg. 112/113) The advantage of the comments in the Digital Workshop is that one message receivers multiple senders. Everybody with access can view the message. This way senders can reach a broad audience. But this also means that private messages can't be placed in the Digital Workshop. Another advantage as that the comments can hold any information that pages of the Digital Workshop can hold. Images, links, tables and other objects can all be placed in the comments. This makes the comments a rich medium for communication.

Summary and Conclusion

Effects of the Digital Workshop

The Digital Workshop enables its users to place text on web pages. This text can take many shapes: documents, images, tables, comments and other types. Users can structure the content on the pages

in the Digital Workshop by creating links from one page to another. New pages are made by creating a link that points to a non-existing page. The course requires students to research and develop a product of their own choice, as long as it is related to IT and the choice must be agreed upon by the teacher. The production of the final product will consist of three stages, each followed by a presentation and a report. Next to the product, the students must make a planning and keep a log of all their activities related to this assignment. The reports, presentations, log and planning will be graded.

The log kept by the students combined with the extensive history kept by the Digital Workshop guarantees individual accountability. Teachers and students can see what every individual group member has contributed. This is important if the collaboration is to be successful. Group members who don't actively participate can seriously disrupt the collaboration in a group. Keeping a log and making a planning forces the students to learn group management skills. These are valuable skills. The different student groups are relatively synchronous, thus true collaboration will take place. The students will learn from collaborating since they have to exchange viewpoints, can see how other group members solve problems and have to come to one viewpoint that will be represented in the product. But no part of the assignment enforces these activities. These activities will have to come naturally from working together. It is expected that such activities could occur more often if the assignment explicitly tells the students to perform learning tasks that enable such activities. This way, it is guaranteed that the learning mechanisms triggered by these activities will occur and likely will occur more often. The intermediate evaluations force the students to reflect upon their work. Reflecting upon ones work helps students learn better. Sharing such reflections with other group members improves learning even more. Conflicts might possibly arise which can result in valuable new insights. However, the assignments do not explicitly ask the students to reflect upon their work as a group after an evaluation. This means that there is no guarantee that such reflection will take place and it would likely occur better if reflection as a group would be explicit part of the assignment.

The open nature of the Digital Workshop has two advantages: Collaboration can take place not only within one group but between members of all groups and teachers. This theoretically increases the group size from 2 or 3 to a size equal to the number of participants. But the assignment only deals with working as one group and not with collaborating with other groups. And the projects of each group is different which makes the groups to asynchronous to truly collaborate. Therefore the effects of this advantage are minimal. It remains a question how much collaboration will take place between members from different groups. Another advantage is that all participants can view each other's work. This stimulates internalization, an learning mechanisms that involves drawing inspiration for your solution to a problem from looking at the solutions to a similar problem of other people. Now students can draw inspiration from the work of all participants and not only from group members.

The Digital Workshop only enables one way of communicating. Users can post messages on a page. These messages can easily be distinct from other text on the page and are linked to one user. They are also rich since any content that can be placed on the page can be placed in such a message. The messages receive a broad audience since everyone who has access to the page can view them. This generally means all participants of the course. However, the sender can't send a message to receivers of his choice. This means that the Digital Workshop isn't suited for private messages. Posting messages is an asynchronous way of communication. This means that receivers will have to check whether they have received a message from a sender. This can take time. A relatively long time

between messages prevents long conversations which consist of many messages from taking place. Thus it is unlikely that deep discussions will take place in the Digital Workshop. Discussions will only consist of a few messages and the true important discussions will have to take place in other media.

It is expected that collaborative learning will take place. The nature of the assignment requires collaboration and certain additional assignments stimulate learning mechanisms related to collaborative learning. But certain learning mechanisms could be triggered more often if additional assignments would be included. In the worst case, these might even not be triggered in the current setup. It is expected that most work will be created in the Digital Workshop since it offers easily accessible centralized storage. Some communication will take place in the Digital Workshop, but students will likely use additional electronic media outside the Digital Workshop. This is because the Digital Workshop supports few types of communication. Overall, the Digital Workshop will be used and will support collaborative learning but there is certainly room for improvement on many fronts.

Concerns about the Digital Workshop

Each group has its own project and the theoretical background of these projects can differ a lot. This means that different groups don't know what the other groups are working on. Studying the theory relevant to another groups project is likely to much of an effort in the eyes of the students. Thus it is unlikely that students from other groups will make comments on the work of a group. The only comments they can make, if they do not bother to study the theoretical background of that group's project, are comments on structure and spelling. It seems that the nature of the assignments prevents that the advantages of the open nature of the Digital Workshop are fully exploited.

Another concern about the Digital Workshop also relates to its open nature. What if students start stealing the work of other students and claim it as their own? This way students might pass a course without learning anything. Fortunately, the fact that students have to choose their own subject for their Research & Development 1 project means that the projects of each group are quite different. This makes blatant copying impossible. If different students do make similar assignments, teachers will have to check that the answer of one student isn't a direct copy of the answer of another student. Teachers can check the date of each contribution, so the history of the page will show who's copied who. Some assignments don't allow for much variety in their answer. These assignments might require more user restrictions, since it is impossible to check which answer is a copy. But such assignments are not in the Research & Development 1 course.

As mentioned in the description of the course setup, this isn't required in the Research & Development 1 course. If a group of students decides to make a deliverable outside the Digital Workshop they will probably not use the discussion pages. But why would students choose to create their deliverables outside the Digital Workshop? Since a deliverable will be graded students might put these documents to a higher standard than any work in progress. Thus students might pay more attention to the layout of a document. Considering the fact the most used word processers are Microsoft Word and the word processer of Open Office, it is likely that the students are used to, and will prefer, a WYSIWYG environment. Using a non-WYSIWIG environment will cost the students more effort, since they are less familiar with these editors. Thus it can be expected that deliverables are made in other text processors than the Digital Workshop. Furthermore, the fact that users are more used to WYSIWYGs might affect the opinion of the users about working in the Digital Workshop in a

negative way. They would prefer it if text editing in the Digital Workshop looked like it does in the text editors they are used to.

It seems that the comment messages on the main page and comments on discussion page offer the same functionality. But the comment messages are even closer to the source of the discussion as the discussion page. The only reason for using the discussion page might come from the need to keep the main page "clean" from any comments or similar objects that aren't part of an actual product. So the discussion pages are only useful if actual deliverables are being made in the Digital Workshop. As mentioned above, it is expected that students will choose to make their deliverables in other text editors. Thus this possible advantage of the discussion page isn't needed. This means that students have little reason to use the Discussion pages.

Results

Activity in the Digital Workshop

Setup of the analysis

The Research Method presents several questions that will be answered trough an analysis. This analysis will be done using statistics. The list of questions presented in the Research Method will be expanded with the statistical functions used to answer these questions. The Microsoft Excel formulas used will be added. The activity in the Digital Workshop has been documented in Microsoft Excel spreadsheets. Note that the language of these spreadsheets and the formulas is Dutch. A spreadsheet has been made for the total of all activity monitored, the total of all activity of one group and the activity on one individual page. Most questions can be answered for all spreadsheets. Furthermore there are three types of pages that require special attention.

Three variables were used to answer the questions that will be discussed below.

Statistic	Absolute Number (formula)	Percentage of total (formula)
Author variable		
Edits per author	(AANTAL.ALS (range: all; criteria: user identifier))	Edits per author (absolute number)/Total number of edits(absolute number)
Edits per group	(AANTAL.ALS (range: all; criteria: group identifier in user identifier))	Edits per group (absolute number/Total number of edits (absolute number)
Total number of edits (needed to calculate the percentages)	AANTALARG(range: all)	
Communication type variable		
Communication (all categories)	(AANTAL.ALS (range: all; criteria: Interpersonal communication, To-do, Schedule, Comment, Question, Reply, Tutor comment, Technical question, Technical comment))	Communication (absolute number)/all categories (absolute number)
Interpersonal communication	(AANTAL.ALS (range: all; criteria: Interpersonal	Interpersonal communication (absolute number)/all

	communication))	categories (absolute number)
Group Management	(AANTAL.ALS (range: all; criteria: To-do, Schedule))	Group Management(absolute number)/all categories (absolute number)
Task Work communication	(AANTAL.ALS (range: all; criteria: Question, Reply, Comment))	Task Work communication (absolute number)/all categories (absolute number)
Tool/Media communication	(AANTAL.ALS (range: all; criteria: Technical question, Technical comment))	Tool/Media communication (absolute number)/all categories (absolute number)
Tutor comments	(AANTAL.ALS (range: all; criteria: Tutor comment))	Tutor comment (absolute number)/all categories (absolute number)
Questions	(AANTAL.ALS (range: all; criteria: Questions))	Questions (absolute number)/all categories (absolute number)
Replies (needed to determine the potential answers to questions variable.	(AANTAL.ALS (range: all; criteria: Reply))	
Potential answers to questions*		Replies (absolute number)/Questions (absolute number)
All categories (needed to calculate the percentages)	(AANTAL.ALS (range: all; criteria: all categories))	
Functionality type variable		
Editing Window – add a special object and Editing Window – add an image	(AANTAL.ALS (range: all; criteria: Editing Window – add a special object, Editing Window – add an image))	Editing Window – add a special object and Editing Window – add an image/all categories

*: *The history of the Digital Workshop does not reveal if a specific question was actually answered. However, any answer to a question would be identified as a reply. Therefore replies may be answers to a question. The relation between the amount of replies and questions gives some idea of the amount of questions answered*

As mentioned in the Research Method, there are three pages or groups of pages that require special attention. There are the pages containing the preparation of presentation 2, the planning pages and all the discussion pages. The question is whether communication on these pages is different from the communication shown in general. Such a comparison will be made per group and for all observed activity.

Results of the analysis

Group and member participation

The Digital Workshop lists the author for each edit made in the history for a page. This information was used to determine the size of the contribution of each group in the total of all observed edits and the size of the contribution of each group member in the total of all edits of one group. Successful collaboration requires equal participation from all involved partners. ([16], pg. 338/339) Thus it is important to find out if such equal participation does occur in the Digital Workshop. And it

is interesting to find out whether there is much variety in the total of edits for each individual group. First the division of work between groups is presented. This should help determine which groups use which pages most. Then the division of edits within the groups will be presented. This will be done per group, since this information is used to determine whether there is a good division of work within these groups.

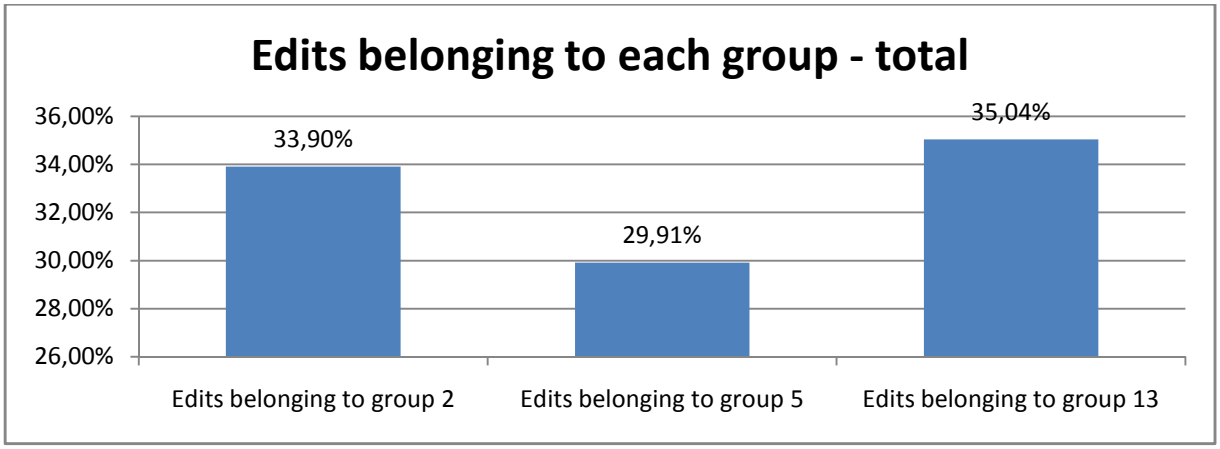
Group participation

For each individual page the occurrence of an author per edit was counted. This was also done for the total of all pages, all pages of a group and all discussion pages. The size of each contribution was determined by dividing the total of all edits on a page by the total of all edits belonging to one author on that page. In the statistics for the total of all pages the contribution of each group was listed as follows:

Formulas	Percentage	Absolute Number
Edits belonging to group 2	33,90%	119
Edits belonging to group 5	29,91%	105
Edits belonging to group 13	35,04%	123
Communication	18,38%	86
Interpersonal communication	0,21%	1
Categorized as Group Management	8,55%	40
Group Management	9,62%	45
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	2,56%	12
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	83,33%	10
Use of the Editing Window - add an image and Editing Window - add a special object	4,56%	16
Total number of edits		351
Total number of categories		468

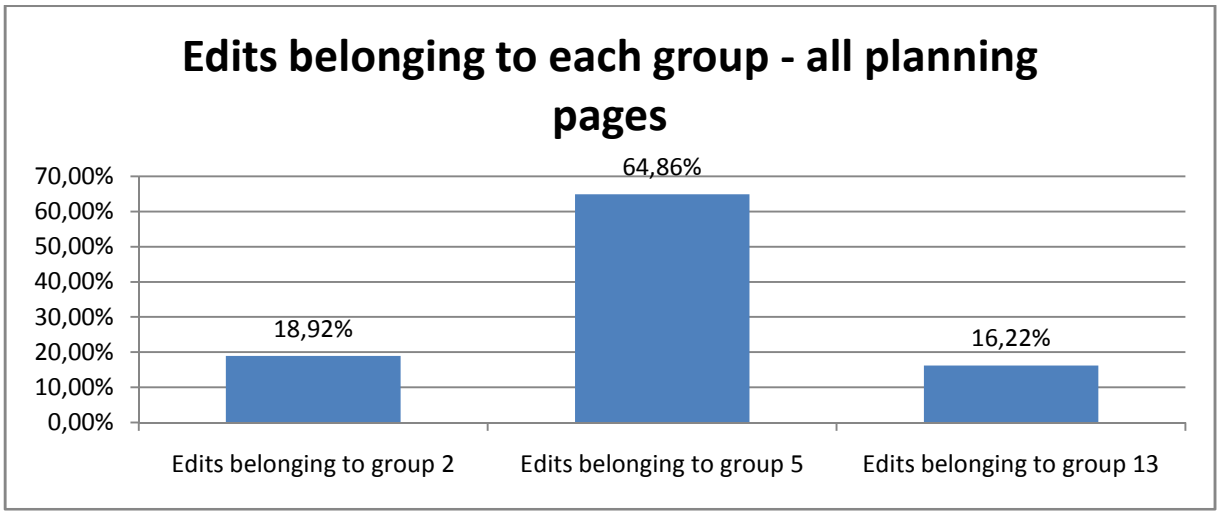
The blue colored fields hold the total number of edits of each group. These numbers were divided by the total number of edits in the green colored fields. The result of this calculation is the relative size

of each groups contribution. This is listed in the blue colored fields of the column named percentage. The graph below shows the size of the contribution of each group:



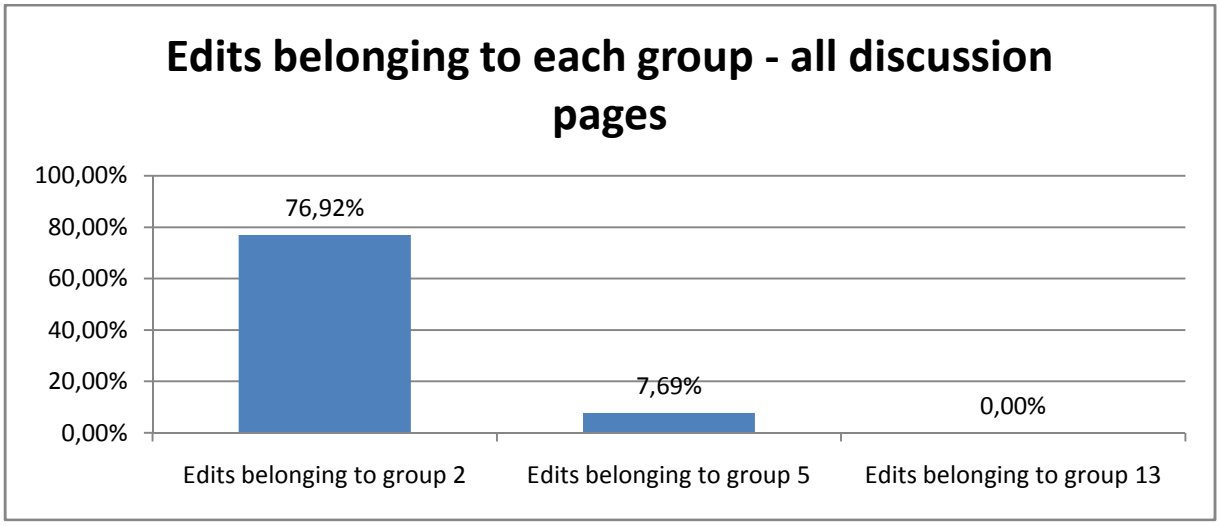
This graph reveals that the size of the contribution of each group are quite similar. The size of each groups contribution is around ⅓ of the total of all edits within a margin of 6%. The variety in size is hardly significant.

Such data was also gathered for the total of all planning pages. The graph below shows the size of the contribution of each group on the planning pages:



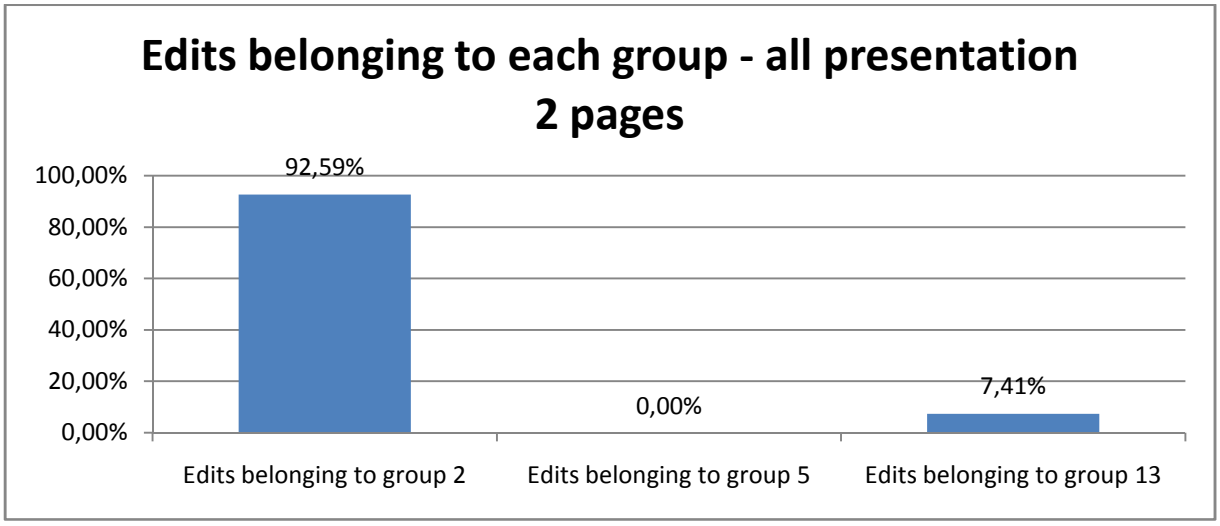
Each group has its own planning page. This graph reveals that the planning page of group 5 had significantly more edits than the pages of the other groups. The number of edits of group 13 and 2 are quite similar, with a difference of only 3%. But the number of edits of group 5 is more than three times higher than the number of edits of group 2.

Similar data was also gathered for the total of all discussion pages. The graph below shows the size of the contribution of each group on the discussion pages. It should be noted that group 13 did not use the discussion pages.



This graph shows that more than 90% of all edits made on the discussion pages were made by group 2. It appears that group 2 chose to use the discussion pages while group 13 didn't use them at all and group 5 only used them incidentally.

The last data gathered that deals with the size of the contribution for each individual group was gathered for the pages used to prepare the second presentation. Group 2 did not place its preparation of the second presentation in the Digital Workshop.



This graph shows results that are quite similar to the results for the discussion pages. Again, group 2 has more than 90% of all the edits made on the presentation 2 pages. The difference is that group 5 made no edits on the presentation 2 pages while group 13 made a small number of edits.

Member participation

The statistics for member participation were gathered in a way similar to the gathering of statistics about group participation. Statistics were gathered per group. Again, an example will be given on the basis of the total of edits, but this time the statistics are only about group 2:

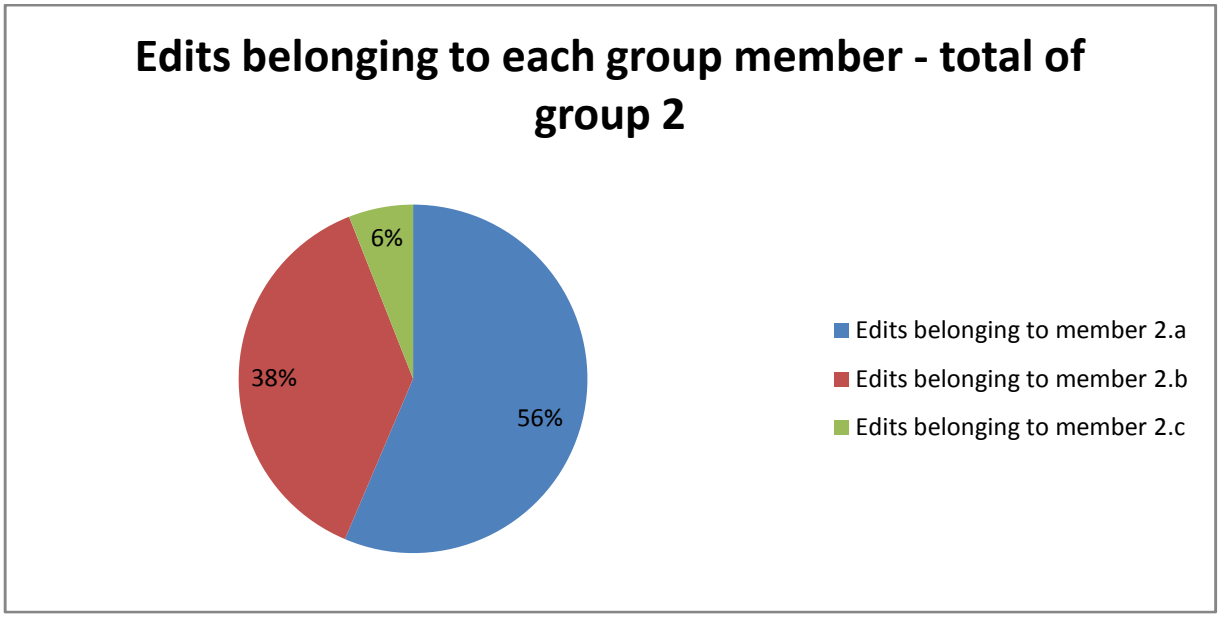
Formulas	Percentage	Absolute Number

Edits belonging to member 2.a	56,41%	66
Edits belonging to member 2.b	37,61%	44
Edits belonging to member 2.c	5,98%	7
Communication	18,06%	26
Interpersonal communication	0,69%	1
Categorized as Group Management	4,86%	7
Group Management	12,50%	18
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	3,42%	4
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	100,00%	4
Use of the Editing Window - add an image and Editing Window - add a special object	6,84%	8
Total number of edits		117
Total number of categories		144

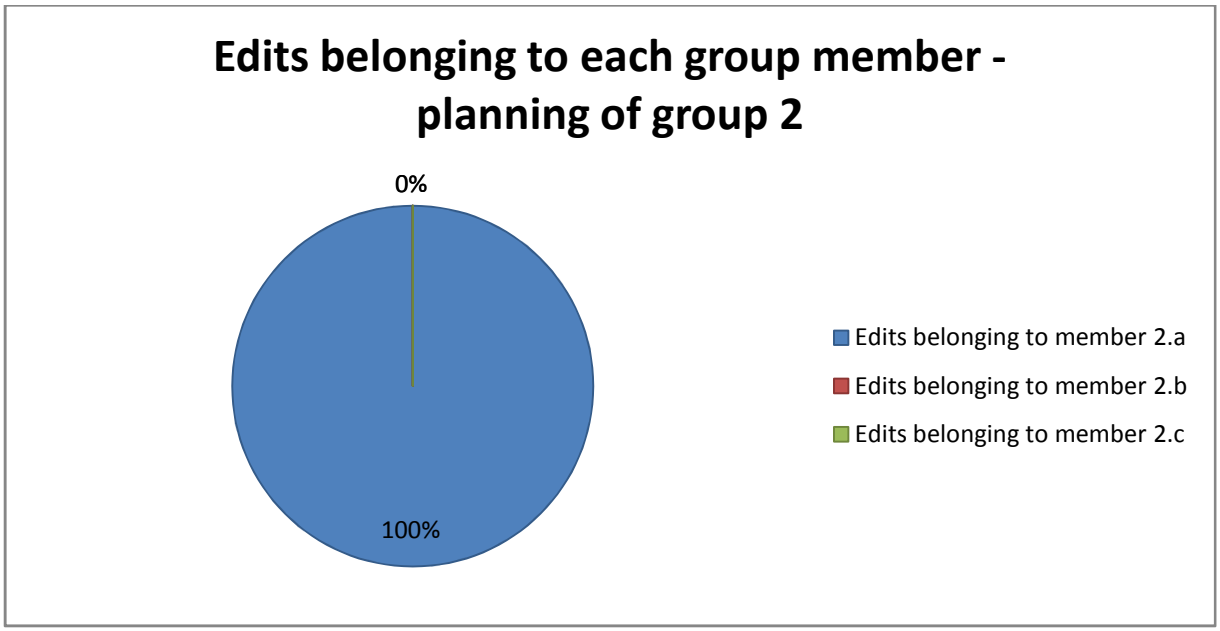
The blue colored fields hold the total number of edits per member. These numbers were divided by the total number of edits in the green colored fields. The result of this calculation is the relative size of each group member This is listed in the blue colored fields of the column named percentage. The graph below shows the division of edits amongst members of group 2. The above data is an example of what the statistics look like for all groups. Below, the results will be discussed for each individual group.

Member participation for group 2

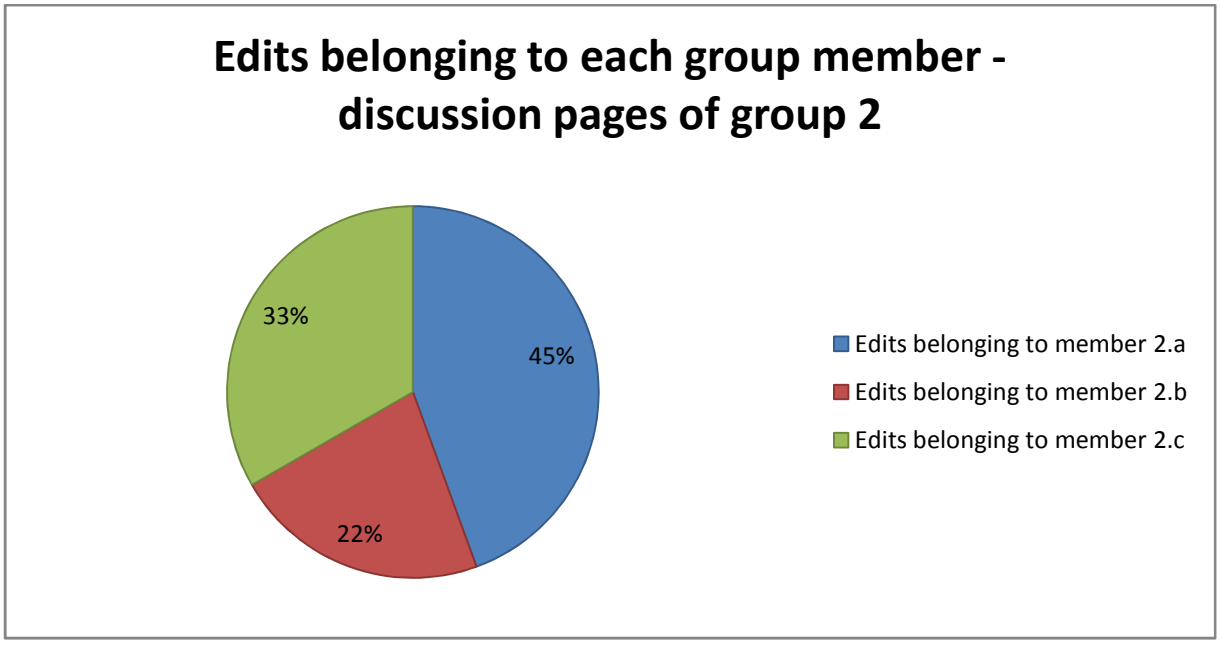
This division is for all pages of group 2:



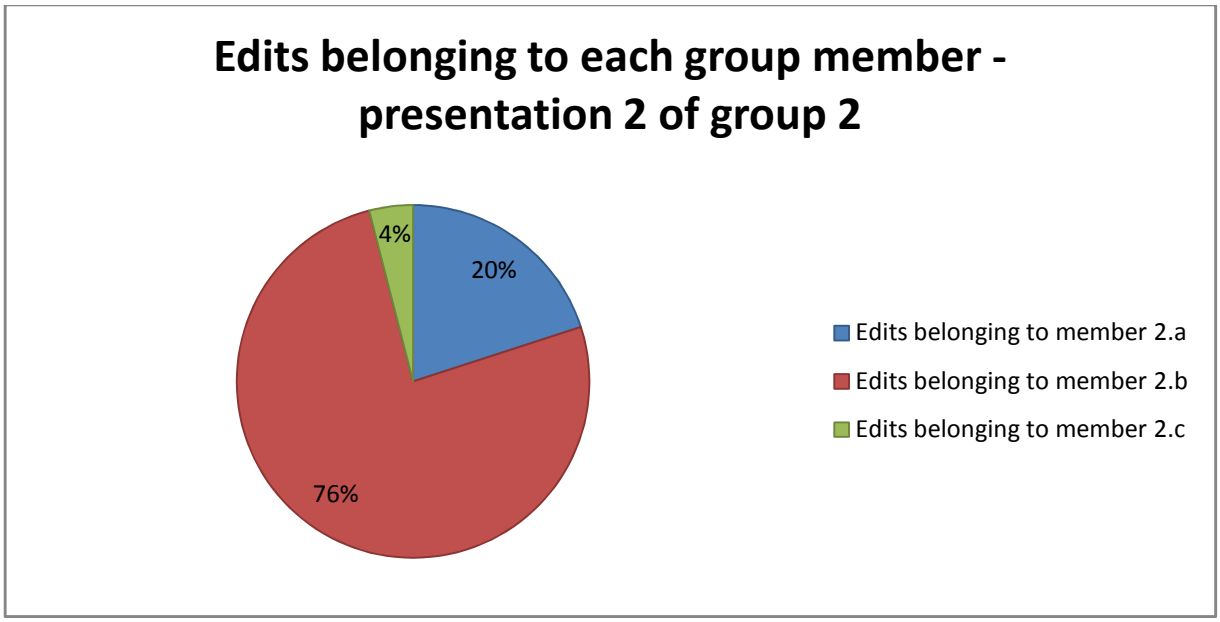
This graph shows that slightly more than half of all edits were made by member 2.a. Member 2.b also made a significant amount of edits. But member 2.c only made a fraction of all edits. The difference between member 2.a and 2.b is 16%. This is a significant difference. But member2.c made less than 1/4 of the number of edits made by 2.b and around 1/9 of the number edits made by member 2.a. The contributions of member 2.c seem insignificant compared to the contributions of the other members.



The results for the planning pages show an even greater inequality. All edits were made by member 2.a.



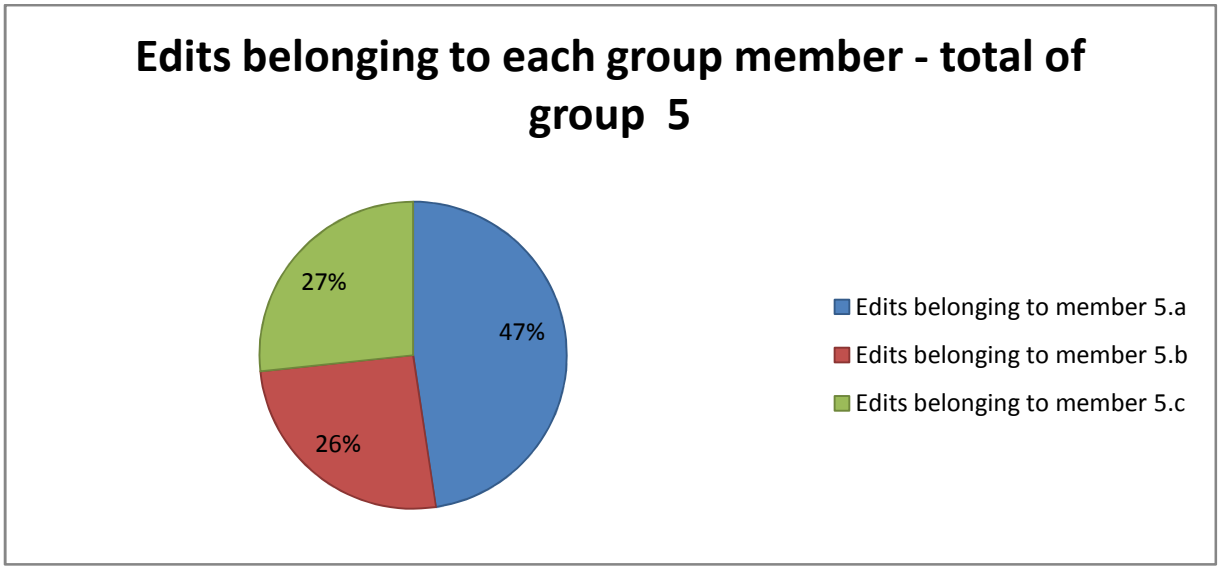
The results for the discussion pages show a different division of work. Again member 2.a made the most edits. But member 2.c also made a significant amount of edits. Apparently all members made a significant contribution to the content on the discussion pages. Member 2.a does have the largest share in the total amount of edits. And the share of member 2.b is slightly less than half the size of the share of member 2.a. But at least all members of group 2 made a significant contribution to the discussion pages.



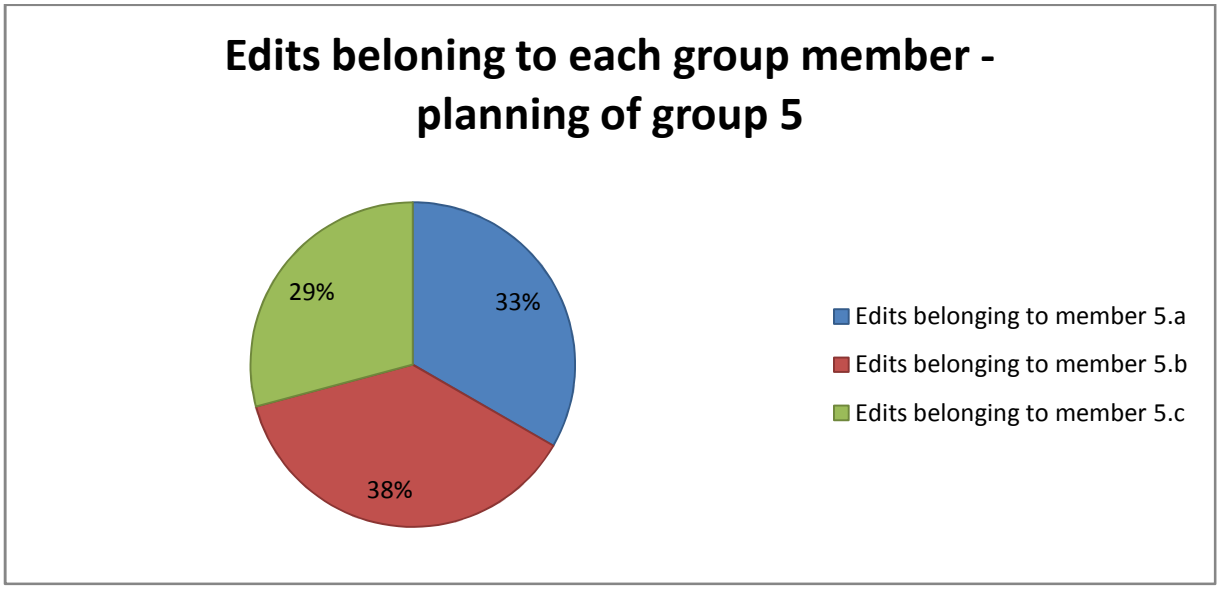
The presentation page shows another unequal distribution of edits. Member 2.c made only 4% of all edits, a insignificant amount. And 3/4 of all edits were made by member 2.b. It is interesting to see that for the presentation page it is member 2.b who made the majority of all edits and not member 2.a.

Member participation for group 5

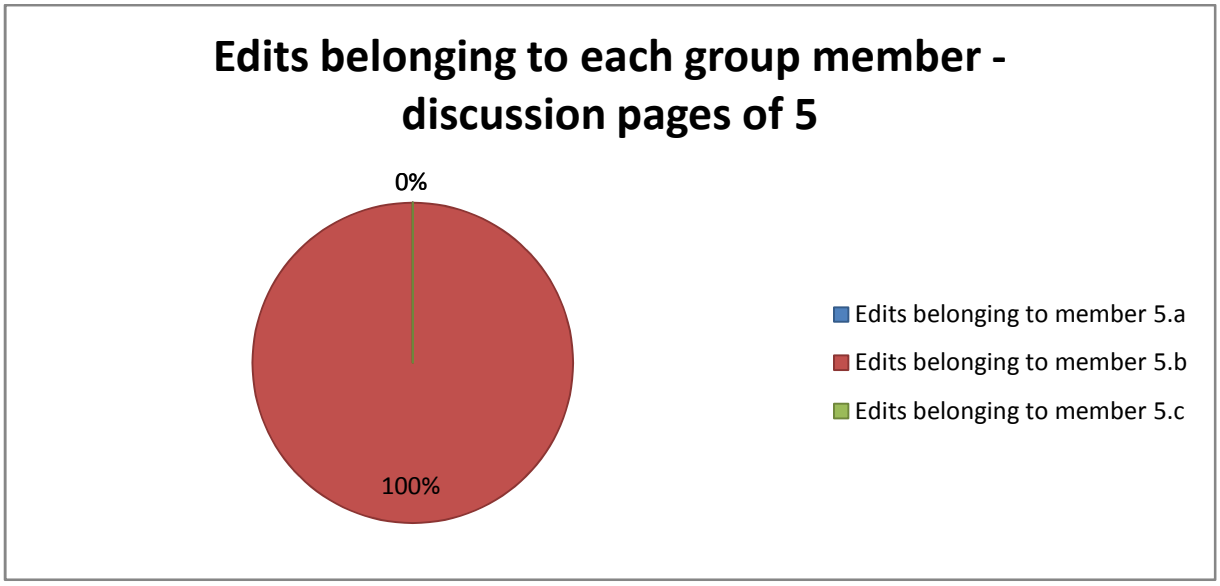
The graph below shows the distribution of edits for group 5:



Member 5.b and 5.c have an almost equal share in the total of edits. Member 5.a made almost twice as many edits as the other members. Each member made a significant contribution to the total of all work of group 5. However, member 5.a's share is larger than that of the others.



The contributions of all members to the planning on the pages of the Digital Workshop are quite equal for group 5. The difference between the smallest share and the largest share is only 9%. These differences are hardly significant, given that there are two factors that can disrupt the image these statistics give. This has been discussed before.

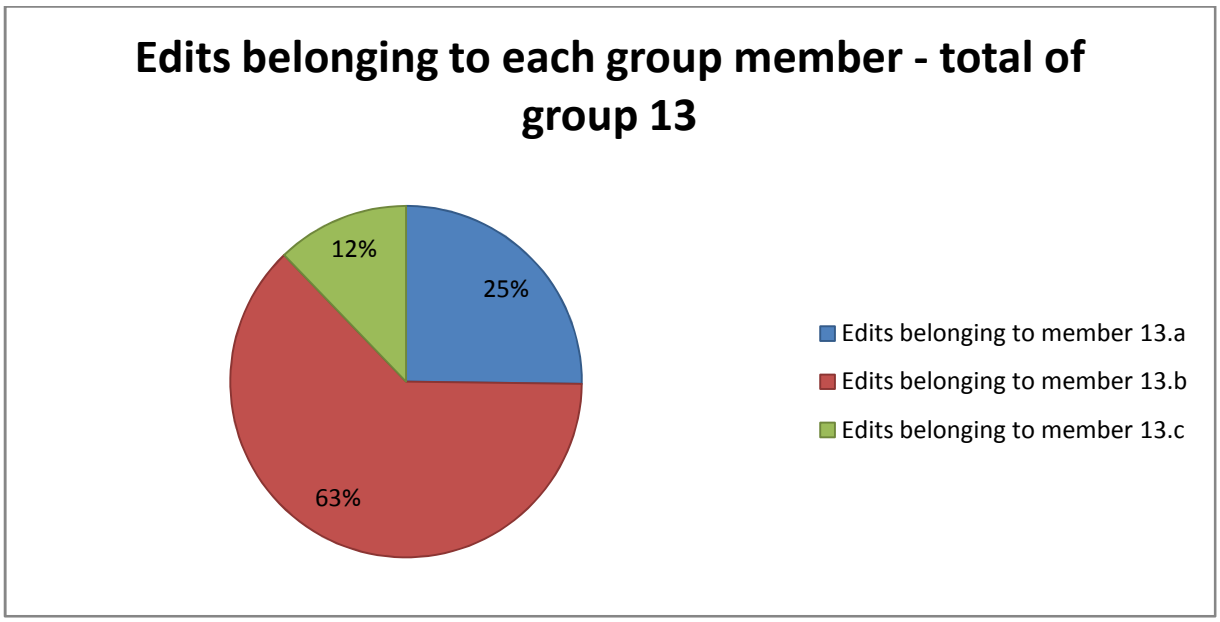


The only member that made a contribution to the discussion page of group 5 is member 5.b. However, the explanation for this distribution comes from the absolute numbers. The statistics for all discussion pages of group 5 reveal that only 4 edits were made. And only one of those was made by member 5.b. The others were made by people who weren't member of group 5. This strange distribution of edits will be discussed in more detail in the analysis of all activity on the page.

Group 5 did not prepare its second presentation in the Digital Workshop.

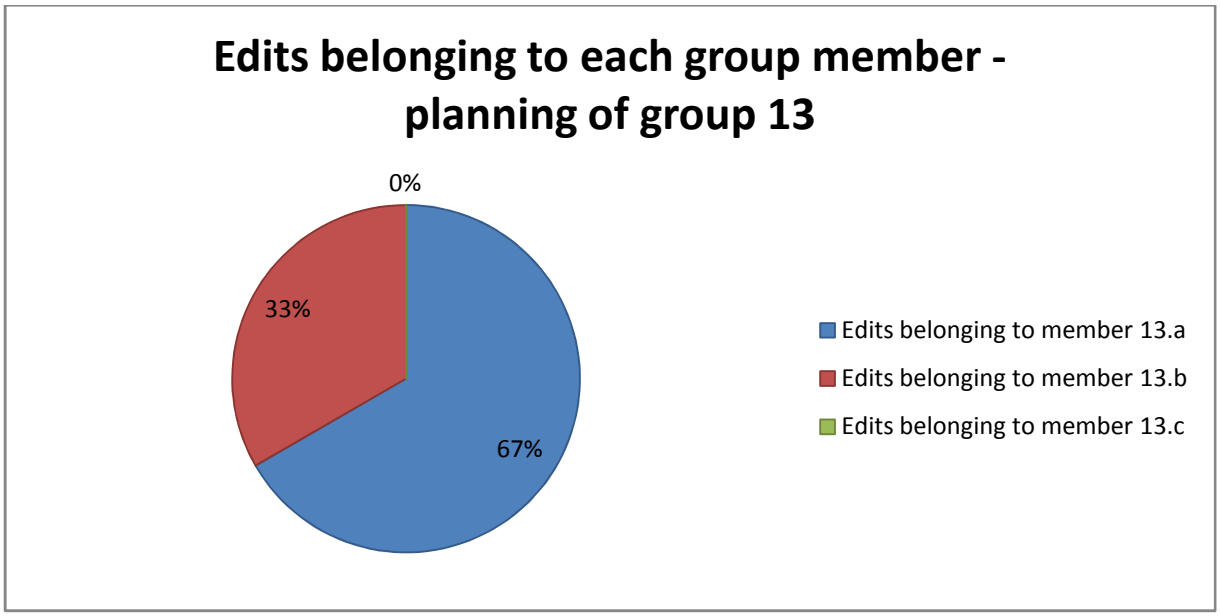
Member participation for group 13

The graph below shows the distribution of edits for group 13:

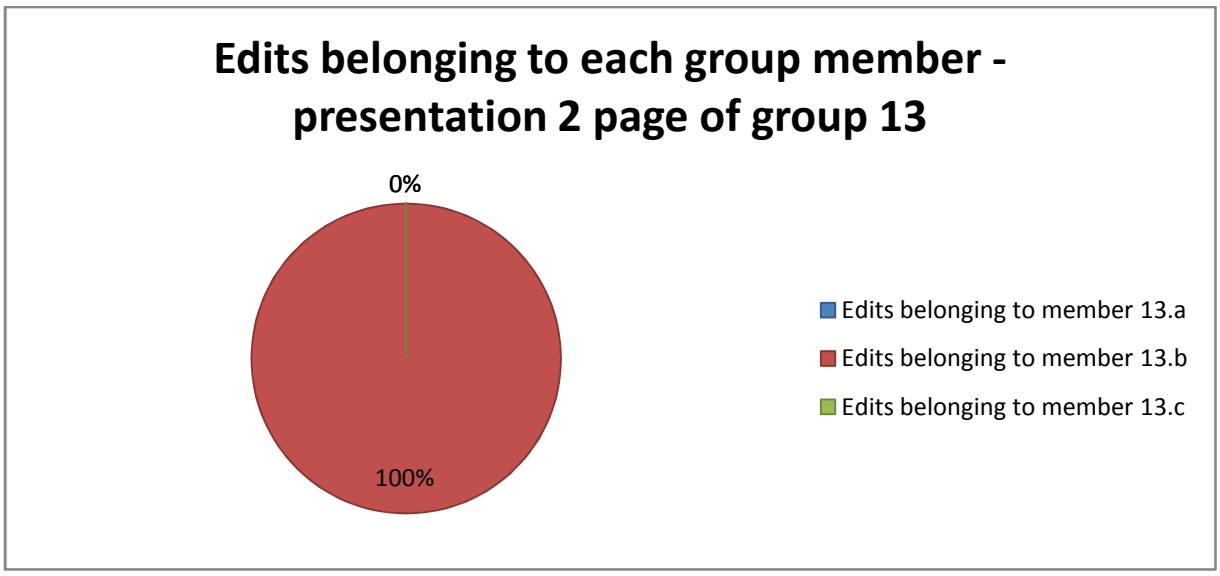


Member 13.b made almost 2/3 of all edits made by group 13. This points towards an unequal distribution of work. Member 13.a made 1/4 of all edits. This is less than half the edits of member 13.b. And member 13.c made less than 1/8 of all the edits. However, it should be noted that member 13.c left this group in the early stages of the project. He will not participate in any interviews performed or in the activity log kept by the students. Still, he made some contributions to the Digital

Workshop, though his share is clearly the smallest. What is more striking is that member 13.b made more than twice as many edits as member 13.a. Though the data for all groups show some inequality the inequality for group 13 seems much greater.



The data for the planning pages shows an opposite division of work. Here, member 13.a made 2/3 of the edits while member 13.b made 1/3 of the edits. This reveals that member 13.a did take responsibility for a page.



The data for the presentation 2 page reveal that this page was made by member 13.b. But the raw data reveals that only two edits were made on this page. This means that group 13 did not put much effort in the presentation 2 page.

Overall activity

The analysis of the work on the Digital Workshop did not only look at the division of work. The amount of communication and the use of certain functionalities were also studied. This section will look at the data for the total off all pages and the total of all pages of one group. There are three

separate sets of data that will be analyzed. First, the occurrence of the different categories of communication will be discussed. Then the answering of questions will be analyzed. This is only a small part of the analysis and the data is somewhat inaccurate but I believe it might give some insight. Then the use of the Editing Window - add an image and the Editing Window - add a special object will be analyzed. Finally, a timeline showing how many edits were made per week will be discussed. This should give some insight into when the students work on their projects. Below an example will be given of the raw data gathered and the calculations performed on this data. This will be done using the data for all edits on all pages:

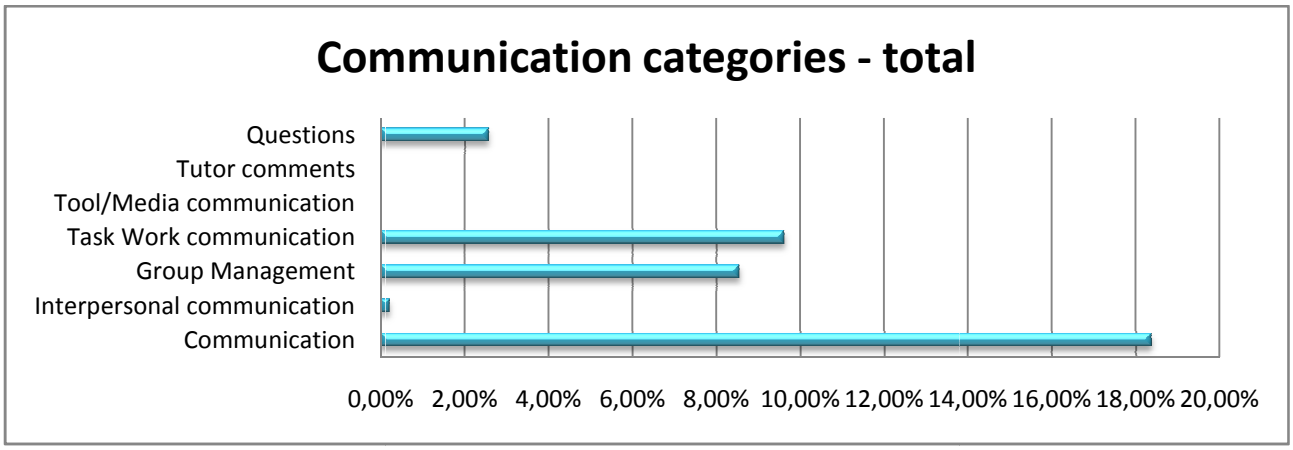
Formulas	Percentage	Absolute Number
Edits belonging to group 2	33,90%	119
Edits belonging to group 5	29,91%	105
Edits belonging to group 13	35,04%	123
Communication	18,38%	86
Interpersonal communication	0,21%	1
Categorized as Group Management	8,55%	40
Group Management	9,62%	45
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	2,56%	12
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	83,33%	10
Use of the Editing Window - add an image and Editing Window - add a special object	4,56%	16
Total number of edits		351
Total number of categories		468

The different types of communications were counted in the red cells. The last column shows the absolute numbers. Instead of counting the edits, the number of assigned categories were counted. This was done because one edit can contain multiple categories of communication. The percentages in the middle column were calculated by dividing the count of each categories (last red column) by the total of all assigned categories (number in the orange row). The data in purple row tries to

determine the rate at which questions were answered. As mentioned before this is not the most accurate measure. The last cell in this row states the total number of replies counted. The percentage in the middle cell represents the relation between questions asked and replies given. Whether these replies actually refer to a question remains unclear. This percentage is determined by dividing the count of questions (lowest red row, last cell) by the count of replies (last purple cell) . The light blue row shows the use of tow special functionalities. The last cell shows the number of occurrences of these categories and the percentage in the middle shows the relation between this number and the total of all categories assigned. This was calculated by dividing the number of occurrences of these special functionalities (last light blue cell) by the total of assigned categories (last orange cell).

All observed groups

The first data shows the distribution of communication categories for all the pages of all the groups:



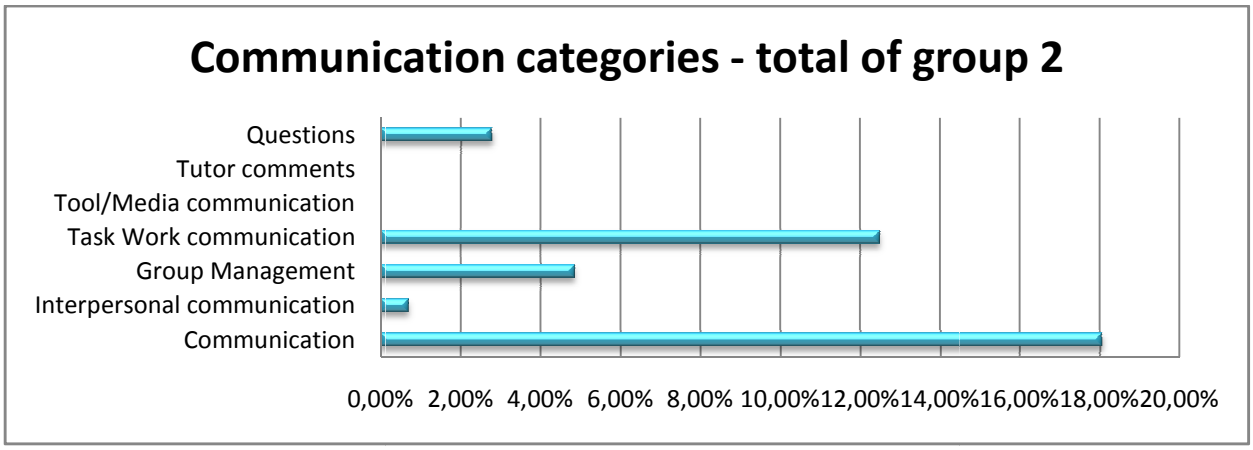
There are 7 categories of communication. The communication category is a grouping of all other categories. Two categories were not assigned. These are the Tutor comment category and the Tool/Media communication category. Apparently this type of category did not occur. One category only covers a fraction of the total of all assigned categories. This is the Interpersonal communication category. If we look at the raw data we see that this category was only assigned once. The question category was used for slightly more than 2% of all the categories that were assigned. This is a small percentage but this still a significant amount. If you look at the times that the communication category was used you see that slightly more than 18% of all categories assigned were communication categories. The 2% of question categories used means that more than 10% of all communication categories used were questions. Thus this 2% is significant. The Task Work communication category and Group Management category were both used round 8 to 9% of the time a category was assigned.

The ratio between questions and replies is 83%. This means that, if every reply was an answer to a question, 83% of all questions were answered. However, not every reply has to be an answer to a question. It can also be a reply to a comment. If all questions would receive an answer one would expect a ratio of at least 100% and likely more than 100%. This number means that not all questions were answered. Maybe 50% of all questions were answered. Maybe more.

Out of all categories of functionality used, the Editing Window- add an image or Editing Window - add a special object categories were assigned 16 times. This is 4.5% of all assigned categories of functionality.

Group 2

The same data was also gathered for all the pages that belonged to group 2. The distribution of the different communication categories used for the work of group 2 is presented in the graph below:



The Tutor comment category and Tool/Media category were never assigned. We already observed this for the total of all pages so this is as expected. This observation was discussed in the previous section and won't be discussed again in this section or in the two other sections that deal with the other groups. Another observation made in the previous section was that the Interpersonal communication category was only assigned once. The graph above shows that this was done on a page of group 2. However, this communication category was still only used once. Thus it's use can be viewed as insignificant. Out of all categories assigned, 18% were communication categories. This is almost the same percentage as the average for all groups. Around 3.5% of all categories used were Question categories. Compared to the average of 2% this means that group 2 placed more questions on the Digital Workshop than average. The two dominant categories are Task Work communication and Group Management. 4.5% of all used categories where Group Management categories and 12.5% of all used categories where Task Work communication categories. Compared to the average of all groups, group 2 used less Group Management communication, but more Task Work communication. The 4.5% for Group Management of group 2 is 56% of the 8% average. This means that group 2 used significantly less Group Management communication in the Digital Workshop.

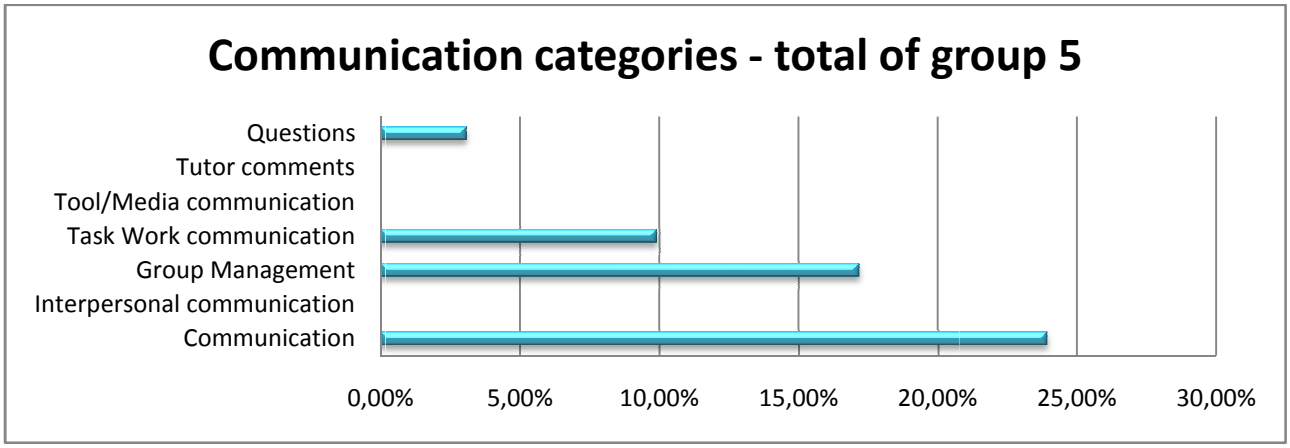
The ratio between questions and replies is 100%. This means that the Reply category was used exactly as many times as the Question category. This also means that if 3.5% of the categories used were Question categories, just as many categories used were reply categories. We can use this information to determine the use of the comment category. (12.5% - 3.5% - 3.5% ≈5.5%) This is more than the average of 4%. The raw data reveals that group 2 made significantly less edits that can be categorized as Group Management and significantly more edits that can be classified as Task Work communication.

The final statistic gathered reveals that 8 of the categories used when describing the functionality used for an edit where of the Editing Window – add an image or Editing Window – add a special

object category. This is 7% of all categories assigned. This is more than the average of 4.5%. These categories were used 16 times in total. Apparently half of those uses where made by group 2.

Group 5

The distribution of the different communication categories used for group 5 is shown in the graph below:

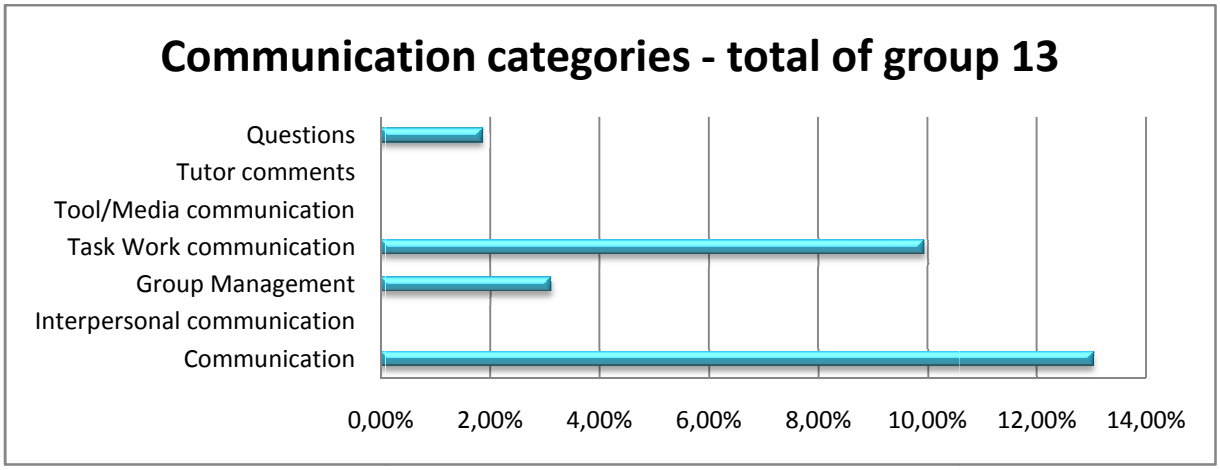


24% of all categories used to categories the edits of group 5 were communication categories. This is 5% more than the average of 18%. Group 5 made the least amount of edits of all groups, though the differences between groups aren't that great. This could mean that group 5 didn't make more edits that can be classified as communication but instead made less edits that would be classified as something else then communication. 3% of all categories used were Question categories. This isn't significantly different from the average for all groups. Almost 10% of the categories used where of the Task Work communication category. The average for all groups is 9%. The 10% for group 5 is not significantly more. The ratio at which questions were answered is 80% for group 5. The average for all groups is 83%. Since the use of the Question and Task Work category and the ratio at which questions were answered are almost exactly the same for group 5 as they are for the average of all groups, Task Work communication in group 5 is no different than average. However, 17% of all categories used where of the Group Management category. The average for all groups is 9%. Group 5 made almost twice as many edits that can be categorized as group management.

The final statistic reveals that 5% of all categories assigned to the functionality used where either Editing Window – ad an image or Editing Window add a special object. This is not significantly more than average.

Group 13

The distribution of the different communication categories used for group 13 is shown in the graph below:



Only 13% of all categories used for group 13 were communication categories. The average for all groups was 18%. Thus significantly less edits of group 13 can be classified as communication. However, 10% of all categories used for group 13 were Task Work communication. This is about the same as the average of 9%. And 2% of the categories used were of the Question category. This is also about the same as the average of 2%. The rate at which questions were answered was 66% for group 5. This is significantly less than the average rate of 83%. This means that most of the Task Work communication of group 13 were comments that were never replied to. This means that less discussion took place in the pages of group 13 than average for the Digital Workshop. If group 13 has less communication than average but an equal amount of Task Work communication than average, another type of communication must occur less than average. This is the case for Group Management. Only 3.5% of all categories used where of the Group Management category. This is half of the average of 8%.

Another remarkable statistic is that group 13 only made 2 edits of which the functionality can be classified as Editing Window- ad an image or Editing Window – add a special object. While the other groups at least used this functionality group 13 seems to almost ignore this functionality. An explanation for this behavior will have to be found in other data.

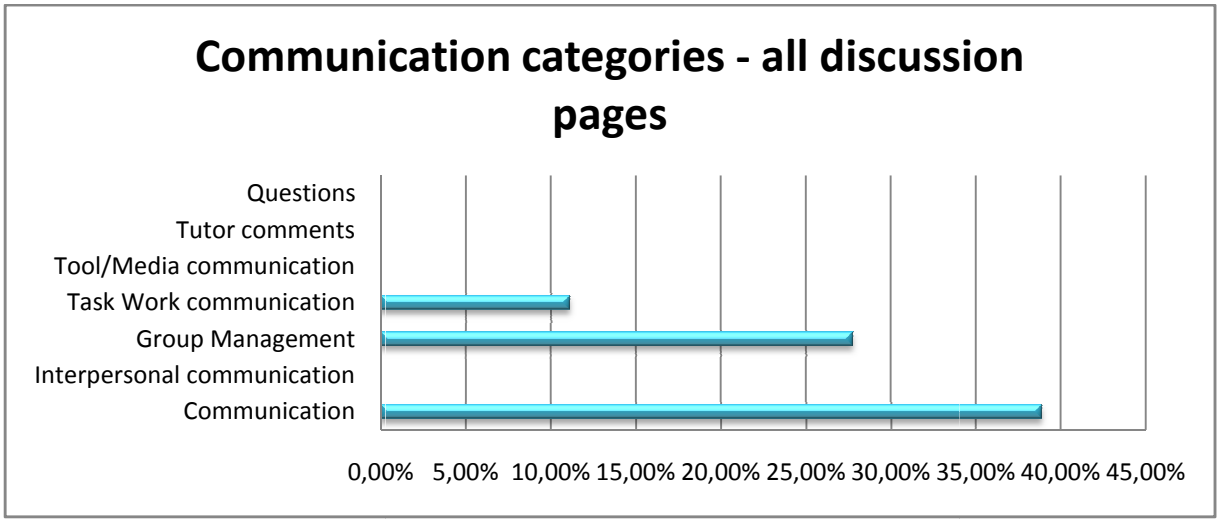
Pages of special interest

Discussion pages

The discussion pages are the pages that can be accessed via the “overleg” tab. Each page has its own discussion page.

All observed groups

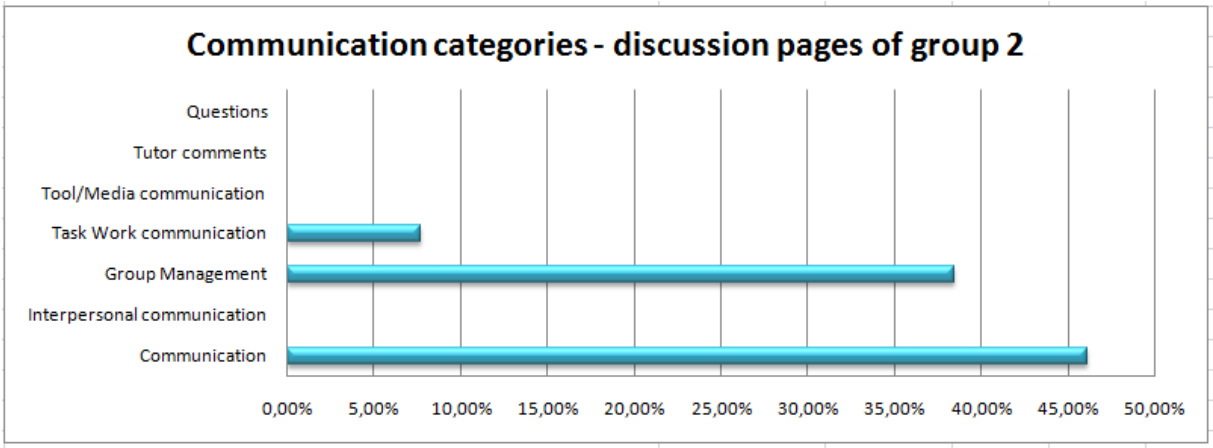
The distribution of categories for all discussion pages is shows in the graph below:



Around 39% of all edits on the discussion pages can be categorized as communication. This is significantly more than the average of all pages. The average is 18%. Thus twice as many edits on the discussion pages are communication. Around 27% of the categories used on the discussion pages were the Group Management category. The question category did not occur and 11% of the categories used where of the Task Work communication category. Since no questions were asked the ratio of questions that were answered is irrelevant. The Editing Window- add an image and Editing Window – add a special object were not used in the discussion pages.

Group 2

The distribution of categories for the discussion pages of group 2 is shows in the graph below:



46% of all categories assigned to the edits on the discussion page of group 2 were categorized as communication. 38% of all categories assigned to the edits on the discussion page of group 2 were categorized as Group Management. And 7% of all the categories assigned to the edits on the discussion page of group 2 were categorized as Task Work communication. The Group Management category was assigned 4.5 times more than the Task Work communication category. Thus the majority of all communication in the discussion pages of group 2 was Group Management.

Group 5

Group 5 made four edits in the discussion pages of which one was communication. One edit that was categorized as communication is no basis for any conclusions other than that this is a freak occurrence. Generally speaking group 5 did not use the discussion pages.

Group 13

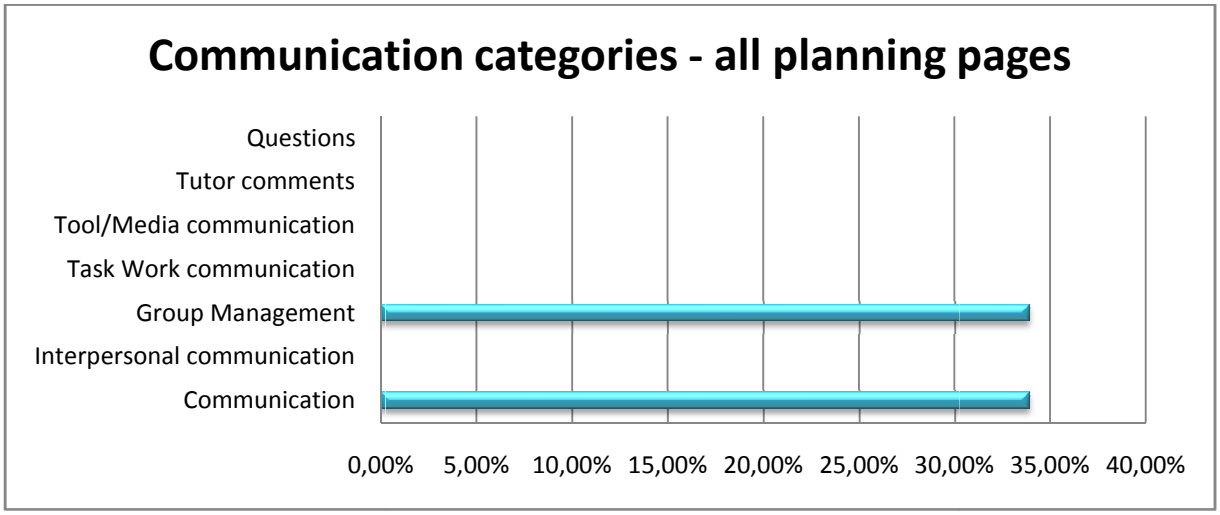
Group 13 did not make any edits on the discussion pages. They did not use the discussion pages.

Planning pages

Each group created a planning page were they made or placed their planning. This was part of the assignment.

All observed groups

The graph below shows the distribution of categories for all edits on all the planning pages:



34% of categories assigned to the edits on the planning pages were communication and all communication was Group Management. This means that all communication on the planning pages was Group Management communication.

Group 2

Group 2 made 7 edits on the planning page. But no edits could be categorized as communication. We found out that group 2 used the discussion pages to hold an create their planning. But what did they use the planning pages for? 5 out of the 7 edits can be categorized as structural additions. The text below is the actual content on the planning pagers of group 2:

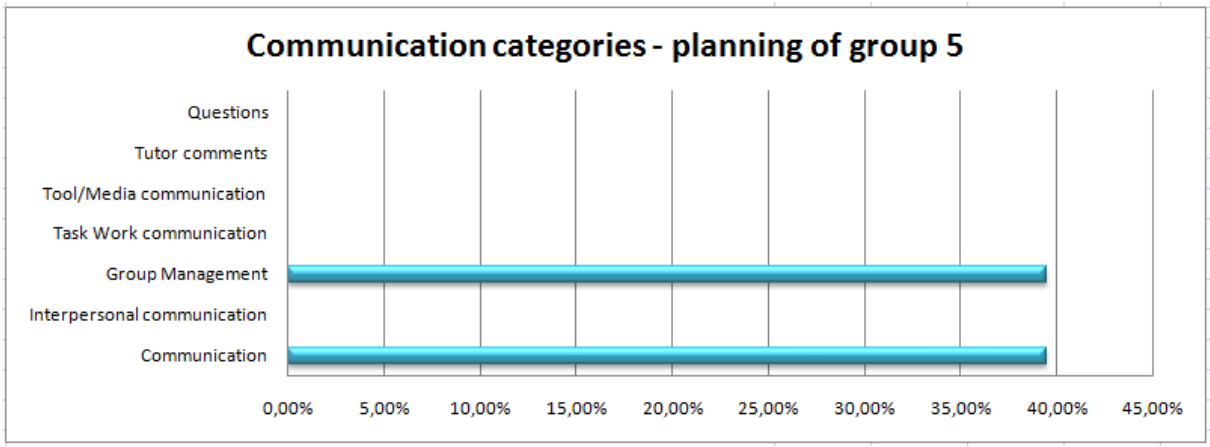
```
==Planning pilot==
([https://lab.cs.ru.nl/algemeen/index.php?title=Overleg:Research_and_Development_1/Projecten/02/Pilot&action=edit '''Bewerken'''])
{{:Overleg:Research_and_Development_1/Projecten/02/Pilot}}

==Planning fase 1==
([https://lab.cs.ru.nl/algemeen/index.php?title=Overleg:Research_and_Development_1/Projecten/02/Fase_1&action=edit '''Bewerken'''])
{{:Overleg:Research_and_Development_1/Projecten/02/Fase_1}}
```

These sections are both references to content on the discussion pages of the Pilot page and Fase 1 page. The planning page of group 2 contains references to the planning on the discussion pages of group 2.

Group 5

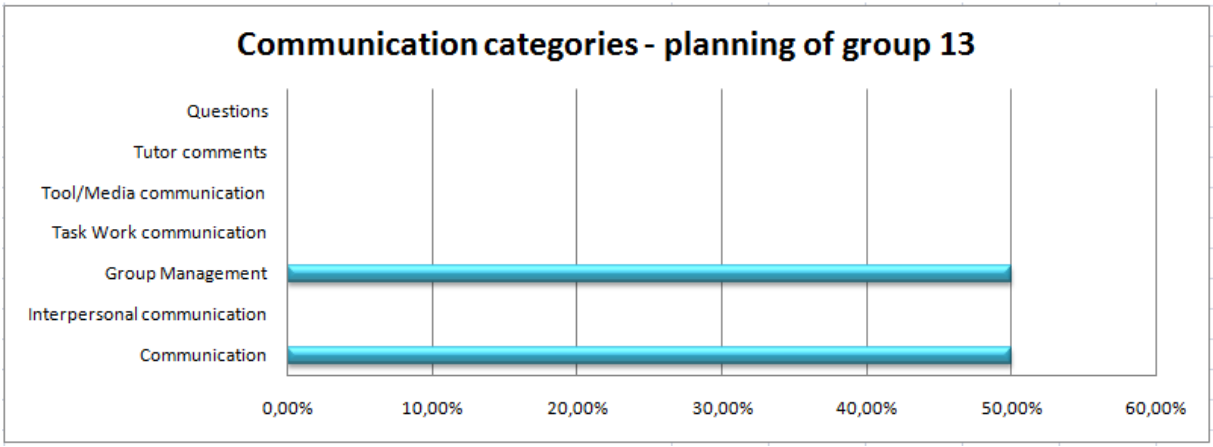
The graph below shows the distribution of categories for the planning page of group 5:



39% of all categories assigned were communication categories and 39% of all categories assigned were Group Management.

Group 13

The graph below shows the distribution of categories for the planning page of group 13:



50% of all categories used in the planning page of group 13 are communication categories and 50% of all categories used are Group Management.

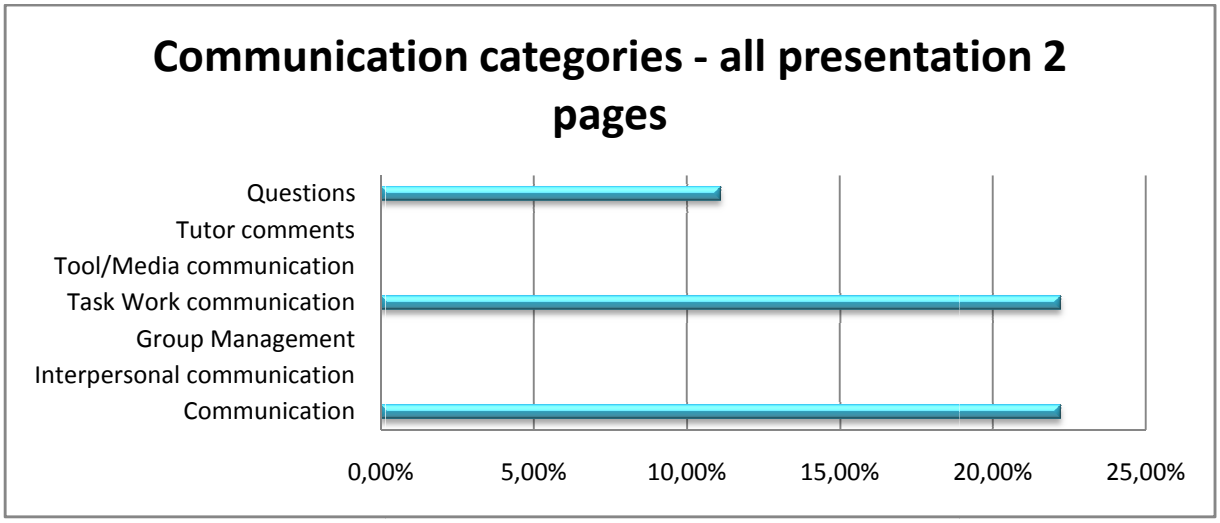
All communication on the planning page of group 13 was Group Management. Group 13 only used the planning page to create their planning. But only 16% of all edits on all planning pages were made by group 13.

Presentation 2 pages

Part of the assignment was that the groups would prepare their second presentation in the Digital Workshop. Group 2 and group 13 made a special page for this. Group 5 did not prepare its presentation in the Digital Workshop.

All observed groups

The graph below shows the distribution of categories for both presentation 2 pages:

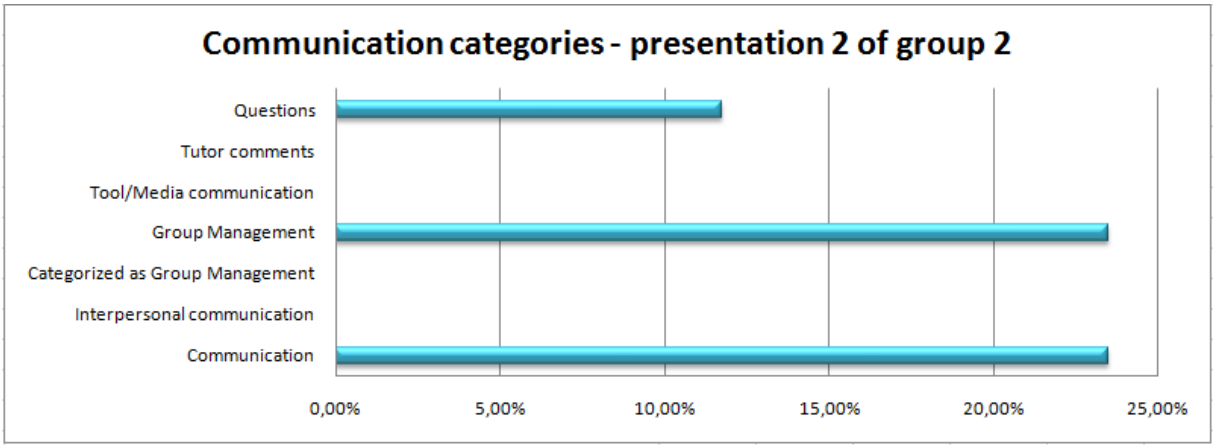


22% of all categories assigned to the edits on the presentation 2 pages are communication. All communication is Task Work communication. 11% of the categories assigned to the edits on the presentation 2 pages are questions. This means that half of the communication categories used are of the Question category. The ratio between questions and replies is 75%. Most of the Task Work communication seems to consist of questions and their replies. It should be noted that one reply can answer multiple questions.

More than 90% of all edits in the presentation 2 pages were made by group 2. The results will not be discussed any further for all of the presentation 2 pages. It is likely that group 2 is the only group that seriously used the presentation 2 pages. Instead the results will be discussed in the group sections.

Group 2

The distribution of categories on the presentation 2 page is shown in the graph below:



24% of all categories used for the edits on the presentation 2 page of group 2 are communication. All communication is Task Work communication and 11% of the categories used are the Question category. The ratio at which the questions were answered is 75%. If 75% of the questions were answered and 11% of the categories used are questions than 8% of the categories used were replies.

Group 5

Group 5 did not create a page that holds the preparation of the second presentation.

Group 13

No communication was found on the presentation 2 pages of group 13. Only 2 edits were found. If we look at the actual content of the page we see the following:

```
[[Bestand:Doel.pdf]]

[[Bestand:Presentatie2.pdf]]
```

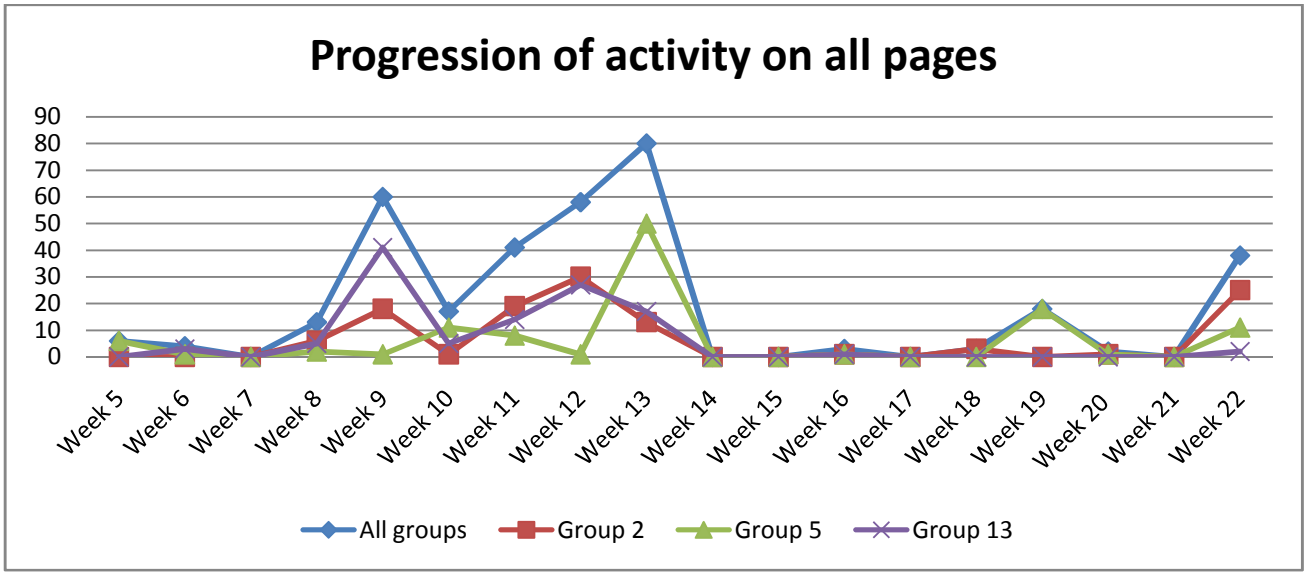
The members of group 13 uploaded two files to the presentation 2 page. Group 13 made their second presentation and its preparation outside the Digital Workshop. Then they uploaded the resulting files to the Digital Workshop. Thus group 13 did not use the Digital Workshop to prepare their presentation, just like group 5.

Progression of activity

The table below was used to determine how many edits were made each week. This information will help determine how the different groups spread their edits over time. The first column holds the week number. The second column holds the first day of that week and the third column holds the last day of that week. The final column counts the number of dates that were between that first and last day. The results will be shown in a line graph.

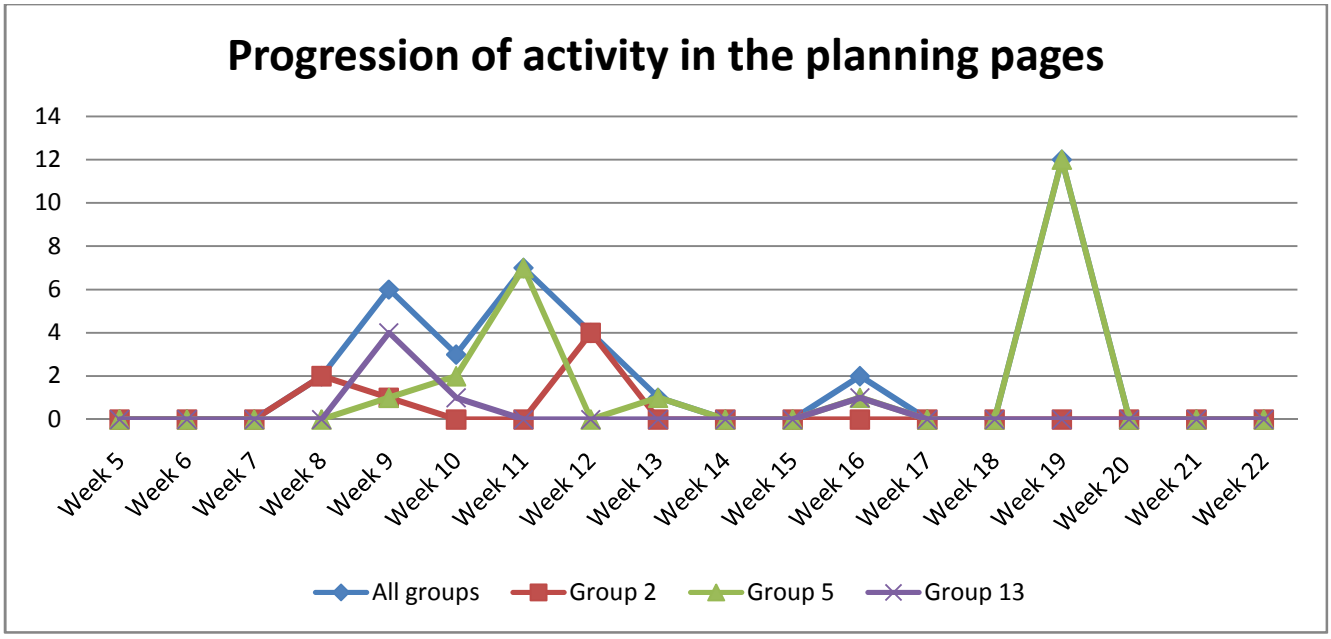
Progression of activity of all pages			
Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	6
Week 6	8-02-10	14-02-10	4
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	13
Week 9	1-03-10	7-03-10	60
Week 10	8-03-10	14-03-10	17
Week 11	15-03-10	21-03-10	41
Week 12	22-03-10	28-03-10	58
Week 13	29-03-10	4-04-10	80
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	3
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	3
Week 19	10-05-10	16-05-10	18
Week 20	17-05-10	23-05-10	2
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	38

Progression of activity for all pages



The graph above shows four peaks for the line of all groups. The line of group 2 corresponds with all of these peaks except for the peak at week 9. The line of group 5 also has four peaks. The first two peaks are in the same area as the peaks of the other groups but the peaks of group 5 start two weeks later and the tops of both peaks are a few weeks behind. This suggests that group 5 lagged behind the other groups. Another difference observed in the line of group 5 is that the second peak is much larger than the first peak. While group 2 and group 13 spread their work over a period starting at week 8 and ending in week 14 group 5 seems to have almost all of their work in week 13. The line of group 13 is quite similar to the line of group 2. However, group 13 doesn't show any activity in the later weeks.

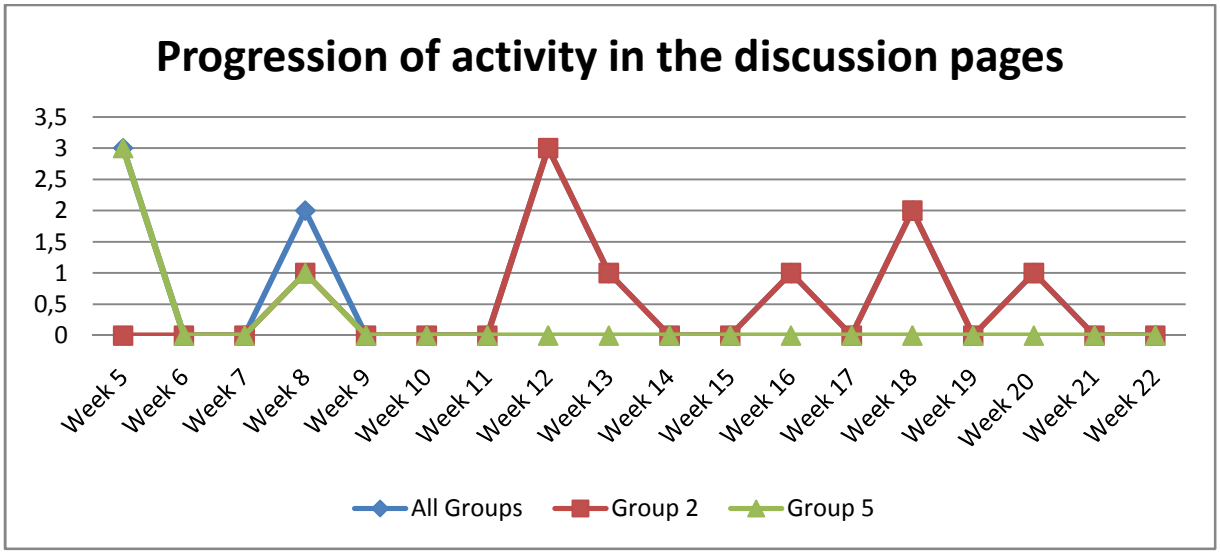
Progression of activity for the planning pages



The peaks of the planning pages match the peaks of the progression for all pages. This supports the conclusion that the work on the planning of the groups is not evenly spread over the entire period that these groups were observed. The only difference is that the last peak is in week 19 instead of

week 22 and that the tops of the peaks occur in week 9 and week 11. This means that the tops of the planning peaks occur before the tops of the peaks representing all activity. This suggests that plannings are made before the work is done. This means that the plannings are genuine.

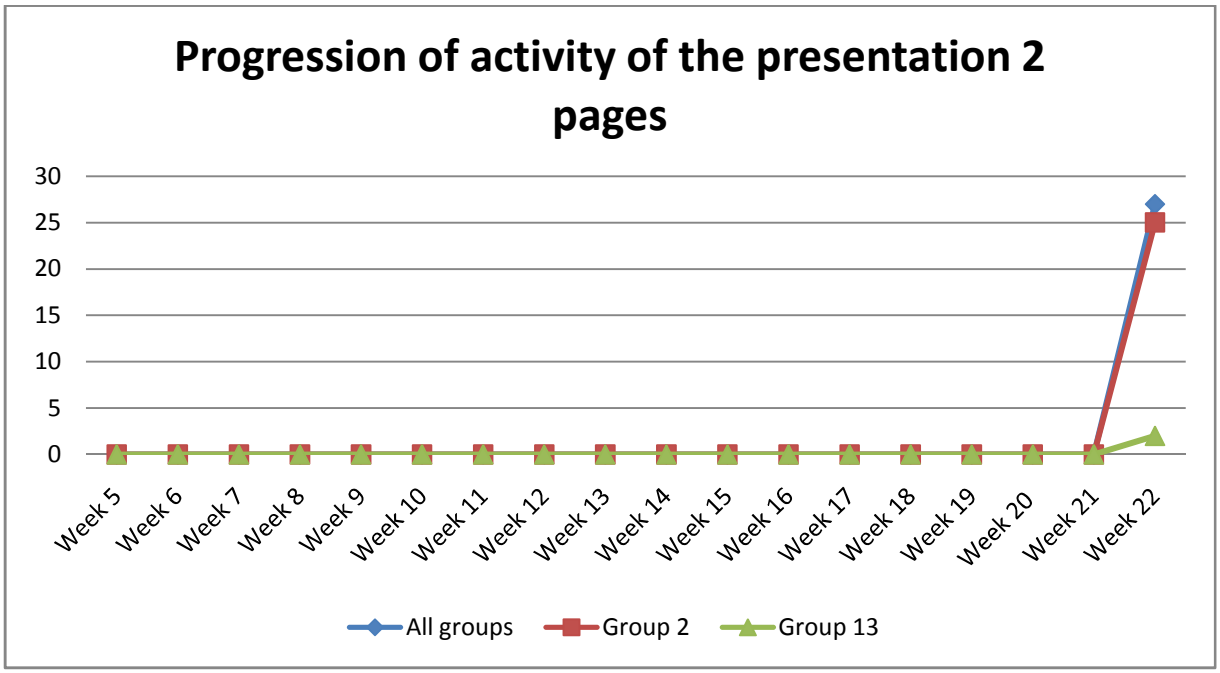
Progression of activity for the discussion pages



The progression on the discussion pages shows a lot of peaks, which vary in size. None of these peaks are really large, varying between 3 and 1 edit per week. But 6 peaks are spread quite evenly over the 22 weeks. This support the idea that there was activity on these pages throughout the entire period. Group 2 is the only group that extensively used the discussion pages. They are responsible for the large spread of activity. Group 5 made some edits in the first few weeks but no longer made any edits during the remainder of the period.

Progression of activity for the presentation 2 pages

All activity on the presentation 2 pages took place in week 22. This suggests that both groups prepared their presentation in the week before or of the presentation itself.



All activity is concentrated in one week. This means that both groups prepared their presentation in one week. Group 2 is responsible for almost all of the edits. This means that group 2 is the only group that prepared their presentation in the presentation 2 pages.

Activity outside the Digital Workshop

The activity outside the Digital Workshop should have been studied using three different techniques. There would be two or three interviews with each group, asking questions about the use of the Digital Workshop and behavior that might lead to collaborative learning. The students were also asked to keep a log of their communication outside the Digital Workshop. This should help determine the place that the Digital Workshop takes within the groups communication. The last technique that would have been used was a survey asking the students about their opinion of the Digital Workshop. But the interviews resulted in enough information about the opinions of the group members. And performing these interviews took longer than planned. Thus no survey was taken for this research. However, this should not lead to a loss of information due to the above mentioned reasons.

Interviews

Setup of the interviews

Part of the work of the student's Research & Development 1 project does not take place in the Digital Workshop. The interviews will be used to determine how the students communicate and collaborate outside the Digital Workshop. The interviews will also be used to gather additional information about the student's use of the Digital Workshop and their perception of the Digital Workshop. The analysis of the activity of the Digital Workshop reveals what each individual student has changed in the Digital Workshop. The interview will be used to determine how the students intent to use the Digital Workshop, what their experiences are, what their opinion is about the Digital Workshop and what role it plays within the communication next to the other media.

Two interviews where held with each group. Three of these interviews progresses without trouble. The first interview with Group 13 suffered from some technical problems. As a result the interview could not be reported and the answers to the questions had to be written down. This yielded less accurate results. For both the first interview with group 5 and the second interview with Group 13 one group member did not show up. However, there was hardly any disagreement between the different group members during the interview and the group members seemed to share the same view on the Digital Workshop. Thus the interviews without all group members should still yield useful results.

Both interviews will be presented below. These interviews where performed in Dutch. However, this article will present the questions and results in Dutch.

Interview 1

Goal of the Interview

The purpose of this first interview is to gather information about the students knowledge of and previous experiences with the Digital Workshop. If the students have used the Digital Workshop before, they may have an opinion and certain expectations of the Digital Workshop. These expectations and opinions might give the students and idea of how they will use the Digital Workshop in the R&D 1 course. The interview will also ask questions about these expectations of the

students. When this interview will be performed the students will already have worked on their R&D 1 project in the Digital Workshop. Therefore this interview will also ask questions about their recent use of the Digital Workshop for the R&D 1 project. The questions of this interview will be limited to questions about the use of the Digital Workshop and other media to communicate. Any questions about the exact nature of the communication going on outside the Digital Workshop will be asked in later interviews.

Setup of questions

This interview tries to find answers for two sub questions of the research question. It looks at the communication inside the Digital Workshop and the communication outside the Digital Workshop. Questions about communication inside the Digital Workshop will deal with communication only and not with additions to the product. The additions to the product can be fully monitored in the Digital Workshop. The questions about work inside the Digital Workshop will relate to the different types of communication presented in the method as well as the structure/functionalities of the Digital Workshop. The interview will also contain questions about the ability to look at the work of other groups. The types of communication a question relates to will be stated after each question.

The second set of questions deals with communication outside the Digital Workshop. These questions will relate to the types of communication and types of media that the students also use when logging their communication. These questions should reveal how the students expect to communicate during their project. it will also reveal how the students have been communicating during the start of their project.

Questions in English

Questions about the expectations and knowledge of the Digital Workshop

- Did you already use the Digital Workshop before the R&D 1 course? *Opening question. If no, questions about past experiences make little sense.*
    - Did you then use the comment functions to comment on each other's group work? *Question about task work communication. Primarily asks about the comment type. It is expected that other types of task work communication will also be revealed.*
    - Did you then use the discussion page's? *Question about the discussion page function of the Digital Workshop.*
    - Did you then once comment or made improvements on the pages of other groups? *Question about task work communication in relation to the work of other groups. (Do outsiders participate in task work communication within groups?)*
    - Do you believe that the Digital Workshop makes working on this project easier then when you make the project offline? *Question about the effectiveness of the Digital Workshop. Primary purpose is to find other characteristics of the Digital Workshop that effect its use.*
- Do you think that you will use the discussion page's in the R&D 1 project? *Question about the discussion page function of the Digital Workshop.*
- Do you think you will use the comment functions to comment on each other's work in the R&D 1 project. *Question about task work communication. Primarily about the comment type of communication.*

- Do you look at the work of other groups, and if yes, for what purpose? *Question about the open nature of the Digital Workshop. Opening question followed by a more in dept question.*
- Would you comment on or make improvements in the work of other groups? *Question about the relation between the open nature of the Digital Workshop and task work communication.*
- Are you afraid that other group's might steal your work or ideas? *Question regarding concerns with the open nature of the Digital Workshop.*

Questions about communication within the project group

- Do you make all your documents directly in the Digital Workshop? *Question about the publishing of work.*
- Which medium do you believe will be used most to evaluate the work of other group members? *Question about commenting, questioning and replying to questions and comments regarding group members work.*
- Which medium do you believe will be used most to make appointments? *Question about scheduling.*
- How often a week does the group come together to meet face-to-face? *Question about meeting face-to-face.*
- Do you use any other online project environments, like Google Docs, for this project? *Question about the webpage medium.*

The interview was recorded and the recording was transcribed. The results where tagged using the following tags:

The tags for the indicators are:

- Use of the Digital Workshop
    - Use of the Digital Workshop in other courses: **[Overall Use:]**
    - Use of the comment function of the Digital Workshop internally: **[Internal Comments:]**
    - Use of the comment function of the Digital Workshop externally:**[External Comments:]**
    - Use of the discussion page's: **[Discussion Page:]**
    - Use of the ability to look at the work of other groups**: [Look Around:]**
- Opinion of the Digital Workshop
    - Positive statement about the Digital Workshop: **[Positive Statement:]**
    - Negative statement about the Digital Workshop: **[Negative Statement:]**
- Use of other media
    - Use of other media for document creation and publishing: **[Publishing Media:]**
    - Use of other media for the discussion of work: **[Discussion Media:]**
    - Use of other media for scheduling: **[Scheduling Media:]**
    - Frequency of face-to-face meetings: **[Face-to-face Meetings:]**
    - Use of other online collaborative software: **[Collaboration Software:]**
    - Positive opinion about the open nature of the Digital Workshop: **[Positive towards Openness:]**
    - Negative opinion about the open nature of the Digital Workshop: **[Negative towards Openness:]**

The results of the interview will be presented below.

Interview 2

Goal of the interview

The purpose of this interview is to try and find out if actual collaborative learning is taking place. The indicators for collaborative learning have been identified and this interview will ask questions that help find out whether these indicators are present in the memory and opinion of the students. The questions in this interview will ask whether the students have performed the activities that enable collaborative learning and in which medium they have performed these activities.

Setup of questions

Four categories of indicators for collaborative learning have been identified: The transfer of knowledge by observation, the reduction of cognitive load, reflection and negotiation.

Reflection refers to the internal evaluation of work and the new knowledge that is created by sharing viewpoints and fixing mistakes. Negotiation refers to internal discussions that aim to fix conflicts. The new knowledge is created by sharing and understanding viewpoints. Central to both of these categories of indicators is the sharing of viewpoints in discussions. In this interview questions about discussions that take place in the group will have to reveal if and where viewpoints are being discussed and shared.

Indicators for the reduction of cognitive load are a division of tasks and coordination between different partners working on the same project. A few questions about this have already been asked in the first interview, but more information about the division of tasks is needed. It is important to note that a very elaborate, rigid division of tasks is bad for collaboration.

The transfer of knowledge by observation is one category of indicators that strongly relies on interviews to be revealed. This is a silent process and generally only the receiver realizes that he acquired knowledge this way. In the interview, questions will have to be asked about whether students learned new concepts by looking at the work of their partners when working together.

Questions in English

Questions about reflection and negotiation

- Does the group evaluate all new additions to the work on or outside the Digital Workshop? *Questions asks about the frequency of reflection.*
- Do you discuss the mistakes found in these evaluations in the whole group? (The discussion should be about finding out why mistakes were made and how they can be fixed?) *Questions asks whether evaluation actually results in reflection.*
- What medium do you use to hold these discussions? *Inquiry about the use of media in the groups communication.*
- What medium do you use to ask questions regarding project work and are these always adequately answered by other group members? *Question asks whether people dare to ask questions and whether other members are willing to explain answers. Also asks what media are used?*
- Have there been any disagreements related to project work in the group and how have these been resolved? *Asks whether negotiation occurs and if the group members take the time to understand each other's points.*

Questions about the transfer of knowledge

- Are there any new things you learned from looking at how other group members solve problems? *Question asks whether the transfer of knowledge occurs within the group and whether the group members are aware of this.*
- Are there any new things you learned from looking at how other groups solve problems? *Previous question applied to inter-group knowledge transfer.*

Questions about the reduction of cognitive load

- (How) are tasks divided within the group? *Questions asks about the approach to the reduction of cognitive load.*
- Do you know and understand what each individual group member is doing or has done? *Questions asks whether group members still are involved with other members work. If this isn't the case, task division might have gone too far and collaboration might be changing into cooperation.*

The interview was recorded and the recording was transcribed. The results were tagged using the following tags:

The tags for the indicators are:

- Exchange of viewpoints in the Digital Workshop
    - Frequency of reflection in the Digital Workshop: **[Frequency of Reflection:]**
    - Does reflection lead to an exchange of viewpoints: **[Reflection and Viewpoints:]**
    - Media used for exchange viewpoints: **[Media and Viewpoints:]**
    - Do questions lead to an exchange of viewpoints: **[Questions and Viewpoints:]**
    - Do conflicts occur between group members and have these been resolved (which requires an exchange of viewpoints): **[Conflicts:]**
- Transfer of knowledge in the Digital Workshop
    - Is knowledge verbally shared (exchange of viewpoints, explanation): **[Knowledge Sharing:]**
    - Does internalization occur within the groups: **[Internal Internalization:]**
    - Does internalization occur outside the groups: **[External Internalization:]**
- Reduction of cognitive load
    - How much task division is there: **[Task Division:]**
    - Are all students aware of what their group members do: **[Task Awareness:]**

The results of the interview will be presented below.

Results of the first interview

Question 1: Does the group evaluate all new additions to the work on or outside the Digital Workshop?

Group 2: One interviewee had used the Digital Workshop in an internship. All interviewees had followed the standard 1st year curriculum for information science and informatics. For information science, this means that they used or are using the Digital Workshop for four courses, including the R&D 1 course.

Group 5: The members of group 5 used the Digital Workshop in one previous course and use it in another course next to the Research & Development 1 course.

Group 13: One member of group 13 did not have any previous experience with the Digital Workshop. Another member had previous experience with the Digital Workshop similar to that of the members of group 5.

[Overall Use:] Previously used by all but one member.

Question 2: Did you then use the comment functions to comment on each other's group work?

Group 2: The members of group 2 indicate that they used the comment function to comment on each other's work in other courses. In one course this was mandatory.

Group 5: The members of group 5 only used the comment function when it is mandatory. In their experience, this resulted in useless comments.

Group 13: The interviewees commented on the work of others. In one course it was mandatory. This resulted in valuable comments in the beginning but further in the course the comments became less useful. Questions were answered.

[Internal comments:] All groups used internal comments. One group only used them when they had to.
[Negative statements:] Comments about spelling are considered useless in the opinion of the members of group 5. When comments are made mandatory, useless comments will follow according to group 5. The members of group 13 believe that the first comments made are useful but that later comments become useless.

Question 3: Did you then use the discussion page's?

Group 2: The students use the discussion page to keep track of what they had done. They would write down what they had done in a table on the discussion page.

Group 5: One student tried to start a discussion in the discussion page's. But the other students wouldn't follow. One student didn't even know that these pages existed.

Group 13: The interviewees did not use the discussion pages in other courses.

[Discussion Page:]

Question 4: Did you then once comment or made improvements on the pages of other groups?

Group 2: During one course the students made individual assignments on one page and they had to comment on these assignments. There is also a group project in this course but they haven't commented on the work of other groups yet.

Group 5: This was mandatory in one course. This led to a lot of comments that where useless in the opinion of the members of group 5. They did not make any comments on the work of other groups in other courses.

Group 13: The interviewees did not give comments on the work of others. They did note that other people did comment on the work of others. They observed that other students would ask other groups what the best approach was. These questions where always answered.

[External Comments:] No group made comments in the work of other groups. The members of group 2 made comments on each other's individual work in a course where they also worked together in a group.

Question 5: Do you believe that the Digital Workshop makes working on this project easier then when you make the project offline?

Group 2:

The interviewees agree that the Digital Workshop is better than mailing around documents. The advantage of the Digital Workshop is that all group members can always get access to the documents and change them. The students do believe that they would have found an alternative to the Digital Workshop if it wouldn't have been available. According to the students, the disadvantage of the Digital Workshop is that the codes needed to create special text in the Digital Workshop are cumbersome. The interviewees dislike that they need to learn how to use these codes.

Group 5: According to the interviewees the Digital Workshop had a lot of technical problems. Furthermore, since the Digital Workshop isn't a "what you see is what you get" environment it isn't easy to use. The interviewees state that they already make a lot of documents offline and mail them instead of using the Digital Workshop. They also use Google Wave to communicate with other group members.

Group 13: One interviewee remarks that the Digital Workshop is useful as a central storage place. But in his opinion the Digital Workshop isn't something what you would use to work on a project with multiple people at the same time. The other interviewee agrees.

[Positive Statement:] The Digital Workshop is useful as a storage place where people can place their work and where other group members can access this work. The members of group 2 and 13 all share this view but the members of group 5 made no positive statements about the Digital Workshop.

[Negative Statement:] All students agree that the lack of a "what you see is what you get" editor is a disadvantage of the Digital Workshop. The members of group 5 experience a lot of technical problems with the Digital Workshop. As a result, the members of group 5 make their work outside the Digital Workshop and then upload it into the Digital Workshop. The members of the other groups do not experience any technical problems with the Digital Workshop. The only issue they have is that the Digital Workshop isn't fast enough.

Question 6: Do you think that you will use the discussion page's in the R&D 1 project?

Group 2: They indicated that they already did in a previous question.

Group 5: One member mentions that he tried to use the Digital Workshop but that no one would follow. Another member believes that the only value of the discussion pages is that they separate the

content from the discussion. But since the content is already a mess the discussion can just as well take place amongst the content.

Group 13: The interviewees do not believe that they will use the discussion pages. They prefer to use the comment function. This is more available and faster in their opinion.

[Discussion Page:] The members of group 2 use the discussion page to create a planning. The other members prefer to hold the discussion on the page itself and not in the accompanying discussion page.

Question 7: Do you think you will use the comment functions to comment on each other's work in the R&D 1 project?

Group 2: The members of group 2 indicated that they already do this in a previous question.

Group 5: The members of group 5 stated that they already made comments during previous courses and that they expect to make comments in the Research & Development 1 course as well.

Group 13: The members of group 13 already make comments to make improvements in the work of other group members and they place questions in the Digital Workshop.

[Internal comments:] All groups already make internal comments or will make internal comments in the Research & Development 1 course.

Question 8: Do you look at the work of other groups, and if yes, for what purpose?

Group 2: The interviewees admit that they used the Digital Workshop to look at the work of others. They look at the work of others because they don't know how to solve a problem or what exactly the assignment is, so that they can continue with the project. In the one course they used the Digital Workshop to look at the subject of the projects of other groups. They also used it to check whether their answers matched the answers of the others. If they were stuck they would also look at the work of others.

Group 5: The members of group 5 look at the work of other groups to determine what structure they should give their pages and how they should divide their pages. However, this has little use according to one member of group 5 since the other groups copy their structure.

Group 13: The interviewees look at the work of others to find out how far the other groups are with their work so that they can check if they are behind. They also looked at how other groups kept their logs for inspiration.

[Look Around:] The members of group 2 looked at the work of other students in one course to help them find inspiration for their own solutions to assignments. They also checked whether their answers match the answers of other groups. The members of group 5 look at the work of others to help determine how they will structure their pages. The members of group 13 look at the work of others to check whether how much progress the other groups have made.

Question 9: Would you comment on or make improvements in the work of other groups?

Group 2: The interviewees don't voluntarily comment on the work of other groups. One interviewee made one comment because he incidentally encountered information that might have been relevant to another group.

Group 5: The members of group 5 believe that the subjects of the different projects differ that much from each other that they can´t make comments that relate to the subject of the project. Comments about spelling and the structure of a page are considered useless by the members of group 5. One member believes that such comments make you unpopular amongst the other students.

Group 13: The interviewees do not expect that they will comment on the work of other groups. The main reason why they do not do this is because they do not know enough about the subject of the other group's work. They refuse to make changes in the layout of other groups since that is something the groups themselves should do.

[External comments:] All groups indicate that they won´t make comments on in the work of other groups. Group 5 and group 13 believe that they don´t know enough about the work of the other groups to make useful comments. They view comments about structure and spelling as useless. The only comment made in the work of another group was made by a member of group 2 who encountered information that was relevant to another group´s project.

Question 10: Are you afraid that other group's might steal your work or ideas?

Group 2: The interviewees are not afraid that students might copy their work. The assignments have different subjects so not much can be copied. They don't know if anybody actually does copy information. They don't really care either. One interviewee remarks that they don't lose anything when someone copies their work.

Group 5: According to the interviewees this only happens in smaller assignments that are done by multiple groups. For R&D 1 the assignments differ too much to copy anything useful. They have little trouble with people copying work as long as they use it to better understand the problem so they can create their own solution. One member states that he did exactly this. Another member believes that students are mature enough to refrain from stealing.

Group 13: The interviewees believe that it is impossible to steal the work of other groups in the R&D 1 course. But that it is possible in the other courses. One interviewee states that it is tough luck when this happens since you put time in your work but another person didn't. Both interviewees agree that copying isn't useful since you won't learn anything. They don't believe students actually copy work but they do look at the work of other people for inspiration.

[Positive towards Openness:] All group members state that this isn´t possible in courses where the subjects of each individual project is different of the subject from another project. The R&D 1 course has such a project. The members of group 2 and group 5 don't care if another member copies their work. They won't lose their work if someone does this. All group members know that they won't learn anything from directly copying another person's work. The members of group 5 do copy the work of others so that they can study it. This will help them in finding a solution of their own.

[Negative towards Openness:] One member of group 13 finds it unfair if another person steals their work since they put effort in it but the person copying the work did not.

Question 11: Do you make all your documents directly in the Digital Workshop?

Group 2: The interviewees create all their documents in the Digital Workshop except when they need to create a report or when they need to make a deliverable in .pdf format. They don't use the export function because they dislike making a layout in the Digital Workshop. The only technical issue the interviewees have with the Digital Workshop is that it can be slow.

Group 5: Group 5 makes most of their documents offline and these are merged and then copied into the Digital Workshop. Documents are also discussed outside the Digital Workshop.

Group 13: The interviewees make all their work in the Digital Workshop except deliverables. The interviewees do not experience any technical problems. One interviewee comments that the Digital Workshop is a bit slow. The other interviewee comments that there is no easily accessible documentation. He needs to look at the work of other people to find out how they made a certain special object in the Digital Workshop.

[Negative Statement:] The members of group 2 do not like the layout support of the Digital Workshop. If layout matters, they will improve it in another text editor. The members of group 5 do not make their documents in the Digital Workshop. Their discussion also takes place outside the Digital Workshop. The members of group 13 complain about a lack of documentation.

[Publishing Media:] Group 2 and group 13 publishes all work that can be published in the Digital Workshop in the Digital Workshop. Group 5 makes and publishes most work outside the Digital Workshop. But they also publish their work in the Digital Workshop.

Question 12: Which medium do you believe will be used most to evaluate the work of other group members?

Group 2: The interviewees evaluate each other's work in the Digital Workshop but reminders about meetings are done through e-mail.

Group 5: Google Wave is used most. The interviewees states that this is the case because their project is about Google Wave. Skype, mail and MSN are also used.

Group 13: The interviewees evaluate each other's work in the Digital Workshop. One interviewee remarks that he likes the fact that the Digital Workshop can sent an e-mail to him once a change in a page has been made. Then he can discuss these comments face-to-face.

[Discussion Media:] Group 2 and group 13 use the Digital Workshop and e-mail. Group 5 primarily uses Google Wave and also use MSN messenger and e-mail.

[Positive Statement:] One member of group 13 states that he likes the automated e-mails that the Digital Workshop sends once an edit has been made.

Question 13: Which medium do you believe will be used most to make appointments?

Group 2: The interviewees confirm that they primarily use mail to make appointments.

Group 5: Most appointments are made face-to-face.

Group 13: The interviewees state that they use mail to make appointments.

[Scheduling Media:] Group 2 and 13 use e-mail. Group 5 makes most appointments face-to-face.

Question 14: How often a week does the group come together to meet face-to-face?

Group 2: The interviewees meet once every two weeks and more when a deadline approaches. The fact that one group member follows a different education makes scheduling more difficult but they still manage to make appointments.

Group 5: The number of face-to-face meetings a week varies greatly. The interviewees do not dare to give an estimate. Some weeks they don't meet at all, sometimes they meet multiple times a week.

Group 13: The interviewees often discuss their work during classes, either before or after them and then they send an e-mail to confirm their discussion. They meet once a week.

[Face-to-face Meetings:] All groups have face-to-face meetings. Group 2 meets once every two weeks. Group 13 meets once a week and between courses. Group 5 meets on an irregular basis. On average they meet at least once per month.

Question 15: Do you use any other online project environments, like Google Docs, for this project?

Group 2: The students do not use any other online project environments in the R&D 1 course.

Group 5: The interviewees use Google Docs to share and view presentations related to the project.

Group 13: The interviewees plan to use an SVN repository to store the code of the programs they will develop.

[Collaboration Software:] The members of group 2, group 5 and group 13 don't use another collaborative software environment for the work that can be done in the Digital Workshop. But group 13 will need an SVN to share programs they work on since the Digital Workshop does not support this. Group 5 shares presentations in Google Docs.

Results of the second interview

Question 1: Does the group evaluate all new additions to the work on or outside the Digital Workshop?

Group 2: The members of group 2 will immediately look at changes made to their recent work. Other changes are rarely evaluated.

Group 5: The members of group 5 sometimes evaluate each other's work in the Digital Workshop.

Group 13: The members of group 13 look at and discuss each new large addition of content.

[Frequency of Reflection:] All groups evaluate some of the additions in the Digital Workshop. The members of group 2 only check changes made to their own work. The members of group 13 evaluate all large additions.

Question 2: Do you discuss the mistakes found in these evaluations in the whole group?

Group 2: The members of group 2 add comments if they find anything wrong. These comments are sometimes discussed in the group. Small errors are immediately fixed.

Group 5: The members of group 5 check the changes on a page once an automated e-mail is sent. They discuss these changes and the mistakes in the group.

Group 13: The members of group 13 make comments when they change someone's work. If someone wishes to reply to these comments they can reply.

[Frequency of Reflection:] The members of group 5 now indicate that they check changes if they receive an automated e-mail.

[Reflection and Viewpoints:] The members of group 2 and group 13 make comments in the Digital Workshop when they see a mistake. The members of group 2 and group 5 discuss mistakes inside the group. The members of group 13 only discuss mistakes when the original author disagrees with a fix.

Question 3: What medium do you use to hold these discussions?

Group 2: Such discussions are face-to-face.

Group 5: Skype or face-to-face communication is used.

Group 13: Small comments are made in the Digital Workshop. Large comments are send by e-mail. Face-to-face communication is also used.

[Media and Viewpoints:] All groups discuss changes and errors in work face-to-face. Group 5 also uses Skype to discuss changes and errors. Group 13 discusses small fixes in the Digital Workshop. Large fixes or errors are discussed using e-mail or face-to-face communication.

Question 4: What medium do you use to ask questions regarding project work and are these always adequately answered by other group members?

Group 2: The Digital Workshop isn't used to ask questions. Questions are asked by e-mail or face-to-face. They do ask questions in the Digital Workshop to persons who are very active in the Digital Workshop. This is not done in the Research & Development 1 course.

Group 5: The members of group 5 ask questions face-to-face or by e-mail. One member of group 5 states that he finds it antisocial to change things or add questions to the pages of other groups.

Group 13: Questions about content that is already in the Digital Workshop are placed in the Digital Workshop. Other questions are asked by e-mail or face-to-face.

[Questions and Viewpoints:] Questions are mostly asked using e-mail or face-to-face. The members of group 2 and 5 indicate that they ask questions to members of other groups. The members of group 13 place questions about content in the Digital Workshop in the Digital Workshop.

[Knowledge Sharing:] All students dare to ask questions to other group members. Thus knowledge is shared internally. The members of group 2 and group 5 ask questions to members of other groups. Thus knowledge is shared externally.

Question 5: Have there been any disagreements related to project work in the group and how have these been resolved?

Group 2: The members of group 2 indicate that they discussed their approach in advance. This way conflicts about content on the Digital Workshop didn't occur. The only problems occurred when a member wouldn't understand something. Then he would ask about what he didn't understand and the other members would answer.

Group 5: The members of group 5 discussed their disagreements in Skype. They occasionally involved a person from another group to get an additional viewpoint to help solve conflicts.

Group 13: One member didn't understand a fundamental principle and this led to several discussions. This issue was resolved by explain the interpretation of this fundamental principle for each member and discussing the errors in his interpretation.

[Conflicts:] Conflicts occurred in group 5 and group 13. Group 5 resolved these by involving another person. Group 13 solved these by carefully explaining each other's viewpoints.

[Knowledge Sharing:] All groups indicate that they explain a certain approach or related theory when one member doesn't understand something. Group 5 even involves external persons to help gather new insights.

Question 6: Are there any new things you learned from looking at how other group members solve problems?

Group 2: The members of group 2 indicate that they did not learn anything by looking at the work of other group members. Different members would perform different tasks. This way the work of other members wasn't relevant to the work of a member.

Group 5: The members of group 5 did not learn anything by looking at the work of other members. All knowledge was shared by words.

Group 13: The members of group 13 indicate that this didn't happen.

[Internal Internalization:] Internal internalization doesn't occur. Group 2 mentions that their task division stands in the way of internal internalization.

Question 7: Are there any new things you learned from looking at how other groups solve problems?

Group 2: The members of group 2 looked at the code on the pages of other groups to find out how certain objects could be created.

Group 5: The members of group 5 indicate that knowledge is shared verbally between groups.

Group 13: The members of group 13 looked at the code on the pages of other groups to find out how certain objects could be created.

[External Internalization:] External internalization occurs for all groups (group 5 indicated this in interview 1) All external internalization led to a sharing of knowledge about the code used in the text editor of the Digital Workshop.

Question 8: (How) are tasks divided within the group?

Group 2: The members of group 2 created a task division in the beginning of the project.

Group 5: The members of group 5 created a task division on the basis of subject. They also made to-do list where each member was free to choose what he would do.

Group 13: The members of group 13 indicate that they created a task division for their research into literature in the beginning of their project. Later in the project there was no task division.

[Task Division:] All groups made a task division in the beginning of their project. Group 5 changed their task division into a to-do where each member could choose their work. Group 13 only made a task division on the basis of literature in the literature study.

Question 9: Do you know and understand what each individual group member is doing or has done?

Group 2: The members of group 2 divided tasks on the basis of who could perform each task best. But they believe that each member could perform each task.

Group 5: The members of group 5 answered with no when asked whether they no longer knew who did what due to the task division.

Group 13: The members of group 13 only made a task division on the basis of literature. This does not affect task awareness.

[Task Awareness:] Task awareness is no issue for group 13. Group 2 and group 5 might have some issues with task awareness due to their task division. But they all believe that each member could have done any work and they believe they know what every member does.

The results of these interviews will be discussed in the discussion chapter.

Logs of external communication

Setup of the analysis

The students had to log their communication outside the Digital Workshop. This log and the information gathered from the interviews should give an idea of what the students communication and collaboration looks like outside the Digital Workshop. The log the students had to keep was presented in the Research Method chapter. In this log the students logged when they communicated, with which medium they communicated and what category there communication was. The different categories of media that the students could choose from where:

- Face-to-face: Verbal and non-verbal communication without using any electronic devices.
- E-mail: Text messages or files send trough e-mail. SMS messages should also be classified as E-mail, since they have the functionality of a primitive e-mail.
- Chat Messages: The use of instant messengers like MSN or other programs like IRC to chat about the project.
- Telephone: The use of telephone to talk about the project. SMS messages should not be categorized as telephone but as e-mail.

- Webpage: Any message or file posted on a webpage, forum or something similar related to the project.

The different categories of communication that the students could choose from where:

- Group Management: Any setting of deadlines, scheduling of meetings or other appointments or creating To-do's and planning's.
- Publishing of Work : Any new content that is part of the final products that is published or presented to the other group members or tutors.
- Question: Any question asked trough any of the media.
- Comment: A reaction on content that has been published. This can be anything from a simple remark on a spelling error to well-structured constructive criticism.
- Reply: A reply on a comment. A reply must comment of the content of a comment and not on the content of newly published content. If it does comment on published content it is a comment.
- Meeting: A meeting in which the entire project has been discussed by more than two group members. In a meeting, comments and replies must occur. New content might be published and discussed in a meeting.

The information gathered in these logs will be used to determine what the communication outside the Digital Workshop looks like. For each category of medium the occurrences will be counted and the percentage of communication in which this medium was used will be determined. This will be done using the following formulas:

- Counting the occurrences: =(AANTAL.ALS(*range*;"**media category**"))
- Determining the percentage: = (*number of occurrences for the specific media categories/total number of edits*)

For the communication categories the following formulas will be used:

- Counting the occurrences: =(AANTAL.ALS(*range*;"**communication category**"))
- Determining the percentage: = (*number of occurrences for the specific communication category/total number of communication categories assigned*)

The resulting statistics will give an idea of what the communication outside the Digital Workshop looks like.

External activity logs

The example below shows the table that was used to gather the data:

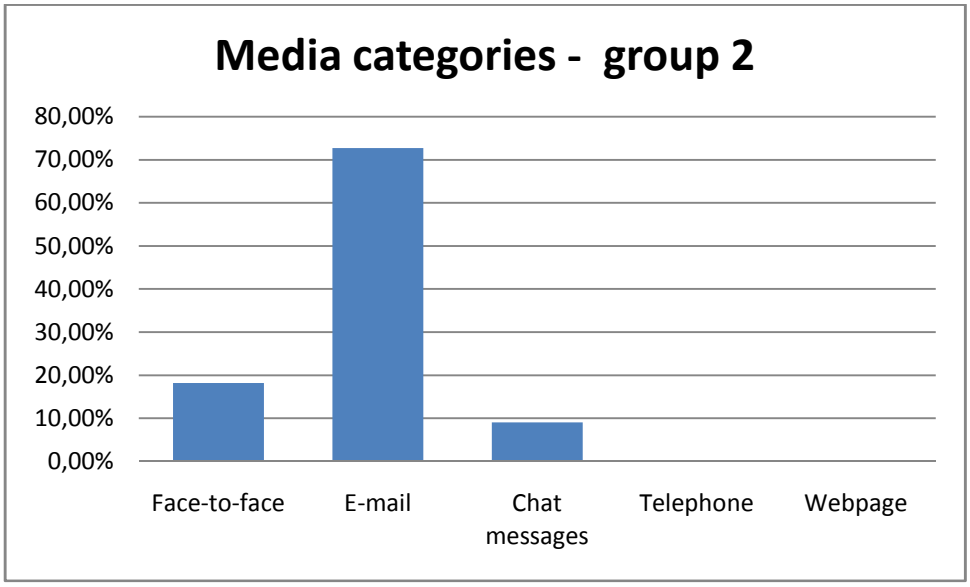
Formulas	Percentage	Absolute Number
Face-to-face	36,84%	7
E-mail	57,89%	11
Chat messages	5,26%	1
Telephone	0,00%	0
Webpage	0,00%	0
All media		19

Group Management	43,48%	10
Publishing of Work	13,04%	3
Question	4,35%	1
Comment	4,35%	1
Reply	8,70%	2
Meeting	26,09%	6
All communication		23

The last orange row shows the number of occurrences for each type of media. The percentages in the second orange row were determined by dividing the numbers in the last orange row by the number in the last green row. The last yellow row shows the number of occurrences for each type of communication. The percentages in the second yellow row were determined by dividing the numbers in the last yellow row by the numbers in the last blue row.

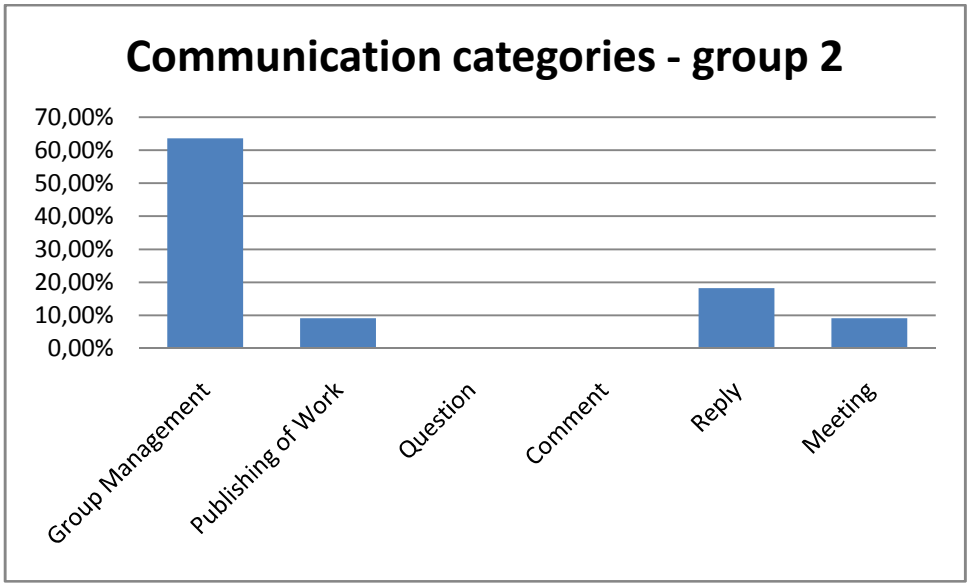
External communication for group 2

The graph below shows the media used by group 2 outside the Digital Workshop:



This graph reveals that three types of media were used. Face-to-face communication occurred, chat messages were used and e-mail were used. Slightly less than 20% of all communication was face-to-face while only 10% of the communication was done trough chat messages. But more than 70% of all communication was done using e-mail. It is clear that outside of the Digital Workshop, group 2 primarily used e-mail to communicate about their project for the R&D1 course.

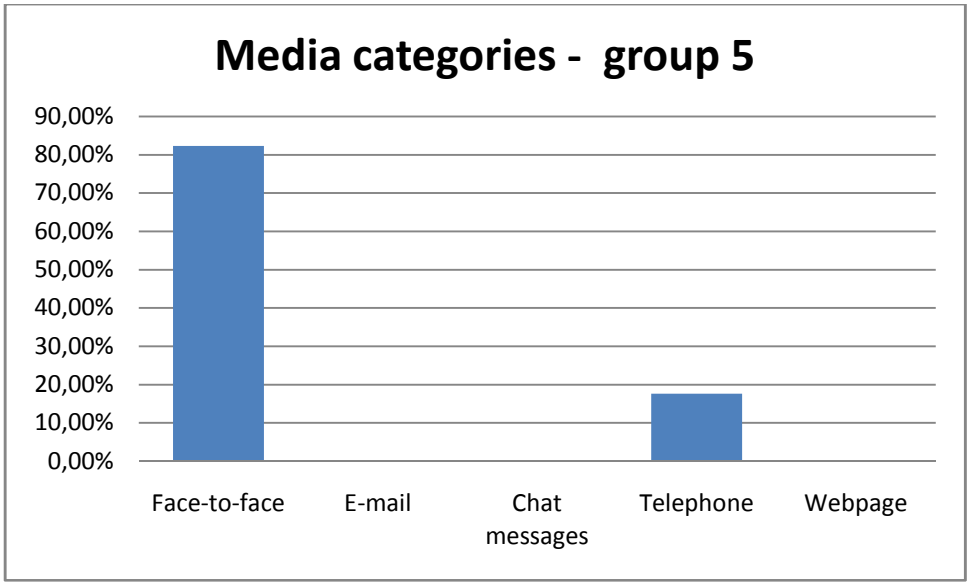
The graph below shows the communication categories that were used by group 2:



Most of the communication made by group 2 was Group Management. More than 60% of all communication was of this category. The other three categories used are the reply category, the meeting category and the publishing of work category. Around 18% of all communication were replies to previous messages. 10% of all communication was done in a meeting and 10% of all communication dealt with the publishing of new work. Only 20% of all communication was done face-to-face. Apparently group 2 relies on digital communication. However, it should be noted that one occurrence of face-to-face communication was a meeting. And face-to-face communication can occur in such a fluid fashion that it is probably the type of communication that is most likely to be forgotten.

External communication for group 5

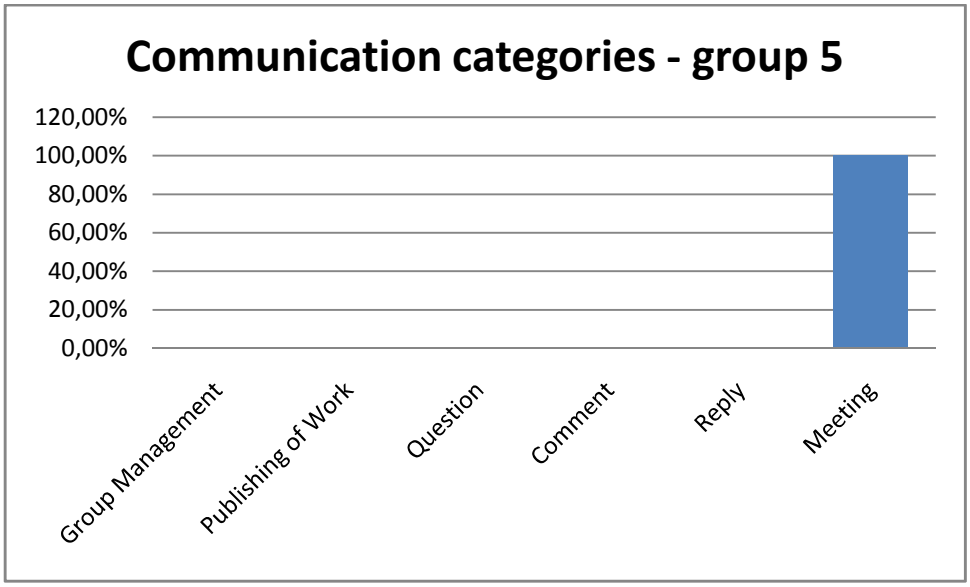
The graph below shows the media used by group 5 outside the Digital Workshop:



Most of the communication in group 2 takes place face-to-face. Some communication is done trough phone, which shows that the members of group 5 have a strong preference for synchronous media. The members of group also noted that they used Google Wave to work on documents online. They

did not log this activity. It was too difficult to log the process of creating a document together. The members of group 5 also used a SVN to share their programming code.

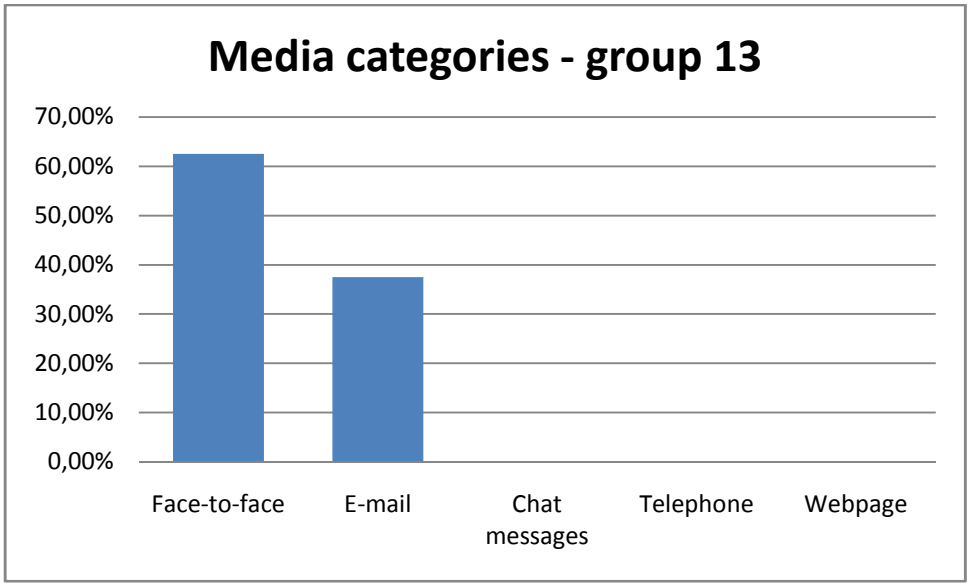
The graph below shows the communication categories that were used by group 5:



All external communication logged by group 5 happened in meetings. Group 5 indicates that they did not log all communication. Other communication took place while working together online. It seems that this communication was to fluid to log.

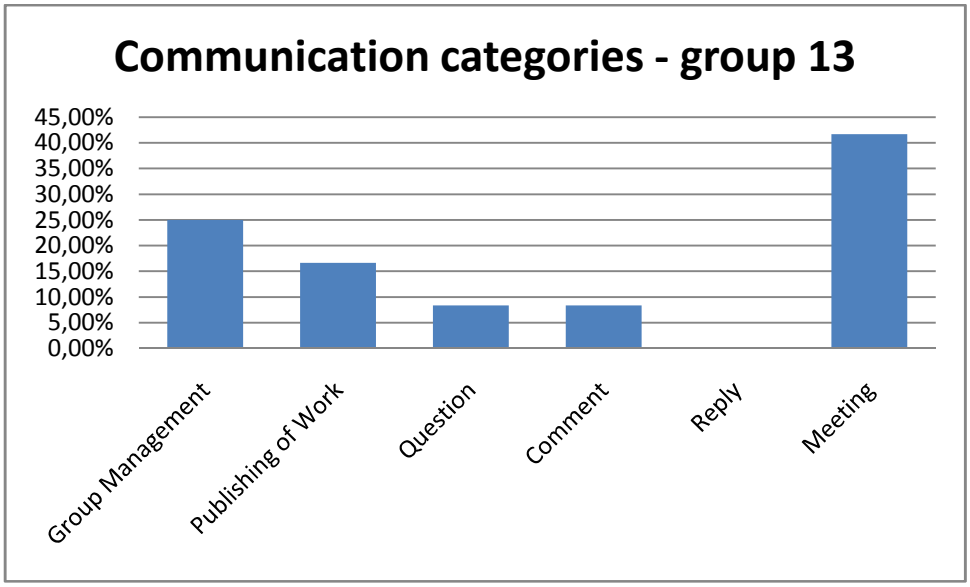
External communication for group 13

The graph below shows the media used by group 13 outside the Digital Workshop:



Group 13 only used two types of media: face-to-face and e-mail. Face-to-face was used most, while e-mail was used slightly more than half the time face-to-face communication occurred.

The graph below shows the communication categories that were used by group 13:



The most used type of communication were meetings. Around 40% of all communication consisted of meetings. The second most used type of communication was Group Management. A quarter of all communication was of this category.

Discussion

Research Progression

The study into the role of the Digital Workshop in the collaborative learning and related communication consisted of three parts. First, the activity of the students in the Digital Workshop was studied. The study itself went as predicted. The history pages of the Digital Workshop were used to analyze all edits. The predetermined categories proved sufficient. Two other researchers will perform a part of this task to help verify the objectivity of the method.

The second part of the study consisted out of interviews. The first interview was used to determine how the students used the Digital Workshop. It also asked the students to give their opinion about the Digital Workshop. The second interview was used to determine what the communication of the students look liked. The research method anticipated for a potential third interview to help answer questions that might have risen from the other parts of the study. But the results of the two planned interviews supplied sufficient information. No third interview was needed.

The last part of the study consisted out of a log that should help reveal the communication of the students outside the Digital Workshop. This log would be kept by the students themselves. Group 2 and group 13 had little trouble keeping these logs. Whether they logged all their communication remains unclear. But the communication logged by these groups supports the conclusions from the interviews. Group 5 had difficulty logging their more fluid communication. However, they indicated this themselves. And the interviews did supply sufficient information about this fluid communication. In the end the logs proved less useful than expected. They only helped confirm the conclusions from the interview. No new insights were revealed by these logs.

Activity in the Digital Workshop

Member participation

The results of the analysis of the activity in the Digital Workshop provide a great deal of information. These results should help determine what types of communication occur in the Digital Workshop. This should help determine what kind of collaborative learning takes place in the Digital Workshop. Certain types of communication are more likely to trigger certain learning mechanisms. This relation determines what the collaborative learning in the Digital Workshop will look like.

The work of the students is analyzed by studying the edits. These edits list the user account that was used to make the edit. Each student had its own user account. These user accounts were made when the students first used the Digital Workshop. It seems unlikely that the student would use the accounts of other students to make edits. Not only is there no need since each student has its own user account but it will also confuse students since such behavior would mean that they can no longer see who made which edit. However, it is possible that several students work together behind one computer. One edit could be made by multiple students. But an edit can only be uploaded by one student. If one student always uses his account when he makes edits together with other students it will look like this students made all these edits on his own. This could result in inaccurate information where one student has significantly more edits than the other students. All conclusions about the division of work should be made with this problem in mind.

One important criteria of collaborative learning is that each member of a group participates in the work the group does. ([16], pg. 337) Though it is impossible to guarantee that every member does exactly the same there should be a certain level of symmetry between the contributions of each member ([17], pg. 7).

But first we must look at the division of work between the different groups that were observed. The results are somewhat remarkable. If one looks at the total of all pages, each group made an almost equal amount of edits. This seems to imply that each group put an equal amount of effort in his work on the Digital Workshop. However, there is no guarantee that the edits are of similar size. Thus the total number of edits might not be the best indicator for the effort of an individual group. Still, it's hard to ignore the fact that each group made an almost equal amount of edits. If one group had far less edits than the other group or one group had far more, this could have meant that that group's performance much worse or much better than the performance of the other groups. But these results seem to imply that the performance of each group is quite equal. The final conclusion that can be drawn from this data is that each group is putting serious effort in his project and that the groups seem to try to keep up with each other. Whether the effort of each group has been enough won't be clear until the results are graded. But at least all of the groups are putting effort in their work, which means that observing these groups should result in useful data.

The results are quite different for the pages that require special attention. All groups use the planning pages. But group 5 made significantly more edits on the planning pages than the other two groups. Apparently, group 5 put more effort in creating a planning than the other groups. Again, it should be noted that the amount of edits might not be the best measure for the effort of a group. But this difference in amount of edits does raise questions? Did group 5 truly put more effort in their planning and if so, why.

The data for the discussion pages show a much greater difference than the differences seen on the planning pages. More than 90% of the edits made in discussion pages were made by group 2. And group 13 didn't even use the discussion pages. This seems to imply that group 2 is the only group that chose to seriously use the discussion pages. However, this data does not reveal why group 2 chose to use the discussion pages and why the other groups chose to not use the discussion pages. Similar results were found for the presentation 2 pages. This time, group 5 didn't create any presentation 2 pages. But again, group 2 made more than 90% of all edits on the presentation 2 pages. Apparently, group 2 puts much more effort in the discussion of work on the Digital Workshop. But why will have to be answered by other data, either the interviews or the personal logs.

However, the divisions of work within the groups are nowhere near as equal as the divisions of work between the groups. The first graph immediately reveals that member 2.a made significantly more edits than the other members. Member 2.c made such little contributions that one can question whether his contributions were of any significance. However, it isn't as clear as it seems to be at first glance. In the previous section it was already mention that individual edits can vary in size. Thus edits do not necessarily equal effort. One should also note that edits relate to user accounts. It is possible that multiple people worked on one edit but in the end it will be uploaded by only one user. This behavior could affect the statistics in a bad way. However, the 6% of member 2.c still remains strange. It is possible that this members contributions were outside the Digital Workshop. This does require further investigation, because an unequal distribution of work is bad for the collaboration in a group.

The distribution of edits on the planning pages is even more remarkable. All edits were made by member 2.a. This seems to imply that member 2.a made the planning all by his own. However, as mentioned before, this data on its own is not enough to draw such conclusions from.

The distribution of edits on the discussion pages show a different image. Though the size of the contributions do still vary in size, they are all significant. This seems to imply that all members had an equal part in the contributions on the discussion pages. This does point towards good collaboration in group 2, at least for the discussion pages.

The results for the presentation 2 page show another unequal distribution of edits. Again, member 2.c has so few edits that his contribution can be viewed as insignificant. However, this time member 2.b made the majority of edits. Thus it isn't always member 2.a who does most of the work. The data for the total of all pages still indications that member 2.a did make most edits. But member 2.b also took responsibility for at least one page

Group 5 shows a different distribution of work. Group member 5.a made almost half of all edits while member 5.b and 5.c both made slightly more than a quarter of all edits. There is some inequality in the distribution of work for group 5. But each member made a significant contribution to the work on the Digital Workshop. Thus there is little need to be worried about the distribution of work of group 5. These data reveal that all members of group 5 collaborate. The collaboration might not be perfect but that is not necessary.

Group 13 is a special group. One member left the group during the first stages of the project. While this member will not be present at any of the interviews and will not keep a log of the communication outside the Digital Workshop he did make some contributions to the Digital

Workshop. The member that left is member 13.c. He made the least edits of the group but that comes as no surprise. Group member 13.a and 13.b are still active. Both group members made a significant contribution. Member 13.a is responsible for a quarter of all edits. But member 13.b is responsible for more than half of all the edits. Thus even though both members made a significant contribution there is still quite some inequality between the size of the contributions. However, as mentioned before, these data about the distribution of work within the Digital Workshop aren't a 100% accurate representation of the contributions that each member made. These data on its own aren't that bad. If member 13.a made significant contributions outside the Digital Workshop then the collaboration in group 13 should be good enough. But the contributions of member 13.a do require special attention.

If we look at the distribution of work for the special pages we see even more inequality. The pages that were used by the groups show a somewhat similar division of work. But certain pages were only edited by one member. These pages often contained little content. This behavior results in the greater inequality observed for the division of work in the special pages. But this behavior does not have any meaning. It only means that some special pages did not have much value to certain groups. This will be discussed in more detail in later sections.

All groups have one member who made significantly more than edits than the other members. In one case one member hardly made any edits at all. The division of work within the groups does not look ideal. We can't conclude that the collaboration is seriously disrupted. More data is required in order to make that statement. But this division of work certainly doesn't improve the collaboration and collaborative learning within the groups.

Communication buildup

This analysis looks at seven categories of communication. One category includes all other categories of communication. Around 18% of all categories used were communication categories. This means that 82% of all categories assigned to edits on the Digital Workshop weren't communication. This supports the theory that most edits made in the Digital Workshop are additions or changes to the documents in the Digital Workshop. These documents are products of the project, and not communication about the project. This means that the Digital Workshop is primarily used as a place where products can be made. However, around 18% of the assigned categories were communication categories. Thus a small, but significant number of edits included communication. The students do use the Digital Workshop to communicate about their project. But the percentages reveal that it isn't the Digital Workshop's primary use. Two categories of communication weren't used and one category as only used once. The conclusion that the Digital Workshop isn't used for these categories of communication can be made. These categories are Tutor comments, Tool/Media communication and Interpersonal communication. The fact that no tutor comments were made means that the teachers did not use their ability to comment on the work of their students in the Digital Workshop. This is one functionality of the Digital Workshop that is simply ignored. This does not necessarily relate to the effectiveness of collaborative learning. Feedback relates to the effectiveness of learning in general. However, intermediate feedback does occur outside the Digital Workshop. The teachers choose to not use the Digital Workshop for their feedback. The second category of communication that isn't used is Tool/Media communication. This is communication about tools or media used for the project. One tool that could be discussed is the Digital Workshop. But this type of communication does not occur. This means that the students do not discuss the workings of the Digital Workshop in

the Digital Workshop itself. This data is not enough to conclude that the students have no trouble using the Digital Workshop. There are other places where they can have Tool/Media communication. However, the observed students choose not to use the Digital Workshop for this. This is unexpected since the prediction is that students discuss problems where they occur. And this is one type of communication that you would expect in the Digital Workshop. Why this type of communication does not occur will have to be answered by the students themselves. The last type of communication that doesn't occur (it does occur, but only once, and this is an insignificant amount) is Interpersonal communication. This is communication that isn't about any serious subjects. This is informal communication about unrelated things that help improve the relations between members. The Digital Workshop is a place where students make their project and where they can discuss it. This doesn't seem like a place where Interpersonal communication would take place. It was already concluded that the Digital Workshop doesn't support fast and fluid communication. Combine this with the fact that students create their work in the Digital Workshop, and it shouldn't be a surprise that students do not use the Digital Workshop for Interpersonal communication.

The categories of communication that were used are the Question category, the Task Work communication category and the Group Management category. Only 2% of all categories used where Question categories. This isn't much. It is only 10% if all communication. Thus asking questions on the Digital Workshop isn't the most important use. The fact that the Digital Workshop only supports asynchronous communication might explain this. This means that the receiver will not receive a notification once a message arrives. In case of the Digital Workshop the receiver does receive an e-mail that states that something has changed on a page but it does not mention what has changed. Thus it can take a while before a question is observed and answered. If a student wants a quick reply he will have to use synchronous communication like face-to-face communication or a telephone. And e-mail is another type of asynchronous communication. People are better used to answering e-mails than looking at the Digital Workshop. Thus students would also prefer e-mail over the Digital Workshop. This means that it isn't unexpected that few questions are placed on the Digital Workshop. But the students are aware of this possibility and they do place questions. The two categories of communication that are dominant are the Group Management category and the Task Work category. Group Management consist of scheduling and to-do's. Thus it has to do with the planning of work. The students do indeed have to make a planning thus this type of communication was expected. The planning pages will have to be studied to determine if all Group Management takes place on these pages. Thus Group Management will be discussed in a later section. Task Work communication consists of comments, questions and replies. Questions were already discussed. But the students also post comments and replies in the Digital Workshop. The second statistic reveals that more questions are placed than replies. The ratio is 83%. This means that around 2% (more than 2% * 0.83 = around 2%) of the communication in the Digital Workshop consist of replies. The students do occasionally reply to comments or questions made in the Digital Workshop. But one would expect more replies if full discussions would take place in the Digital Workshop. These do not occur in the Digital Workshop, or if they do, incidentally. Most of the Task Work communication consist of comments (9.5% - 2.2 % - 2% ≈4%). Comments can only be the start of discussions. This supports the idea that long discussions do not occur in the Digital Workshop. Lone comments will be given and these occasionally receive a reply. We can conclude that the Digital Workshop isn't used to hold long conversations. This means that its use as a communication medium is limited, given the students use of the Digital Workshop. The asynchronous nature of the Digital Workshop is an

disadvantage. This was predicted in earlier chapters and this is the most likely reason why the Digital Workshop is not used for long conversations. This also means that the Digital Workshop must compete with e-mail, another asynchronous media. And this is a medium with which the students are likely more familiar. Thus communication in the Digital Workshop is limited and it has a strong competitor. What this exactly means will be discussed in a later section.

Group 2 made less communication that can be classified as Group Management than the other groups . But they made more communication that can be classified as Task Work communication. All subcategories of Task Work communication (Questions, Replies, Comments) were used more than average. This seems to suggest that group 2 had more discussions in the Digital Workshop. However, since the ratio between questions, replies and comments remains almost the same, group 2 did not hold longer discussions in the Digital Workshop. The total of all communication categories used by group 2 was relatively the same as that for the total of groups. This means that group 2 did indeed hold more discussions in the Digital Workshop. It also means that group 2 needed less edits to create a planning in the Digital Workshop. Thus the planning page(s) of group 2 requires special attention.

The distribution of categories for group 5 looks much like the average. The division of Task Work communication and its subcategories is almost exactly the same as the division of the average. However, group 5 did make almost twice as many edits that could be classified as Group Management. This suggests that group 5 made a more extensive planning than the other groups. The fact that more than half of all edits on all planning pages belong to members of group 5 support this theory. The planning of group 5 is significantly larger than the planning of any other groups.

Group 13 seems to have just as much Task Work communication in the Digital Workshop as any other group. However, it appears that more isolated comments occur in the work of group 13. This can either mean that the members of group 13 communicate less. This would be a bad sing for the collaboration in group 13. Or it could mean that the members of group 13 prefer to reply to comments in the Digital Workshop outside the Digital Workshop. Other data should reveal this. But the most notable difference in communication is that group 13 has much less Group Management communication than the other groups. This suggests that the planning of group 13 is much smaller than the planning of the other groups. However, edits can vary in size thus this doesn't have to be the case. What it does mean is that group 13 made less changes in their planning.

The lack of any Interpersonal communication doesn't come as a surprise. Interpersonal communication is informal communication that helps improve the relations between group members. It isn't about any work that must be done. The communication supported by the Digital Workshop was discussed in the chapter that deals with the relation between the theoretical workshop and the design of the Digital Workshop. The Digital Workshop only supports asynchronous communication. This type of communication can be slow. ([43], [17]) And a receiver can easily miss a message. ([43]) Spontaneous communication requires fast and fluid communication channels. And Interpersonal communication is generally spontaneous.([17]) Thus it should come as no surprise that the students do not use the Digital Workshop for their interpersonal communication. This is likely done face-to-face or trough synchronous electronic media. Interpersonal communication does benefit collaboration. But the most important reason that we don't observe Interpersonal communication is that the Digital Workshop's support for Interpersonal communication is limited. It is likely that interpersonal communication does take place outside the Digital Workshop.

The lack of Tool/Media communication cannot be explained. Previous sections of this chapter mentioned that this observation can mean two things: The students do not have any trouble using this tool. This would mean that there is no need for Tool/Media communication. Or the students communicate about Tool and Media in other media. Additional data from other sources will have to answer this question.

Two categories of communication are dominant. Task Work communication and Group Management. Group Management includes scheduling and the addition of to-do's. These are types of messages that are used to make plannings. Part of the assignment was that each group made a planning for their work. And all observed groups did this. Group 5 and group 13 created a planning in their planning page. All communication identified in these pages was Group Management. Group 2 did create a planning page but they did not make their planning in this page. They made their planning in the discussion pages and referred to these discussion pages on their planning pages. 4/5 of the communication in these discussion pages was Group Management communication. All groups created a planning. But not every planning was equally large. Group 2 and group 5 worked on their planning throughout the project. But group 13 only worked on their planning during the beginning of their project. As a result, their planning is smaller than the planning of the other groups. Fortunately, all plannings were made before the actual work was done. Thus all plannings are genuine. Creating a planning can trigger several learning mechanisms. Students have to divide work and plan their work to benefit from the advantages of working together. Learning this fits the learning mechanisms of Cognitive load. Furthermore students have to create a planning that they can all agree upon. This requires discussion and can result in conflict, which helps trigger almost all learning mechanisms. Unfortunately such discussions are not observed on any of the planning pages. Group 2 does have some communication on their discussion pages that isn't Group Management. This supports the theory that planning does lead to discussion. However, these discussions have to take place. They just don't take place in the Digital Workshop.

Task Work communication consist out of comments, questions and replies. Task Work communication occurs just as frequently as Group Management on average. But this relation varies between groups. Group 2 and group 13 have more Task Work communication than Group Management while group 5 has more Group Management than Task Work communication. The difference in proportions for group 13 can be explained by the fact that group 13 has a small planning. But the plannings of group 2 and group 5 are relatively similar in size. Apparently group 2 and group 13 do use the Digital Workshop for Task Work communication while group 5 does this far less. Why group 5 communicates less in the Digital Workshop can't be answered by this data. Other data is needed to answer this question. This difference does reveal that the Digital Workshop does not play the same role in the collaboration of every group. It plays a less important role in the communication of group 5 than it does in the communication of other groups.

Another statistic that was gathered from the analysis of the activity of the Digital Workshop is the ratio at which questions were answered. The limitations of this metric have been discussed before. The ratio lays between 75% and 100% . This means that some questions are certainly answered but not all. If these questions truly aren't answered, then this would be bad for the collaboration in the groups. Not having your own questions answered by your group members could frustrate individual members and hurt internal relations. And it could slow than progress. Other data will have to reveal whether these questions are answered outside the Digital Workshop.

Thus communication does take place in the Digital Workshop. All groups communicate about what must be done. But this is part of the assignment the groups received. All groups also communicate about the task at hand. However, group 5 communicates significantly less about the task at hand than the other groups. Why remains unclear. Students to dare to place questions in the Digital Workshop. But they aren't always answered in the Digital Workshop. If they are answered outside the Digital Workshop remains unclear.

Use of the special pages

The categories used on the discussion pages seem to suggest that the discussion pages were not used to hold discussions. Out of 39%, more than 2/3 of the assigned categories were Group Management categories. It seems that the primary use of the discussion page was a holding the plannings of the groups. It should be noted that the other 60% of categories assigned were structural additions, corrections and deletes. These make up all the work needed to create and bring structure to these pages and all the work needed to make changes to these pages. None of the categories assigned indicate that any other content was placed on these pages. The statistics about the division of edits amongst groups show that group 2 made more than 90% of all edits on the discussion pages. This suggests that group 2 may have chosen to create their planning in the discussion pages. The other groups made an insignificant amount of edits on the discussion pages.

The progression and the division of categories support the theory that group 2 used the discussion pages to make and hold their planning. Most communication categories assigned were Group Management. And the progression of the page spans the entire period that the group was observed. Thus we can conclude that group 2 chose to use the discussion pages to hold their planning. Since 90% of all edits were made by group 2 this leads us to believe that the discussion pages were not used to hold discussions. The only group that chose to use these pages used them for a different purpose.

All communication in the planning pages was Group Management. This supports the conclusion that the planning pages were only used to make plannings. Most of the edits on the discussion pages were made by group 5. Group 2 made their planning in the discussion pages and refers to these discussion pages for the planning page. This explains why no communication could be found in the edits of the planning pages. Group 5 created its plannings before the actual work is done. The plannings are genuine plannings. And all of groups 5 planning was made in the planning page. Group 13 made less edits than any other group. Group 13 only made a general planning in the start of their project. This is the only planning they ever made in the Digital Workshop. The planning of group 13 is the smallest of all plannings.

Group 2 made more than 90% of all edits on the presentation 2 pages. Group 5 did not use this page and group 123uploaded two files to these pages. Group 2 created their preparation for the second presentation on the presentation 2 page in one week. Many questions were placed on the pages and many replies were given, though not enough to conclude that all questions were answered. It seems that the members of group 2 created and discussed their preparation of the second presentation in the presentation 2 page. Only one group used the presentation 2 page. But they did use it as intended, and this did result in a discussion. This means that the presentation 2 pages do indeed help stimulate discussion in the Digital Workshop.

Progression of activity

The progression of activity has been discussed in previous sections of this chapter. We can conclude that all groups work towards deadlines. Their activity is not equally spread over the weeks. However, the activity on the discussion pages was more equally spread amongst the weeks. This suggest that the students never stop looking and thinking about their project. But they do concentrate their work along deadlines. All plannings were made before the deadlines. This should indeed happen and this means that the students did not fake their plannings. It also confirms that group 2 is the only group that prepared their presentation in the Digital Workshop. And group 2 is responsible for most of the discussion in the Digital Workshop. The activity of group 5 seems to follow a different pattern than the activity of the other groups. This suggest that group 5 uses the Digital Workshop in a different way. This needs to be explained.

Activity outside the Digital Workshop

Interviews

The first questions of the interview dealt with the student's previous experiences with the Digital Workshop. However, the students already worked on their Research & Development 1 project before the interviews were performed. Thus in practice the first questions dealt with the student's general experience with the Digital Workshop. All but one student had previous experience with the Digital Workshop. The students were asked to predict what functions they would and wouldn't use based on their previous experiences with the Digital Workshop. What became clear is that all groups will use the comment function to comment on the work of other group members. However, it is unlikely that they will comment on the work of other groups. In one course, of which all groups had at least one member who took part in this course, making comments on the work of other groups was mandatory. Group 5 and group 13 both stated that this led to a lot of small comments on spelling mistakes and document structures. These comments were useless in the eyes of group 5 and 13. One member of group 13 even stated that making such comments made you unpopular amongst the other students. Another function of the Digital Workshop that was discussed were the discussion pages. It appears that the members of group 2 use the discussion pages to create their plannings. This enables them to make a planning for each page. The other groups don't use the discussion pages. One member of group 5 tried to start a discussion but no other members would follow. Thus no group uses the discussion pages as intended. This supports the conclusion that the discussion pages don't work. However, the use of the discussion pages by group 2 does suggest that there is some use in a secondary page linked to a primary page.

An unique characteristic of the Digital Workshop is that it allows users to look and even edit the work of other users, even if these are members of another group. As mentioned above, the users don't place comments in the pages of other groups. This is one potential advantage that isn't used by the students. But there are other ways in which the students can take advantage of this open nature. The members of group 2 look at the solutions of other users to look for inspiration for their own solutions. However, the projects of the R&D 1 course differ to much from each other. The members of group 2 did this in other courses but not in the R&D 1 course. The members of group 5 look at the structure of individual pages and the division of the project into multiple pages of other groups. They try and find inspiration in this for their own division into multiple pages and for their structure of the individual pages. Group 13 looks at the pages of other groups to check the progress of other groups. This helps them determine if they are on schedule. All members of all groups looked at the code of

other groups pages to find out how they could create certain special objects on the pages like tables. This behavior means that external internalization takes place in the Digital Workshop. Internalization will be discussed in further detail later in this section. However, one possible disadvantage of this open nature is that students might possibly steal work from other students. The interviewees were asked to give their opinion about this. Only one student was concerned about this behavior. He found the idea that someone would benefit from his work without putting in the effort worrying. All other students questioned whether such behavior would happen. The most commonly heart argument against such behavior was that the individual projects were to different from each other. There was nothing that could be copied. Students also argued that you didn't learn anything from copying work. Thus the copier wouldn't benefit. This made copying less of an issue for the students. In the end, the students weren't really concerned with the behavior of other students.

One goal of the first interview was to determine what media the students used to communicate. One of the media the students could use was the Digital Workshop. The students of group 2 and group 13 made almost all their documents in the Digital Workshop. As mentioned in previous chapters the Digital Workshop does not support all document types. All groups mentioned that presentations and .pdf files had to be made in different environments. Group 13 had to create programs for their project. The Digital Workshop doesn't support this. Thus the members of group 13 will have to use a SVN to share their programs. The members of group 5 make all their documents in outside the Digital Workshop. They experienced technical difficulties with the Digital Workshop. This pressed them to make all their work in different programs. Final products are uploaded into the Digital Workshop. Group 2 and 13 also evaluate new contributions in the Digital Workshop. They also use other media but they do use the Digital Workshop. Group 5 doesn't use the Digital Workshop to evaluate work.

The difference in use of the Digital Workshop between the use of group 2 and 13 and the use of group 5 makes one wonder if group 5 has a different opinion about the Digital Workshop. The students were asked to state whether they believed that the Digital Workshop made their work easier. The members of group 2 and 13 did indeed believe that the Digital Workshop made their work easier. Both groups view the Digital Workshop as a document repository. It allows them to place all work in and access all work from one location. Another feature of the Digital Workshop that is appreciated by all groups are the automated e-mails the Digital Workshop sends once a page has been changed. However, neither groups see themselves working together online in the Digital Workshop. And both groups note that the Digital Workshop isn't fast enough. Group 5 doesn't believe that the Digital Workshop make their work easier. They complain about technical problems. The editor is not supported by their internet browser of choice. And two members of this group uploaded their individual changes at the same time. As a result, both uploads were lost. This is why the members of group 5 make all their work outside the Digital Workshop and this is why they view the Digital Workshop as an obstacle.

The students also used other media to communicate within the R&D 1 project. All groups used e-mail for a variety of reasons. They used it to send files to each other that couldn't be made in the Digital Workshop. They used it to evaluate work, though this was also done in the Digital Workshop. One member of group 13 mentions that small evaluations are done in the Digital Workshop while big evaluations are done through e-mail. E-mail is also used to make appointments. Group 5 is the only group that uses Skype and MSN messenger to communicate. Group 5 also is the group that uses the least face-to-face communication. Depending on how much work must be done, they meet between

maybe once a month and multiple times per week. Group 2 meets face-to-face at least once every two weeks. Group 13 meets at least once a week and they also meet in between classes. There is a great difference in how often these groups meet face-to-face. As a result, group 5 uses more digital media but this doesn't seem to affect the use of the Digital Workshop.

While interview 1 tried to reveal how the groups used the Digital Workshop and what other media the groups used to communicate interview 2 tried to gather information about the collaborative learning in the Digital Workshop and the R&D 1 course. The sharing and discussing of viewpoints is central to collaborative learning. This can be accomplished by the answering of questions, working on a solution together or by resolving conflicts. It is important that students are aware of each other's work and that they understand what the others do.

Students should evaluate all additions to the project in the Digital Workshop if they want to fully understand the work of their colleagues. Though many additions are evaluated, not all are. The members of group 2 indicated that they were most interested in changes to their own work. The members of group 13 only look at the larger additions. If the members find something in these changes that they disagree with they can do two things. They can change it or they can voice their disagreement in a message. Small errors are often fixed immediately. The members of group 13 fix all errors and notify the original author about what they changed and why they changed it in a comment. If the original author disagrees with this edit he can start a discussion in or outside the Digital Workshop. The other groups discuss the changes that need discussion in their group. They do this in meetings. This leads us to the conclusion that the students of all groups take their time to look at the bigger changes in their work. If they disagree with something they discuss it in the group. This should lead to an exchange of viewpoints and subsequently lead collaborative learning.

One obvious way in which the students can share knowledge is by asking questions. One question that was presented to the students was whether they did this and in which media they did this. All group members ask questions if they don't understand something. The members of group 2 and 5 even ask questions to members of other groups. Thus knowledge is also shared between groups. However, the Digital Workshop is never used for this. The questions and analysis of the Digital Workshop lead us to believe that communication between groups was minimal. Apparently this does happen but the Digital Workshop doesn't play a role in this.

Another process in which students from other groups were involved was resolving conflicts for group 5. If there would be within this group, which were often discussed in Skype, and they couldn't come to an agreement themselves they would involve a student from another group to give his opinion. This shows that conflicts don't just result in a sharing of viewpoints within groups but it may also result in the introduction of new viewpoints from outside. Group 2 and 13 don't involve members from other groups in their conflict resolution. Group 2 did not experience any serious conflicts. Work was planned in advance and the only problems encountered in these preparations were that certain members didn't understand everything. Carefully explaining this member what the viewpoints were of the other members helped solve this problem. Group 13 experienced similar issues. One group member didn't understand a fundamental principle. This led to several disagreements. They resolved this by carefully explaining each other their understanding of this principle. This resolved the issue. All examples show that conflict does indeed lead to an exchange of viewpoints and the sharing of knowledge. One group even involves external members to resolve their internal conflicts.

However, the Digital Workshop doesn't play a role in this communication. This is almost always done trough synchronous media like face-to-face communication or Skype.

Another way in which students can share knowledge is internalization. This means that students learn something by looking at the solutions of other students. As mentioned above, most students learned how to program text in the editor of the Digital Workshop by looking at the solutions of other students. However, this is the only internalization that occurred according to the students. Internally all knowledge was shared verbally (or trough text). Group 2 mentioned that their task division meant that the work of each individual member differed to much from each other. This is worrying, since this would mean that the task division of group 2 disrupted the collaboration in the group. Previous chapters mentioned that an extensive task division can disrupt collaborative learning. The other groups stated that there was no need for internalization since all questions were answered and all work that needed to be discussed was discussed.

The issue with the task division of group 2 brings us to the role task division plays in the collaborative learning of each group. The members of group 2 already mentioned that their task division prevented that internal internalization could happen. Each task was assigned to the member who's skills were most suited for the task. But the members of group 2 believe that every member can complete every task of their project. And the results of the task are discussed in the group. This means that all members should at least understand all the work involved in the project. The members of group 5 and 13 made a task division of their literature study. However, this was purely done to spread the effort. Each study involved the same process. Group 5 also made a to-do list which indicated what had to be done. Each member could choose a task he wanted to perform. But no division was made in advance. Group 13 didn't make any other task divisions. Thus task division shouldn't be an issue for group 5 and group 13.

The results of this interview lead us to believe that the Digital Workshop is primarily used as an online document repository. The project is placed in then Digital Workshop as well as the planning. Comments are made to ask questions, criticize work or inform the original author of changes made to their work. But all large discussions like those needed to resolve conflicts are done in synchronous media. As predicted, somewhat heated discussions require synchronous media. Asynchronous media are simply too slow. Group 5 seems to avoid the Digital Workshop due to technical difficulties. But only group 5 seems to experience these difficulties. Why should be studied. But the behavior of group 5 shows how technical complications can radically change the users opinion and use of software. Fortunately collaborative learning does take place in the Digital Workshop. Plenty of this discussion takes place in the groups and there is even some discussion between groups. But the Digital Workshop could play a larger role in the communication that results in an exchange of viewpoints. One unique characteristic that increases the value of the Digital Workshop is its open nature. The students use this in various ways. This open nature facilitates the external internalization that is crucial in the increase of knowledge about the language used to create text in the Digital Workshop. This becomes even more important due to the lack of good documentation about this language.

External activity logs

It appears that most of the communication of group 2 outside the Digital Workshop was Group Management communication and done through e-mail. Thus much of the communication of group 2

consists of e-mails stating what has to be done or e-mails that either make or confirm an appointment. Two categories of communication that each constitute only 10% of all communication are the meeting category and the publishing of work communication. It isn't surprising that these categories don't occur that often. Meetings take time to plan since all group members must come together in one place. However, much of is discussed in these meetings. They play an important role in the communication of any group. The publishing of work doesn't occur that often since most work is made in the Digital Workshop. Group 2 likely only makes work outside the Digital Workshop that can't be made in the Digital Workshop. The only document that the students have to make which can't be made in the Digital Workshop are the slides for their presentation(s). It is likely that all "publishing of work" communication was made to share the slides for the presentation(s).

The logs of group 5 support the believe that group 5 only communicated in meetings, most done face-to-face but some done over distance trough telephone (to be exact, Skype). However, group 5 made a note in their log that stated that the communication that took place while they were working together online in Google Wave was not documented, since this communication was fluid. This information reveals that all communication of group 5 was fluid, synchronous communication. The other groups used asynchronous media like e-mail. The members of group 5 did not.

It appears that group 13 held quite a lot of face-to-face meetings. They also held several meetings trough e-mail. The second most common type of communication was group management. Again group management plays an important role. The other types of communication also occur. The only type of communication that doesn't occur are replies. This seems strange, since the students have to answer messages to communicate. It is likely that no communication was categorized as reply since most replies also fit another category. And it is hard to distinguish replies from messages in fluid communication like face-to-face conversations. This brings us to another observation. Most of the communication outside the Digital Workshop was done face-to-face. This means that the members of group 13 had little trouble meeting face-to-face. And, as discussed in the previous chapters, face-to-face communication is the most rich and preferred medium for communication. Given that the members of group 13 had little trouble meeting face-to-face it isn't surprising that most communication was face-to-face communication. The interviews will have to confirm whether group 13 did indeed have little trouble meeting face-to-face.

Group 2 and group 13 both used e-mail and face-to-face communication to communicate. They both show a variety of types of communication, though group 13 held significantly more meetings than group 2. Group 5 had difficulty with keeping their log. The only type of communication they managed to log where their meetings. These happened face-to-face, like most meetings. Some meetings were held using the telephone. (Skype allows its users to make telephone calls on a computer.) They state that most other communication happened trough Google Wave while they were working together online. This process was to fluid to document in the logs. Whether this is true remains the question. The only conclusion we can make is that all of group 5's communication was fluid and synchronous while group 2 and 13 also used e-mail.

Future Research

During this research, the activity inside the Digital Workshop was observed directly. But all information about the activity of the groups outside the Digital Workshop relied upon the interpretation of the students. The logs that the students kept supplied some more accurate

information. But these were not extensive enough to remove the need for the information supplied by the interviews. A future research could consist of directly monitoring all communication of one group. Such research would be very intrusive and time consuming. These are the reasons why this research did not include such a study. But if such a research proves possible, it could help give a more accurate and extensive insight in the communication of one group of students. Then all collaborative learning in the Research & Development 1 course can be observed. Such a research will be about the entire course and not just the role of the Digital Workshop in the course.

The Research & Development 1 course is not the only course that uses the Digital Workshop. Other courses use the Digital Workshop as well. These courses may have a different setup. This could affect the role of the Digital Workshop in these courses and it could affect the way the Digital Workshop is used. A research that compares the use of the Digital Workshop is multiple courses may reveal more information about the role of the Digital Workshop than this research does. This research reveals that certain groups exist in more than one course that uses the Digital Workshop. This means that it would be possible to follow one group in two or more different courses. This would negate the differences caused by the differences in group composition which, as this research reveals, are significant. Such a research could give new insights into potential uses of and potential faults in the Digital Workshop.

This research suggests three possible additions or changes to the Digital Workshop. It also suggests that certain errors should be fixed. Future researches could look into the effect of these changes. Fixing the errors should help assure that all groups are willing to use the Digital Workshop. Changing the editing window into a WYSIWYG environment should result in more documents that are created in the Digital Workshop. The effects of these changes will not change the role the Digital Workshop plays in the collaborative learning of the students. But the additions suggested that should help make communication more fluid will likely effect the role of Digital Workshop in the collaborative learning of the students. It should change the way students communicate in the Digital Workshop and help trigger more discussions in the Digital Workshop. If these suggestions are implemented, future research could look at whether these predicted changes do actually occur.

Conclusion

Comparison to other Computer Supported Collaborative learning Environments

The Digital Workshop is different from most other CSCL environments discussed in literature in two ways. Both ways have little to do with the technical characteristics of the Digital Workshop. It is the way that the technical workshop is used in the course(s) that makes it different from other CSCL environments. The user accounts in the Digital Workshop have extensive access rights. They can view all work of the other groups that take part in the course. This enables the students to collaborate with students from other groups. However, each project has a different subject. Thus students will likely have to little knowledge of the other group's subject to make significant contributions. That is why little communication between groups within the Digital Workshop was expected. The extensive access rights also enables internalization between groups. Students can look at the work of other groups and observe how other groups solve a problem. It was expected that this form of learning would indeed occur.

The other way in which the Digital Workshop is different from the existing CSCL environments is that it is used in a course given in conventional classrooms. Almost all CSCLs discussed in the literature were used in digital classrooms. The students could only communicate digitally. But in the R&D 1 course the students can also communicate face-to-face. This means that the students do not rely on the Digital Workshop for their communication. Since face-to-face communication is the preferred communication, it was expected that less communication would take place in the Digital Workshop. It also means that one user account can be used by multiple group members at the same time. This means that the edit's made by a user account are a less accurate measure.

The functionality that is central to the Digital Workshop is the editing window. The editing window functions as a text editor. It is used to add content to the pages in the Digital Workshop. This content can be part of the result of the project or communication about the project. This shows that the primary use of the Digital Workshop is that of an online document repository. Communicating has to be done using the same functionality. As a CSCL environment, the Digital Workshop focuses on document creation. It offers little functionality purpose build for communication.

Expected value of the Digital Workshop

The main function of the Digital Workshop is that of an online document repository. The students can place their work in one location that is accessible for all other students through the internet. This helps make group work easier since all students can view and change the project work in one location. Since the students must place their work in the Digital Workshop this value will be realized in the R&D 1 course. The Digital Workshop supports communication in two ways. Each page has an additional discussion page. And there is a text field specially designed for comments that can be placed on a page. The discussion pages will add little value since the comments can also be placed on the main page. And students likely will not separate their discussion from the content on the main page since most work in the Digital Workshop is work in progress. The comments will be used because it allows students to place remarks right next to the content where these remarks are about. But this functionality supports an asynchronous form of communication. And proper discussions require synchronous media since discussions are a fluid form of communication. The Digital Workshop will only support communication in a limited way. Thus the role of the Digital Workshop in the exchange of viewpoints between the students will be limited.

But the value of the Digital Workshop is not only determine by the Digital Workshop's technical characteristics. The setup of the course will also have an influence on the use of the Digital Workshop. The assignment states that the students must make a planning in the Digital Workshop. And the students must prepare their second presentation in the Digital Workshop. It is expected that both the planning and the preparation of the second presentation will help stimulate discussion and communication, in and outside the Digital Workshop.

The use of the Digital Workshop

Two of the groups created their work in the Digital Workshop. One group placed their work in the Digital Workshop after they had created their work in another text editor. They did this because they experienced several technical difficulties with the Digital Workshop. Only one group used the discussion pages. But they used these to create their planning. Thus no group used the discussion pages as intended. All groups created a planning in the Digital Workshop. Only one group actually prepared their second presentation in the Digital Workshop.

Most of the work in the Digital Workshop could not be classified as communication. Around 18% of the categories assigned where communication categories. This means that the primary function of the Digital Workshop is indeed that of an online document repository and text editor. Not all documents are created and placed in the Digital Workshop. The Digital Workshop only supports text based documents and the groups created different types of documents. Communication does occur in the Digital Workshop. Most of the communication in the Digital Workshop was Task Work communication and Group Management. The plannings of the groups were responsible for most of the Group Work communication. Thus this part of the assignment helped stimulate communication in the Digital Workshop. Task Work communication was scattered across various pages. This consisted out of comments made on the work of another group member. The group that did not create their documents in the Digital Workshop had the least Task Work communication. The only group that prepared their second presentation in the Digital Workshop actually held a discussion on this page, consisting from a series of comments. This is the only discussion that took place in the Digital Workshop.

The students also asked questions in the Digital Workshop. It is difficult to determine how many were answered, but the students themselves seem to believe that almost all questions were indeed answered. Some were answered in the Digital Workshop. The other categories of comments did not occur in the Digital Workshop.

There was only one incidental occurrence of communication between groups in the Digital Workshop. Thus communication between different groups in the Digital Workshop does not occur. However, communication with other groups does occur outside the Digital Workshop.

Most of the observed behavior matches the expectations. The only surprise was that no technical comments or questions were made in the Digital Workshop. The interviews revealed that technical issues were overcome by looking at the solutions of other students in their own or other groups. This shows that internalization played a major role in overcoming the difficulties related to working with the Digital Workshop. No other forms of internalization were found. One other surprise was that one group did use the discussion pages. But since they used the discussion pages to hold their planning, no group used the discussion pages as intended.

Educational value of the Digital Workshop

Collaborative learning did occur while the students were working on their R&D 1 project. The students discussed their approach, resolved internal conflicts and helped fellow group members who did not understand something. This means that the students did exchange viewpoints. The students learned new things from each other. The clearest indicator for this is that students explained solutions other students did not understand. But the other forms in which viewpoints are exchanged are also indicators for collaborative learning. Not all collaborative learning occurred in the Digital Workshop. All groups held frequent face-to-face meetings. And all groups used e-mail to communicate. Most discussions and conflicts occurred face-to-face. This indicates that synchronous media are needed to facilitate discussions. The best exchange of viewpoints occurs in fluid communication.

The mandatory planning and mandatory preparation of the second presentation both result in additional communication in the Digital Workshop that lead to collaborative learning. This shows actively designing assignments to stimulate discussion does indeed help.

The nature of discussions also explains why the Digital Workshop plays a limited role in the communication and collaborative learning of the students. The Digital Workshop does not support the fluid communication that is needed for a good exchange of viewpoints. The type of collaborative learning in which the Digital Workshop plays its most significant role is internalization. This shows that the open nature of the Digital Workshop has benefits. The interviews reveal that the students do not believe that the possible disadvantage of this open nature, copying the work of other students, does occur. Thus the Digital Workshop does play significant positive role in the collaborative learning of the students. It should also be noted that two groups did not use any alternative collaboration software. The Digital Workshop does succeed as an online document repository and text editor, though not without criticism. The only group that does not use the Digital Workshop as a text editor is the group that experienced unique technical difficulties.

Suggestions for improvement

Two other aspects of the Digital Workshop are criticized. Good documentation is lacking, and the students all show a preference for a WYSIWYG interface for the text editor. Improving both aspects should make document creation in the Digital Workshop easier. It will improve the Digital Workshop as a text editor.

But these improvements do not help increase the role the Digital Workshop can play in the communication of the students. One improvement is the integration of a synchronous media. This could be done in the form of a simple chat box. This way students can hold fluid discussions in the Digital Workshop. However, one can question what the objection is against using an existing chat box like MSN next to the Digital Workshop. A smaller improvement that may help communication in the Digital Workshop is the addition of a list below each page that shows which users are reading that page at the moment. This way users know who is currently active and they can content this user if they want to work together with him. Such a list could be made per page, but also for all the pages of one group. As long as it is always visible.

The course could also play a bigger role in the collaborative learning of the students. All observed discussions occurred spontaneously. But the assignment could also require that the students discuss their work in the Digital Workshop. If this does not increase the number of this discussions, it would at least help make discussions visible to the teachers. Currently, the teachers choose to help the students in face-to-face discussions. This way teachers can actively participate in the reflection of the students on the evaluation they just received. But the teachers do not use the Digital Workshop. It might be an improvement if the teachers actively try to trigger discussions in the Digital Workshop.

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Attachment

Daan Pijper
12-07-2010

Contents

Activity in the Digital Workshop

Documentation of the activity in the Digital Workshop

The activity in the Digital Workshop is logged on the history page of the Digital Workshop. For each change made, 2.a version is created. Versions can be compared In this analysis these different versions will be analyzed. For each version the date and (ammonized) author will be listed. Furthermore each change made will be classified with 2.a communication type and 2.a type of functionality that was used.

The communication types are:

- Additions
    - Content addition
    - Structural addition
    - Content adjustment
    - Structural adjustment
    - Correction
    - Delete
- Communication
    - Interpersonal communication
    - To-do
    - Schedule
    - Comment
    - Question
    - Tutor comment
    - Reply
    - Technical question
    - Technical comment

The types of functionality, gathered from the use case diagram, are:

- Editing Window
- Editing Window –add an image
- Editing Window- add an special object
- Rename a page

The additions to the Digital Workshop will be listed in 2.a table. Tables will be listed per group. Each page will have its own table. Each list will start on the main page. If 2.a page is accessible from another page, that other page will be listed as (x ->) where x is the page name.

Group 2

Main Page

Date	Author	Communication Type	Functionality Used
30-03-2010 9:29	2.a	Correction	Editing Window
29-03-2010 21:21	2.a	Content Addition, Structural Addition	Editing Window
25-02-2010 9:23	2.b	Content Addition	Editing Window
22-02-2010 22:49	2.a	Structural Addition, Content Addition	Editing Window, Editing Window- add an image

Fase 1 (Main Page ->)

Date	Author	Communication Type	Functionality Used
24-03-2010 19:55	2.a	Contend Addition	Editing Window
04-05-2010 20:27	2.c	Content Addition	Editing Window – add a special object

Overleg of Fase 1 (Fase 1->)

Date	Author	Communication Type	Functionality Used
17-05-2010 17:44	2.a	Comment	Editing Window
04-05-2010 20:06	2.c	Delete	Editing Window
04-05-2010 20:05	2.c	To-Do	Editing Window
20-04-2010 10:27	2.b	Structural Addition, To-Do, Schedule	Editing Window
30-03-2010 09:24	2.c	Structural Addition, To-Do	Editing Window
24-03-2010 20:40	2.a	Correction	Editing Window
24-03-2010 20:39	2.a	Structural Addition	Editing Window

Presentatie (Fase 1 ->)

Date	Author	Communication Type	Functionality Used
02-06-2010 10:46	2.b	Correction	Editing Window
02-06-2010 10:40	2.b	Structural Addition, Content Addition	Editing Window, Editing Window – add a special object
02-06-2010 10:26	2.b	Question, Correction	Editing Window
02-06-2010 10:25	2.b	Delete, Question	Editing Window
02-06-2010 10:23	2.b	Content Addition	Editing Window
02-06-2010 10:17	2.b	Content Addition	Editing Window
02-06-2010 9:56	2.b	Comment	Editing Window
02-06-2010 9:17	2.b	Content Addition	Editing Window
02-06-2010 8:59	2.b	Correction, Content Adjustment	Editing Window
02-06-2010 8:51	2.a	Content Addition	Editing Window

02-06-2010 8:46	2.a	Content Adjustment, Delete	Editing Window
01-06-2010 19:43	2.a	Reply	Editing Window
01-06-2010 19:28	2.c	Question	Editing Window
01-06-2010 19:17	2.b	Content Addition	Editing Window
01-06-2010 19:09	2.b	Correction	Editing Window
01-06-2010 19:08	2.b	Delete, Content Addition	Editing Window
01-06-2010 19:05	2.b	Content Addition	Editing Window
01-06-2010 18:32	2.b	Content Addition	Editing Window
01-06-2010 18:01	2.b	Content Addition, Structural Addition	Editing Window
01-06-2010 17:53	2.a	Reply, Content Adjustment	Editing Window
01-06-2010 17:45	2.a	Reply	Editing Window
01-06-2010 17:36	2.b	Correction	Editing Window
01-06-2010 17:36	2.b	Question	Editing Window
01-06-2010 16:36	2.b	Content Addition, Structural Addition	Editing Window
01-06-2010 15:56	2.b	Structural Addition	Editing Window

Pilot (Main Page ->)

Date	Author	Communication Type	Functionality Used
09-03-2010 20:12	2.a	Interpersonal Communication	Editing Window
01-03-2010 22:32	2.a	Correction	Editing Window
01-03-2010 22:31	2.a	To-do, Comment	Editing Window
01-03-2010 22:08	2.c	Structural Addition	Editing Window
01-03-2010 21:51	2.c	Comment	Editing Window
01-03-2010 20:59	2.a	Comment	Editing Window
01-03-2010 20:56	2.b	Correction	Editing Window
01-03-2010 20:55	2.b	Comment	Editing Window
01-03-2010 20:54	2.b	Correction	Editing Window
01-03-2010 20:47	2.b	Comment	Editing Window
01-03-2010 20:37	2.b	Content Addition	Editing Window, Editing Window – add a special object
01-03-2010 20:35	2.a	Correction, Content Adjustment	Editing Window
01-03-2010 20:23	2.a	Reply	Editing Window
01-03-2010 20:26	2.b	Comment	Editing Window
01-03-2010 20:05	2.b	Comment	Editing Window
01-03-2010 00:14	2.a	Correction	Editing Window
01-03-2010 00:14	2.a	Comment	Editing Window
01-03-2010 00:03	2.a	Structural Addition	Editing Window
25-02-2010 09:00	2.b	Structural Addition	Editing Window

Overleg of Pilot (Pilot->)

Date	Author	Communication Type	Functionality Used
24-03-2010 20:30	2.a	Correction	Editing Window
25-02-2010 09:21	2.b	Structural Addition, To-Do	Editing Window

Onderzoek van Patrick (Pilot ->)

Date	Author	Communication Type	Functionality Used
29-03-2010 20:25	2.a	Correction	Editing Window
29-03-2010 20:25	2.a	Correction	Editing Window
29-03-2010 20:19	2.a	Structural Adjustment	Editing Window, Editing Window – add a special object
29-03-2010 20:17	2.a	Correction	Editing Window
29-03-2010 18:47	2.a	Delete	Editing Window
29-03-2010 18:45	2.a	Content Addition	Editing Window
29-03-2010 17:32	2.a	Correction	Editing Window
29-03-2010 17:24	2.a	Correction	Editing Window
29-03-2010 17:15	2.a	Content Addition	Editing Window
24-03-2010 20:17	2.a	Correction	Editing Window
24-03-2010 20:13	2.a	Content Addition	Editing Window, Editing Window - add an image
24-03-2010 15:18	2.b	Correction	Editing Window
24-03-2010 00:30	2.a	Content Addition	Editing Window
24-03-2010 00:26	2.a	Content Adjustment	Editing Window
24-03-2010 00:25	2.a	Content Addition	Editing Window
24-03-2010 00:19	2.a	Content Addition	Editing Window
23-03-2010 23:56	2.a	Delete	Editing Window
23-03-2010 23:56	2.a	Content Addition	Editing Window
23-03-2010 19:22	2.b	Correction	Editing Window
22-03-2010 22:29	2.a	To-Do, Structural Addition	Editing Window
20-03-2010 16:26	2.a	Correction	Editing Window
20-03-2010 15:57	2.a	Structural Addition	Editing Window
20-03-2010 15:54	2.a	Structural Addition	Editing Window
20-03-2010 15:49	2.a	Structural Addition, Content Addition	Editing Window
19-03-2010 22:53	2.a	Content Addition	Editing Window
19-03-2010 22:39	2.a	Structural Addition	Editing Window
19-03-2010 22:25	2.a	Structural Addition, Content Addition	Editing Window
19-03-2010 22:18	2.a	Content Addition	Editing Window
19-03-2010 22:04	2.a	Content Addition	Editing Window
19-03-2010 22:01	2.a	Content Addition	Editing Window
19-03-2010 21:57	2.a	Structural Addition	Editing Window
19-03-2010 21:55	2.a	Correction, Content Addition	Editing Window
19-03-2010 21:50	2.a	Structural Addition	Editing Window
19-03-2010 21:46	2.a	Correction, Content Addition	Editing Window
19-03-2010 21:42	2.a	Structural Adjustment	Editing Window
19-03-2010 21:41	2.a	Structural Addition	Editing Window
19-03-2010 21:22	2.a	Correction	Editing Window
19-03-2010 21:21	2.a	Content Addition, Structural Addition	Editing Window

Opzet Onderzoek (Pilot ->)

Date	Author	Communication Type	Functionality Used
23-03-2010 19:48	2.b	Content Adjustment	Editing Window
23-03-2010 19:45	2.b	Content Adjustment, Content Addition	Editing Window

23-03-2010 19:40	2.b	Content Adjustment	Editing Window
17-03-2010 20:04	2.b	Content Addition, Structural Addition	Editing Window

Verslag (Pilot ->)

Date	Author	Communication Type	Functionality Used
29-03-2010 20:13	2.a	Correction	Editing Window
24-03-2010 15:29	2.b	Content Addition	Editing Window
24-03-2010 15:26	2.b	Strucutral Addition, Content Addition	Editing Window
24-03-2010 15:16	2.b	Structural Addition	Editing Window
24-03-2010 15:11	2.b	Correction	Editing Window
24-03-2010 15:10	2.b	Nothing changed	
24-03-2010 15:05	2.b	Content Addition	Editing Window
24-03-2010 14:54	2.b	Structural Addition, Content Addition	Editing Window
24-03-2010 14:32	2.b	Structural Addition	Editing Window

Planning (Main Page ->)

Date	Author	Communication Type	Functionality Used
24-03-2010 20:42	2.a	Delete	Editing Window
24-03-2010 20:37	2.a	Structural Addition, Content Addition	Editing Window – add a special object
24-03-2010 20:28	2.a	Structural Addition, Content Addition	Editing Window – add a special object
24-03-2010 20:25	2.a	Correction	Editing Window
01-03-2010 00:21	2.a	Structural Addition, Content Addition	Editing Window – add a special object
22-02-2010 23:04	2.a	Structural Addition	Editing Window – add a special object
22-02-2010 22:57	2.a	Structural Addition	Editing Window

Group 5

Main Page

Date	Author	Communication Type	Functionality Used
01-06-2010 19:09	5.b	Content Addition	Editing Window
10-03-2010 13:43	5.b	Correction	Editing Window – add a special object
10-03-2010 05:53	5.b	Structural Addition, Content Addition	Editing Window – add a special object
22-02-2010 23:17	2.a	Structural Adjustment	Rename a Page
08-02-2010 10:57	5.a	Content Addition	Editing Window
03-02-2010 16:37	tutor	Correction	Editing Window
03-02-2010 16:12	d	Structural Adjustment	Rename a Page
03-02-2010 16:05	5.a	Structural Adjustment	Editing Window

Overleg of Main Page (Main Page->)

Date	Author	Communication Type	Functionality Used
22-02-2010 23:17	2.a	Structural Adjustment	Rename a Page
03-02-2010 17:46	5.b	Delete	Editing Window
03-02-2010 16:16	d	Correction	Editing Window
03-02-2010 16:15	d	Comment, Structural Addition	Editing Window

Fase 1 (Main Page->)

Date	Author	Communication Type	Functionality Used
02-06-2010 12:26	5.a	Delete	Editing Window
01-06-2010 19:22	5.b	To-Do	Editing Window
01-06-2010 19:16	5.b	Content Adjustment, Content Addition	Editing Window
01-06-2010 10:19	5.c	To-Do, Reply	Editing Window
01-06-2010 07:55	5.c	Question, To-Do	Editing Window
01-06-2010 07:28	5.c	Question, To-Do, Reply	Editing Window
01-06-2010 07:17	5.c	Question, To-Do	Editing Window
01-06-2010 07:05	5.c	Question	Editing Window
01-06-2010 06:48	5.a	Reply, Content Addition, Correction	Editing Window
31-05-2010 21:40	5.b	Structural Addition, To-Do, Comment	Editing Window
17-05-2010 18:59	5.c	Content Addition	Editing Window – add a special object
15-05-2010 17:18	5.a	Content Adjustment	Editing Window
11-05-2010 18:57	5.a	Content Adjustment, Content Addition	Editing Window
11-05-2010 18:51	5.a	Content Adjustment	Editing Window
11-05-2010 18:41	5.a	Content Addition, Structural Addition	Editing Window – add a special object
11-05-2010 18:20	5.a	Structural Addition, Content Addition	Editing Window
11-05-2010 18:09	5.a	Structural Addition	Editing Window

Pilot (Main Page->)

Date	Author	Communication Type	Functionality Used
19-03-2010 14:36	5.a	Structural Addition, Content Addition	Editing Window – add a special object
10-03-2010 10:20	5.a	Correction	Editing Window
10-03-2010 10:19	5.a	Structural Adjustment, Structural Addition	Editing Window
09-03-2010 22:57	5.a	Structural Addition	Editing Window
09-03-2010 22:57	5.a	Content Addition, Structural Addition	Editing Window
09-03-2010 22:29	5.a	Content Addition, Structural Addition	Editing Window
09-03-2010 22:17	5.a	Correction	Editing Window
09-03-2010 22:16	5.a	Content Addition, Structural Addition	Editing Window

Verslag (Pilot->)

Date	Author	Communication Type	Functionality Used
02-04-2010 15:55	5.a	Delete	Editing Window
02-04-2010 15:54	5.a	Structural Addition, Content Addition	Editing Window
02-04-2010 15:16	5.a	Structural Addition, Content Addition	Editing Window

02-04-2010 15:11	5.a	Correction	Editing Window
02-04-2010 15:09	5.a	Structural Addition	Editing Window
02-04-2010 15:02	5.b	Correction, Content Addition, Structural Adjustment, To-Do	Editing Window
02-04-2010 14:48	5.b	Delete, Content Addition, Structural Addition, To-Do	Editing Window
02-04-2010 14:34	5.a	Structural Addition	Editing Window
02-04-2010 14:33	5.a	Structural Addition	Editing Window
02-04-2010 14:31	5.a	Correction	Editing Window
02-04-2010 14:30	5.a	Structural Addition	Editing Window
02-04-2010 14:28	5.c	Delete, Reply, Content Addition	Editing Window
02-04-2010 14:27	5.c	Delete	Editing Window
02-04-2010 14:24	5.a	Structural Addition	Editing Window
02-04-2010 14:22	5.a	Structural Addition	Editing Window
02-04-2010 14:21	5.a	Structural Addition	Editing Window
02-04-2010 14:20	5.b	Correction	Editing Window
02-04-2010 14:17	5.b	Content Adjustment	Editing Window
02-04-2010 14:16	5.a	Structural Adjustment	Editing Window
02-04-2010 13:59	5.a	Correction	Editing Window
02-04-2010 13:56	5.a	Structural Addition, To-Do	Editing Window
02-04-2010 13:52	5.c	Question	Editing Window
02-04-2010 13:51	5.c	Delete, Content Addition	Editing Window
02-04-2010 13:49	5.a	Structural Addition	Editing Window
02-04-2010 13:44	5.c	To-Do	Editing Window
02-04-2010 13:42	5.a	Structural Adjustment	Editing Window
02-04-2010 13:42	5.a	Structural Adjustment	Editing Window
02-04-2010 13:41	5.c	Delete	Editing Window
02-04-2010 13:39	5.a	Content Addition	Editing Window
02-04-2010 13:38	5.a	Structural Adjustment	Editing Window
02-04-2010 13:37	5.a	Correction	Editing Window
02-04-2010 13:37	5.b	Content Addition	Editing Window
02-04-2010 13:33	5.b	Delete, Content Addition	Editing Window
02-04-2010 13:32	5.c	Delete	Editing Window
02-04-2010 13:32	5.c	Delete	Editing Window
02-04-2010 13:32	5.c	Delete	Editing Window
02-04-2010 13:30	5.c	Delete	Editing Window
02-04-2010 13:29	5.c	Delete	Editing Window
02-04-2010 13:28	5.c	Delete	Editing Window
02-04-2010 13:27	5.a	Correction, Content Adjustment	Editing Window
02-04-2010 13:27	5.c	Structural Addition	Editing Window
02-04-2010 13:26	5.c	Delete, Structural Addition	Editing Window
02-04-2010 13:18	5.c	Content Adjustment	Editing Window
02-04-2010 13:15	5.a	Content Addition	Editing Window
02-04-2010 13:09	5.b	Correction	Editing Window
02-04-2010 13:00	5.b	To-Do	Editing Window
02-04-2010 12:51	5.b	Correction	Editing Window
02-04-2010 12:47	5.a	Content Adjustment	Editing Window
02-04-2010 12:28	5.b	Content Addition, Structural Addition, To-Do	Editing Window

Opbouw (Verslag->)

Date	Author	Communication Type	Functionality Used
26-03-2010 21:38	5.b	Structural Addition, To-Do	Editing Window

Planning (Main Page->)

Date	Author	Communication Type	Functionality Used
14-05-2010 14:12	5.b	Schedule, Structural Adjustment	Editing Window
14-05-2010 11:30	5.b	Correction	Editing Window
13-05-2010 15:50	5.a	Correction	Editing Window
13-05-2010 15:35	5.b	Schedule, Structural Adjustment	Editing Window
13-05-2010 15:33	5.b	Schedule, Structural Adjustment	Editing Window
13-05-2010 15:29	5.b	Correction	Editing Window
13-05-2010 15:26	5.b	Schedule, Structural Adjustment	Editing Window
13-05-2010 15:20	5.a	Correction	Editing Window
13-05-2010 15:18	5.a	Structural Adjustment	Editing Window
13-05-2010 15:12	5.a	Schedule, Structural Adjustment	Editing Window
13-05-2010 14:49	5.a	Schedule, Structural Addition, Correction	Editing Window
11-05-2010 15:35	5.b	To-Do	Editing Window
22-04-2010 12:01	5.a	Schedule, Structural Addition	Editing Window
02-04-2010 10:34	5.b	To-Do, Structural Adjustment	Editing Window
19-03-2010 13:28	5.c	Correction	Editing Window
19-03-2010 13:27	5.c	Correction	Editing Window
19-03-2010 13:25	5.c	Schedule	Editing Window
19-03-2010 13:24	5.c	Correction	Editing Window
19-03-2010 13:24	5.c	Correction	Editing Window
19-03-2010 13:23	5.c	Correction	Editing Window
19-03-2010 12:24	5.c	Schedule, Structural Addition	Editing Window
09-03-2010 16:24	5.a	To-Do, Schedule, Delete, Structural Adjustment	Editing Window
09-03-2010 12:21	5.a	Schedule, Structural Addition	Editing Window
02-03-2010 09:04	5.b	Schedule	Editing Window – add a special object

Groep 13

Main Page

Date	Author	Communication Type	Functionality Used
03-03-2010 15:36	13.b	Delete	Editing Window
03-03-2010 15:36	13.b	Structural Addition	Editing Window
03-03-2010 15:24	13.b	Delete	Editing Window
03-03-2010 15:23	13.b	Structural Adjustment	Editing Window
03-03-2010 15:20	13.b	Structural Adjustment	Editing Window
03-03-2010 15:19	13.b	Structural Addition	Editing Window
03-03-2010 14:56	13.a	Structural Addition	Editing Window
10-02-2010 12:04	13.b	Structural Adjustment	Editing Window
09-02-2010 11:04	13.b	Structural Adjustment	Editing Window

09-02-2010 09:29	13.b	Structural Addition	Editing Window

Informatie (Main Page->)

Date	Author	Communication Type	Functionality Used
03-03-2010 16:28	13.a	Structural Adjustment	Rename a Page
03-03-2010 15:27	13.b	Structural Adjustment	Editing Window
03-03-2010 15:26	13.b	Structural Addition	Editing Window
03-03-2010 15:25	13.b	Delete	Editing Window
03-03-2010 15:23	13.b	Structural Addition	Editing Window
01-03-2010 21:21	13.c	Structural Addition	Editing Window
01-03-2010 20:51	13.a	Structural Addition, Content Addition	Editing Window

ESMTP (Informatie->)

Date	Author	Communication Type	Functionality Used
03-03-2010 16:28	13.a	Structural Adjustment	Rename a Page
03-03-2010 16:10	13.a	Content Addition	Editing Window
03-03-2010 16:07	13.a	Structural Addition, Content Addition	Editing Window
03-03-2010 16:04	13.a	Structural Adjustment	Rename a Page
03-03-2010 15:27	13.b	Structural Addition	Editing Window
03-03-2010 15:26	13.a	Structural Addition	Editing Window

Network Programming (Informatie->)

Date	Author	Communication Type	Functionality Used
10-03-2010 15:11	13.b	Structural Adjustment	Rename a Page
10-03-2010 15:03	13.b	Correction	Editing Window
10-03-2010 15:02	13.b	Delete	Editing Window
10-03-2010 15:02	13.b	Structural Addition, Content Addition, Comment	Editing Window

SMTP-AUTH (Informatie->)

Date	Author	Communication Type	Functionality Used
07-03-2010 00:56	13.c	Content Adjustment	Editing Window
07-03-2010 00:50	13.c	Content Addition, Structural Addition	Editing Window
06-03-2010 21:17	13.c	Content Addition	Editing Window
06-03-2010 20:38	13.c	Correction	Editing Window
06-03-2010 20:37	13.c	Correction	Editing Window
06-03-2010 20:37	13.c	Structural Addition, Content Addition	Editing Window
03-03-2010 16:28	13.a	Structural Adjustment	Rename a Page
03-03-2010 16:15	13.a	Content Addition	Editing Window
03-03-2010 16:14	13.a	Structural Addition, Content Addition	Editing Window
03-03-2010 16:11	13.a	Structural Addition, Content Addition	Editing Window

Pilot (Main Page->)

Date	Author	Communication Type	Functionality Used
03-03-2010 16:26	13.b	Structural Adjustment	Editing Window
03-03-2010 16:26	13.b	Structural Addition	Editing Window

Verslag (Pilot->)

Date	Author	Communication Type	Functionality Used
02-04-2010 18:25	13.b	Structural Adjustment	Rename a Page
02-04-2010 18:23	13.b	Correction	Editing Window
02-04-2010 18:22	13.b	Structural Addition	Editing Window
02-04-2010 18:21	13.b	Structural Addition, Content Addition	Editing Window
02-04-2010 18:19	13.b	Correction	Editing Window
02-04-2010 18:18	13.b	Structural Addition	Editing Window
02-04-2010 18:18	13.b	Structural Addition	Editing Window
02-04-2010 18:16	13.b	Structural Adjustment	Editing Window
02-04-2010 18:14	13.b	Structural Addition, Content Addition	Editing Window
02-04-2010 18:12	13.b	Structural Addition, Content Addition	Editing Window
02-04-2010 18:11	13.b	Structural Addition, Content Addition	Editing Window
24-03-2010 10:03	13.b	Structural Addition	Editing Window
23-03-2010 14:09	13.c	Structural Addition, Content Addition	Editing Window

Planning (Main Page->)

Date	Author	Communication Type	Functionality Used
24-04-2010 07:56	13.b	Structural Addition, Schedule	Editing Window
09-03-2010 12:33	13.b	Correction	Editing Window
03-03-2010 15:19	13.a	Structural Addition	Editing Window
03-03-2010 15:17	13.a	Schedule	Editing Window
03-03-2010 15:05	13.a	Schedule	Editing Window
01-03-2010 20:58	13.a	Structural Addition, To-Do	Editing Window

Presentatie2 (Main Page->)

Date	Author	Communication Type	Functionality Used
31-05-2010 18:08	13.b	Correction	Editing Window
31-05-2010 18:08	13.b	Structural Addition	Editing Window

Preventie (Main Page->)

Date	Author	Communication Type	Functionality Used
03-03-2010 15:26	13.b	Structural Addition	Editing Window
01-03-2010 21:09	13.a	Structural Addition, Content Addition	Editing Window

Discussie (Preventie->)

Date	Author	Communication Type	Functionality Used
24-03-2010 10:04	13.b	Structural Addition	Editing Window
23-03-2010 14:14	13.a	Structural Addition, Content Addition	Editing Window

Inleiding (Preventie->)

Date	Author	Communication Type	Functionality Used
24-03-2010 10:25	13.c	Structural Addition, Content Addition	Editing Window
24-03-2010 10:04	13.b	Structural Addition	Editing Window
23-03-2010 14:07	13.c	Structural Addition, Content Addition	Editing Window

Onderzoeksresultaten (Preventie->)

Date	Author	Communication Type	Functionality Used
24-03-2010 10:05	13.b	Structural Adjustment	Editing Window
24-03-2010 10:05	13.b	Structural Addition	Editing Window
23-03-2010 14:08	13.c	Structural Addition, Content Addition	Editing Window

Presentatie (Preventie->)

Date	Author	Communication Type	Functionality Used
02-04-2010 08:52	13.b	Structural Adjustment	Editing Window
02-04-2010 08:51	13.b	Structural Adjustment	Editing Window
02-04-2010 08:47	13.b	Structural Adjustment	Editing Window
02-04-2010 08:46	13.b	Structural Addition	Editing Window

Werkplaats (Main Page->)

Date	Author	Communication Type	Functionality Used
03-03-2010 15:59	13.b	Content Adjustment, Comment	Editing Window
03-03-2010 15:57	13.b	Correction	Editing Window
03-03-2010 15:54	13.b	Structural Adjustment, Structural Addition	Editing Window
03-03-2010 14:57	13.a	Structural Adjustment	Rename a Page
01-03-2010 20:56	13.a	Structural Addition	Editing Window
27-02-2010 11:59	13.b	Comment, To-Do	Editing Window
27-02-2010 11:55	13.b	Comment	Editing Window
27-02-2010 11:52	13.b	Content Adjustment	Editing Window
27-02-2010 11:52	13.b	Content Addition	Editing Window
27-02-2010 11:43	13.b	Structural Addition	Editing Window

Inl Verslag (Werkplaats->)

Date	Author	Communication Type	Functionality Used

02-04-2010 07:32	13.b	Delete	Editing Window
02-04-2010 07:32	13.b	Structural Addition, Content Addition, Comment	Editing Window, Editing Window – add a special object

nsSMTP (Werkplaats->)

Date	Author	Communication Type	Functionality Used
19-03-2010 15:39	13.b	Comment	Editing Window
18-03-2010 12:24	13.a	Comment	Editing Window
17-03-2010 15:26	13.c	Correction	Editing Window
17-03-2010 15:25	13.c	Content Addition	Editing Window
17-03-2010 15:11	13.c	Comment	Editing Window
17-03-2010 14:36	13.a	Structural Addition	Editing Window
17-03-2010 14:29	13.a	Content Addition	Editing Window
17-03-2010 14:29	13.b	Reply	Editing Window
17-03-2010 14:27	13.b	Reply	Editing Window
17-03-2010 14:24	13.a	Correction	Editing Window
17-03-2010 14:23	13.a	Question, Content Addition,	Editing Window
16-03-2010 14:44	13.b	Correction	Editing Window
16-03-2010 14:43	13.b	Structural Addition	Editing Window
16-03-2010 14:42	13.b	Structural Addition, Content Addition, Comment	Editing Window

Protocol (Werkplaats->)

Date	Author	Communication Type	Functionality Used
25-03-2010 21:59	13.a	Correction, Content Addition	Editing Window
25-03-2010 21:55	13.a	Correction, Content Addition, Structural Addition	Editing Window
24-03-2010 11:08	13.b	Structural Addition	Editing Window
23-03-2010 10:20	13.c	Content Addition	Editing Window
23-03-2010 12:49	13.a	Correction	Editing Window
23-03-2010 12:48	13.a	Correction	Editing Window
23-03-2010 12:47	13.a	Content Addition, Structural Addition	Editing Window
22-03-2010 21:12	13.a	Content Addition, Structural Addition	Editing Window, Editing Window – add a special object

Stukje Verslag (Werkplaats->)

Date	Author	Communication Type	Functionality Used
27-03-2010 16:14	13.b	Structural Adjustment	Rename a Page
27-03-2010 09:01	13.b	Comment	Editing Window
27-03-2010 09:00	13.b	Structural Adjustment	Editing Window
27-03-2010 09:00	13.b	Structural Adjustment	Editing Window
27-03-2010 08:59	13.b	Structural Adjustment	Editing Window
27-03-2010 08:59	13.b	Delete	Editing Window

27-03-2010 08:58	13.b	Structural Adjustment	Editing Window
27-03-2010 08:57	13.b	Structural Adjustment	Editing Window
27-03-2010 08:56	13.b	Content Addition, Structural Addition, Question	Editing Window

Stukje Verslag 2 (Werkplaats->)

Date	Author	Communication Type	Functionality Used
28-03-2010 10:52	13.b	Correction	Editing Window
28-03-2010 09:06	13.b	Content Adjustment	Editing Window
28-03-2010 09:06	13.b	Structural Addition	Editing Window
28-03-2010 09:05	13.b	Structural Adjustment	Editing Window
28-03-2010 09:04	13.b	Structural Adjustment, Comment	Editing Window
28-03-2010 09:04	13.b	Content Addition, Structural Addition, Question	

Statistics gathered from the documentation of the activity

All groups

All groups – all pages

Formulas	Percentage	Absolute Number
Edits belonging to group 2	33,90%	119
Edits belonging to group 5	29,91%	105
Edits belonging to group 13	35,04%	123
Communication	18,38%	86
Interpersonal communication	0,21%	1
Group Management	8,55%	40
Task Work communication	9,62%	45
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	2,56%	12
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	83,33%	10
Total number of edits		351
Total number of categories		468
Use of the Editing Window - add an image and Editing Window - add a special object	4,56%	16

All groups – all planning pages

Formulas	Percentage	Absolute Number
Edits belonging to group 2	18,92%	7
Edits belonging to group 5	64,86%	24
Edits belonging to group 13	16,22%	6
Communication	33,93%	19
Interpersonal communication	0,00%	0
Categorized as Group Management	33,93%	19
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		0
Total number of categories		37
Use of the Editing Window - add an image and Editing Window - add a special object	13,51%	56 5

All groups – all discussion pages

Formulas	Percentage	Absolute Number
Edits belonging to group 2	76,92%	10
Edits belonging to group 5	7,69%	1
Edits belonging to group 13	0,00%	0
Communication	38,89%	7

Interpersonal communication	0,00%	0
Categorized as Group Management	27,78%	5
Group Management	11,11%	2
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		13
Total number of categories		18
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

All groups – all presentation 2 pages

Formulas	Percentage	Absolute Number
Edits belonging to group 2	92,59%	25
Edits belonging to group 5	0,00%	0
Edits belonging to group 13	7,41%	2
Communication	22,22%	8
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	22,22%	8
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	11,11%	4
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	75,00%	3
Total number of edits		27
Total number of categories		36
Use of the Editing Window - add an image and Editing Window - add a special object	3,70%	1

Group 2

Group 2 – all pages

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	56,41%	66
Edits belonging to member 2.b	37,61%	44
Edits belonging to member 2.c	5,98%	7
Communication	18,06%	26
Interpersonal communication	0,69%	1
Group Management	4,86%	7
Task Work communication	12,50%	18
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	2,78%	4
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	100,00%	4
Total number of edits		117
Total number of categories		144
Use of the Editing Window - add an image and Editing Window - add a special object	6,84%	8

Group 2 – main page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	75,00%	3
Edits belonging to member 2.b	25,00%	1
Edits belonging to member 2.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0

Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		4
Total number of categories		6
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 2 – fase 1 page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	50,00%	1
Edits belonging to member 2.b	0,00%	0
Edits belonging to member 2.c	50,00%	1
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		2
Total number of categories		2
Use of the Editing Window - add an image and Editing Window - add a special object	50,00%	1

Group 2 – overleg of fase 1

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	42,86%	3
Edits belonging to member 2.b	14,29%	1
Edits belonging to member 2.c	42,86%	3

Communication	50,00%	5
Interpersonal communication	0,00%	0
Categorized as Group Management	40,00%	4
Group Management	10,00%	1
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		7
Total number of categories		10
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 2 – presentatie page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	20,00%	5
Edits belonging to member 2.b	76,00%	19
Edits belonging to member 2.c	4,00%	1
Communication	23,53%	8
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	23,53%	8
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	11,76%	4
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	75,00%	3
Total number of edits		25
Total number of categories		34
Use of the Editing Window - add an image and Editing Window - add a special object	4,00%	1

Group 2 – pilot page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	47,37%	9
Edits belonging to member 2.b	42,11%	8
Edits belonging to member 2.c	10,53%	2
Communication	52,38%	11
Interpersonal communication	4,76%	1
Categorized as Group Management	4,76%	1
Group Management	42,86%	9
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		1
Total number of categories		19
Use of the Editing Window - add an image and Editing Window - add a special object	5,26%	21
		1

Group 2 – overleg of pilot page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	50,00%	1
Edits belonging to member 2.b	50,00%	1
Edits belonging to member 2.c	0,00%	0
Communication	33,33%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	33,33%	1
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		0
Total number of categories		2
		3

Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 2 – onderzoek van 2.a page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	94,74%	36
Edits belonging to member 2.b	5,26%	2
Edits belonging to member 2.c	0,00%	0
Communication	2,27%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	2,27%	1
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		38
Total number of categories		44
Use of the Editing Window - add an image and Editing Window - add a special object	2,63%	1

Group 2 – opzet onderzoek page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	0,00%	0
Edits belonging to member 2.b	100,00%	4
Edits belonging to member 2.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0

How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		4
Total number of categories		6
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	
		0

Verslag page

Formulas	Percentage	Absolute Number
What percentage of edits of one group were made by member 2.a?	11,11%	
		1
What percentage of edits of one group were made by member 2.b?	88,89%	
		8
What percentage of edits of one group were made by member 2.c?	0,00%	
		0
What percentage of the categories found belong to the communication category?	0,00%	
		0
What percentage of the categories found belong to the Interpersonalcommunication category?	0,00%	
		0
What percentage of the categories found belong to the Group Management category?	0,00%	
		0
What percentage of the categories found belong to the Task Work communication category?	0,00%	
		0
What percentage of the categories found belong to the Tool?Media communication category?	0,00%	
		0
How many tutor comments were made?	0,00%	0
How many questions were asked?	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		9
Total number of categories		9
What percentage of all edits were made with the Editing Window - add an image or Editing Window - add a special object functionality?	0,00%	
		0

Planning page

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	100,00%	7

Edits belonging to member 2.b	0,00%	0
Edits belonging to member 2.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		7
Total number of categories		10
Use of the Editing Window - add an image and Editing Window - add a special object	57,14%	4

All discussion (overleg) pages

Formulas	Percentage	Absolute Number
Edits belonging to member 2.a	44,44%	4
Edits belonging to member 2.b	22,22%	2
Edits belonging to member 2.c	33,33%	3
Communication	46,15%	6
Interpersonal communication	0,00%	0
Categorized as Group Management	38,46%	5
Group Management	7,69%	1
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0

How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		9
Total number of categories		13
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 5

Group 5 - All pages

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	45,05%	50
Edits belonging to member 5.b	24,32%	27
Edits belonging to member 5.c	25,23%	28
Communication	23,93%	39
Interpersonal communication	0,00%	0
Group Management	17,18%	28
Task Work communication	9,91%	11
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	3,07%	5
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	80,00%	4
Total number of edits		111
Total number of categories		163
Use of the Editing Window - add an image and Editing Window - add a special object	5,41%	6

Group 5 – main page

Formulas	Percentage	Absolute Number

Edits belonging to member 5.a	25,00%	2
Edits belonging to member 5.b	37,50%	3
Edits belonging to member 5.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		8
Total number of categories		9
Use of the Editing Window - add an image and Editing Window - add a special object	25,00%	2

Group 5 – overleg of main page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	0,00%	0
Edits belonging to member 5.b	25,00%	1
Edits belonging to member 5.c	0,00%	0
Communication	20,00%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	25,00%	1
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0

Total number of edits		4
Total number of categories		5
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 5 – fase 1 page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	47,06%	8
Edits belonging to member 5.b	17,65%	3
Edits belonging to member 5.c	35,29%	6
Communication	46,67%	14
Interpersonal communication	0,00%	0
Categorized as Group Management	20,00%	6
Group Management	47,06%	8
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	13,33%	4
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	75,00%	3
Total number of edits		17
Total number of categories		30
Use of the Editing Window - add an image and Editing Window - add a special object	11,76%	2

Group 5 – pilot page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	100,00%	8
Edits belonging to member 5.b	0,00%	0
Edits belonging to member 5.c	0,00%	0

Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		8
Total number of categories		13
Use of the Editing Window - add an image and Editing Window - add a special object	12,50%	1

Group 5 – verslag page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	48,98%	24
Edits belonging to member 5.b	20,41%	10
Edits belonging to member 5.c	30,61%	15
Communication	12,12%	8
Interpersonal communication	0,00%	0
Categorized as Group Management	9,09%	6
Group Management	4,08%	2
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	1,52%	1
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	100,00%	1
Total number of edits		49
Total number of categories		66

Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 5 – opbouw page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	0,00%	0
Edits belonging to member 5.b	100,00%	1
Edits belonging to member 5.c	0,00%	0
Communication	50,00%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	50,00%	1
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		1
Total number of categories		2
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 5 – planning page

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	33,33%	8
Edits belonging to member 5.b	37,50%	9
Edits belonging to member 5.c	29,17%	7
Communication	39,47%	15
Interpersonal communication	0,00%	0
Group Management	39,47%	15
Task Work communication	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0

Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		24
Total number of categories		38
Use of the Editing Window - add an image and Editing Window - add a special object	4,17%	1

Group 5 – all discussion pages

Formulas	Percentage	Absolute Number
Edits belonging to member 5.a	0,00%	0
Edits belonging to member 5.b	25,00%	1
Edits belonging to member 5.c	0,00%	0
Communication	20,00%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	25,00%	1
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		4
Total number of categories		5
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13

Group 13 – all pages

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	25,20%	31
Edits belonging to member 13.b	62,60%	77
Edits belonging to member 13.c	12,20%	15
Communication	13,04%	21
Interpersonal communication	0,00%	0

Group Management	3,11%	5
Task Work communication	9,94%	16
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	1,86%	3
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	66,67%	2
Total number of edits		123
Total number of categories		161
Use of the Editing Window - add an image and Editing Window - add a special object	1,63%	2

Group 13 – main page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	10,00%	1
Edits belonging to member 13.b	90,00%	9
Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		10
Total number of categories		10
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – informatie page

Formulas	Percentage	Absolute Number

Edits belonging to member 13.a	28,57%	2
Edits belonging to member 13.b	57,14%	4
Edits belonging to member 13.c	14,29%	1
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		7
Total number of categories		8
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – ESMTP page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	83,33%	5
Edits belonging to member 13.b	16,67%	1
Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		6
Total number of categories		7

Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – SMTP-AUTH page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	40,00%	4
Edits belonging to member 13.b	0,00%	0
Edits belonging to member 13.c	60,00%	6
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		10
Total number of categories		14
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 - Pilot page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	92,31%	12
Edits belonging to member 13.c	7,69%	1
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0

Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		13
Total number of categories		18
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 - Planning page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	66,67%	4
Edits belonging to member 13.b	33,33%	2
Edits belonging to member 13.c	0,00%	0
Communication	50,00%	4
Interpersonal communication	0,00%	0
Group Management	50,00%	4
Task Work communication	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		6
Total number of categories		8
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 - Presentatie 2 page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	100,00%	2

Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		2
Total number of categories		2
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Preventie page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	50,00%	1
Edits belonging to member 13.b	50,00%	1
Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		2
Total number of categories		3
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Discussie page

Formulas	Percentage	Absolute Number

Edits belonging to member 13.a	50,00%	1
Edits belonging to member 13.b	50,00%	1
Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		2
Total number of categories		3
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Inleiding page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	33,33%	1
Edits belonging to member 13.c	66,67%	2
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		3
Total number of categories		5
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Onderzoeksresultaten page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	66,67%	2
Edits belonging to member 13.c	33,33%	1
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		0
Total number of categories		3
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	4
		0

Group 13 – Presentatie page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	100,00%	4
Edits belonging to member 13.c	0,00%	0
Communication	0,00%	0
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		0
		4

Total number of categories		4
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Werkplaats page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	20,00%	2
Edits belonging to member 13.b	80,00%	8
Edits belonging to member 13.c	0,00%	0
Communication	30,77%	4
Interpersonal communication	0,00%	0
Categorized as Group Management	7,69%	1
Group Management	23,08%	3
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
Total number of edits		0
Total number of categories		10
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	13
		0

Group 13 - Inl verslag page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	100,00%	2
Edits belonging to member 13.c	0,00%	0
Communication	25,00%	1
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	25,00%	1
Tool/Media communication	0,00%	0

Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	
		0
Total number of edits		2
Total number of categories		4
Use of the Editing Window - add an image and Editing Window - add a special object	50,00%	1

Group 13- nsSMTP page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	35,71%	5
Edits belonging to member 13.b	42,86%	6
Edits belonging to member 13.c	21,43%	3
Communication	41,18%	7
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	41,18%	7
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	5,88%	1
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	200,00%	
		2
Total number of edits		14
Total number of categories		17
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	
		0

Group 13 - Protocol page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	75,00%	
		6
Edits belonging to member 13.b	12,50%	
		1
Edits belonging to member 13.c	12,50%	1
Communication	0,00%	0

Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	0,00%	0
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	0,00%	0
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	#DEEL/0!	0
Total number of edits		8
Total number of categories		13
Use of the Editing Window - add an image and Editing Window - add a special object	12,50%	1

Group 13- Stukje verslag page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	100,00%	9
Edits belonging to member 13.c	0,00%	0
Communication	18,18%	2
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	18,18%	2
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	9,09%	1
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	0,00%	0

Total number of edits		9
Total number of categories		11
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Group 13 – Stukje verslag 2 page

Formulas	Percentage	Absolute Number
Edits belonging to member 13.a	0,00%	0
Edits belonging to member 13.b	100,00%	6
Edits belonging to member 13.c	0,00%	0
Communication	22,22%	2
Interpersonal communication	0,00%	0
Categorized as Group Management	0,00%	0
Group Management	22,22%	2
Tool/Media communication	0,00%	0
Tutor comments	0,00%	0
Questions	11,11%	1
How many potential questions to answers (replies were made)? (*The percentage represents how many replies there are per question/ The absolute number represents the total number of replies)*	0,00%	0
Total number of edits		6
Total number of categories		9
Use of the Editing Window - add an image and Editing Window - add a special object	0,00%	0

Progression of activity

All pages

All groups

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	6
Week 6	8-02-10	14-02-10	4
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	13
Week 9	1-03-10	7-03-10	60
Week 10	8-03-10	14-03-10	17
Week 11	15-03-10	21-03-10	41
Week 12	22-03-10	28-03-10	58

Week 13	29-03-10	4-04-10	80
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	3
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	3
Week 19	10-05-10	16-05-10	18
Week 20	17-05-10	23-05-10	2
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	38

Group 2

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	6
Week 9	1-03-10	7-03-10	18
Week 10	8-03-10	14-03-10	1
Week 11	15-03-10	21-03-10	19
Week 12	22-03-10	28-03-10	30
Week 13	29-03-10	4-04-10	13
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	3
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	1
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	25

Group 5

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	6
Week 6	8-02-10	14-02-10	1
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	2
Week 9	1-03-10	7-03-10	1
Week 10	8-03-10	14-03-10	11
Week 11	15-03-10	21-03-10	8
Week 12	22-03-10	28-03-10	1

Week 13	29-03-10	4-04-10	50
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	18
Week 20	17-05-10	23-05-10	1
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	11

Group 13

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	3
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	5
Week 9	1-03-10	7-03-10	41
Week 10	8-03-10	14-03-10	5
Week 11	15-03-10	21-03-10	14
Week 12	22-03-10	28-03-10	27
Week 13	29-03-10	4-04-10	17
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	2

Planning pages

All Groups

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	2
Week 9	1-03-10	7-03-10	6
Week 10	8-03-10	14-03-10	3

Week 11	15-03-10	21-03-10	7
Week 12	22-03-10	28-03-10	4
Week 13	29-03-10	4-04-10	1
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	2
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	12
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Group 2

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	2
Week 9	1-03-10	7-03-10	1
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	4
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	0
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Group 5

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	0
Week 9	1-03-10	7-03-10	1

Week 10	8-03-10	14-03-10	2
Week 11	15-03-10	21-03-10	7
Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	1
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	12
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Group 13

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	0
Week 9	1-03-10	7-03-10	4
Week 10	8-03-10	14-03-10	1
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Discussion pages

All groups

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	3
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	2

Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	3
Week 13	29-03-10	4-04-10	1
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	2
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	1
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Group 2

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	1
Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	3
Week 13	29-03-10	4-04-10	1
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	1
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	2
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	1
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Group 5

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	3
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	1
Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0

Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	0
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	0

Presentation 2 pages

All groups

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	0
Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	0
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	27

Group 2

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	0
Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0

Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	0
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	25

Group 13

Week	First Day	Last Day	Number of edits
Week 5	1-02-10	7-02-10	0
Week 6	8-02-10	14-02-10	0
Week 7	15-02-10	21-02-10	0
Week 8	22-02-10	28-02-10	0
Week 9	1-03-10	7-03-10	0
Week 10	8-03-10	14-03-10	0
Week 11	15-03-10	21-03-10	0
Week 12	22-03-10	28-03-10	0
Week 13	29-03-10	4-04-10	0
Week 14	5-04-10	11-04-10	0
Week 15	12-04-10	18-04-10	0
Week 16	19-04-10	25-04-10	0
Week 17	26-04-10	2-05-10	0
Week 18	3-05-10	9-05-10	0
Week 19	10-05-10	16-05-10	0
Week 20	17-05-10	23-05-10	0
Week 21	24-05-10	30-05-10	0
Week 22	31-05-10	6-06-10	2

Activity outside the Digital Workshop

Interview 1

The tags for the indicators are:

- Use of the Digital Workshop
  - Use of the Digital Workshop in other courses: **[Overall Use:]**
  - Use of the comment function of the Digital Workshop internally: **[Internal Comments:]**
  - Use of the comment function of the Digital Workshop externally:**[External Comments:]**

    - Use of the discussion page's: **[Discussion Page:]**
    - Use of the ability to look at the work of other groups**: [Look Around:]**
- Opinion of the Digital Workshop
    - Positive statement about the Digital Workshop: **[Possitive Statement:]**
    - Negative statement about the Digital Workshop: **[Negative Statement:]**
- Use of other media
    - Use of other media for document creation and publishing: **[Publishing Media:]**
    - Use of other media for the discussion of work: **[Discussion Media:]**
    - Use of other media for scheduling: **[Scheduling Media:]**
    - Frequency of face-to-face meetings: **[Face-to-face Meetings:]**
    - Use of other online collaborative software: **[Collaboration Software:]**
    - Positive opinion about the open nature of the Digital Workshop: **[Positive towards Openness:]**
    - Negative opinion about the open nature of the Digital Workshop: **[Negative towards Openness:]**

Daan Pijper 21-05-2010

Questions in English

Questions about the expectations and knowledge of the Digital Workshop

Did you already use the Digital Workshop before the R&D 1 course? *Opening question. If no, questions about past experiences make little sense.*

Answer and analysis group 2:

[Overall Use: Ja. Stage. **]**(a) Erin gewerkt of eraan gewerkt? (b) **[Overall Use:** Ja, bij DM, bij B&B dan, R&D, andere vakken dan, Ja,:architectuur.**]** (b) Everybody followed the standard 1st year curriculum? **[Overall Use:** Ja, wij hebben dan informatiekunde en (a) informatica.(b)**]** Dus een paar vakken zijn anders maar… (b)

One interviewee had used the Digital Workshop in an internship. All interviewees had followed the standard 1st year curriculum for information science and informatics. For information science, this means that they used or are using the Digital Workshop for four courses, including the R&D 1 course.

Answer and analysis group 5:

[Overall Use: Ja, bij de cursus Introductie Informatica en Informatiekunde (III) en nu tegelijkertijd met R&D1 bij Beweren en Bewijzen (B&B).**]**

The summary of the answers states that the interviewees had used the Digital Workshop at the III course and are using the Digital Workshop right now in the B&B and R&D 1 course.

Answer and analysis group 13 :

Uh, **[Overall Use:** Nee, ik niet.**]** (a) Uhm, **[Overall Use:** Ja, Ik wel voor domein modellering**]**, om de antwoorden erop te zetten, **[Overall Use:** Beweren en Bewijzen precies hetzelfde eigenlijk en dan alleen bij R&D1.**]** (b)

One interviewee did not use the Digital Workshop in any other course than the R&D 1 course. The other interviewee used the Digital Workshop in the DM course and the B& B course as well.

Did you then use the comment functions to comment on each other's group work? *Question about task work communication. Primarily asks about the comment type. It is expected that other types of task work communication will also be revealed.*

Answer and analysis group 2:

Ja, **[Internal Comments:** moest bij B&B.] (c) **[Internal Comments:** B&B sowieso, ja, moest moest, 't was, ja je kon dat doen als een van de opdrachten **]**en bij.. **[Internal Comments:** DM hebben we dat ook wel gedaan, ja**]**… en verder (b)

The interviewees used the comment functions of the Digital Works during the B&B course since this was part of one of the assignments a student could choose. They also used the comment functions in the DM course, though it wasn't mandatory in this course.

Answer and analysis group 5:

[1.2, 1.3: Waar we dit deden was het verplicht. Er moest commentaar geleverd worden op het werk van anderen.**]** Dit resulteerde in veel, in onze ogen **[Negative Statement:** nutteloos, commentaar over spellingfouten en de structuur van de documenten.**]**

The summary states that the interviewees only did this when it was mandatory. According to the interviewees this primarily resulted in useless comments about spelling mistakes.

Answer and analysis group 13:

Eh, **[1.2, 1.3:** Ja (b) Het was een verplicht onderdeel van de cursus dat je commentaar gaf op het werk van iemand anders.**]** **[2.2, 2.1:** Begin begon het redelijk goed maar daarna zwakte het af werd het wat minder gedaan**]**, **[Positive Statement:** maar als je een vraag had dan werd er wel op geantwoord.**]** (a)

The interviewees commented on the work of others. In one course it was mandatory. This resulted in valuable comments in the beginning but further in the course the comments became less useful. Questions were answered.

Did you then use the discussion page's? *Question about the discussion page function of the Digital Workshop.*

Answer and analysis group 2:

Ja, bij uhm, **[Discussion Page:** R&D doen we dat en bij, waar nog meer, bij 2: B&B… **] [Discussion Page:** niet heel veel maar ja, als je dingen als je iets moet bijhouden hoe ver je al bent dan zet je dan gewoon tabelletje **]** daarop en dan uh, ja… (b)

The students use the discussion page to keep track of what they had done. They would write down what they had done in a table on the discussion page. The students did this in the R&D and B&B course.

Answer and analysis group 5:

(a) **[Discussion Page:** Ik heb het geprobeerd maar andere groepsleden keken niet naar de discussie pagina. Als niemand anders er gebruik van maakt heeft het weinig nut om er zelf dingen op te zetten.**]**(b) **[Discussion Page:** Ik wist niet dat er een discussie pagina was.**]**

Interviewee (a) tried to start a discussion on the discussion page but no one took part in it. Interviewee (b) did not know there were discussion pages.

Answer and analysis group 13:

1: **[Discussion Page:** Nee**]** (b)

The interviewees did not use the discussion pages before.

Did you then once comment or made improvements on the pages of other groups? *Question about task work communication in relation to the work of other groups. (Do outsiders participate in task work communication within groups?)*

Answer and analysis group 2:

[External Comments: Ja, uh, we hebben nog niet zo zeer bij andere groepjes **]** maar iedereen had apart een, iedereen, we hadden pagina waar je dan allemaal beweringen op moet zetten en dan **[External Comments:** moest je op elkaar reageren **]**, maar het was **[External Comments:** niet zo dat het een uh, dat we op elkaars werkgroep**]**, want ja, je hebt dan een werkstuk maar we hebben **[External Comments:** nog niet bij elkaar daarop moeten reageren.**]** (b)

During the B&B course the students made individual assignments on one page and they had to comment on these assignments. There is also a group project in the B&B course but they haven't commented on the work of other groups yet.

Answer and analysis group 5:

Question was answered in the previous question about the comment function. According to the interviewees this was mandatory in one course and it led to a lot of useless comments about spelling mistakes.

Answer and analysis group 13:

[External Comments: Zelf niet zo**]**, **[External Comments:** Andere mensen deden dit wel.**]** Meestal was er dan een **[External Comments:** vraag van "hoe kan ik dit het beste doen?"en daar werd dan wel antwoord opgegeven.**]** (b)

The interviewees did not give comments on the work of others. They did note that other people did comment on the work of others. They would often ask what the best approach was and then other people would answer.

Do you believe that the Digital Workshop makes working on this project easier then when you make the project offline? *Question about the effectiveness of the Digital Workshop. Primary purpose is to find other characteristics of the Digital Workshop that effect its use.*

Answer and analysis group 2:

[Positive Statement: Ik denk het wel eerlijk gezegd..**]** want uh, ja, het is wel makkelijk omdat iedereen kan uh, ja **[Positive Statement:** iedereen kan er altijd op en kan er dingen aan aanpassen en het is lastiger als je de hele tijd elkaar het werkstuk moet mailen**]** of zo, maar ja, **[Negative Statement:** anders hadden we waarschijnlijk wel iets anders gevonden om het op te doen**]**, neem ik aan maar uh, (b) **[Positive Statement:** Ja de idee van de werkplaats is misschien goed **]** maar **[Negative Statement:** het is uh, toch soms erg omslachtig in de werkplaats te werken. **]**(c) Ja, best wel. Je moet wel echt.. **[Negative Statement:** Je moet wel leren hoe het moet, en eh, vooral die codes, voordat je daar een beetje normaal mee kan werken **]** In het begin vond ik het **[Negative Statement:** echt een ramp.**]** Beetje normaal uh.. (b)

The interviewees agree that the Digital Workshop is better than mailing around documents. The advantage of the Digital Workshop is that all group members can always get access to the documents and change them. The students do believe that they would have found an alternative to the Digital Workshop if it wouldn't have been available. According to the students, the disadvantage of the Digital Workshop is that the codes needed to create special text in the Digital Workshop are cumbersome. The interviewees dislike that they need to learn how to use these codes.

Answer and analysis group 5:

[Negative Statement: Nee, de Digitale Werkplaats werkt niet goed op alle besturingssystemen.**]** **[Negative Statement:** Verder is de editor niet ideaal en men werkt liever in een WYSYWIG(What you is what you get) omgeving.**]** **[Negative Statement:** Men zou liever de documenten offline maken en dan delen via mail of Google Wave **]** **[3.1**In de praktijk worden al veel documenten eerst offline gemaakt en rond gemaild en dan later pas in de Digitale Werkplaats gezet.**]**

According to the interviewees the Digital Workshop had a lot of technical problems. Furthermore, since the Digital Workshop isn't a "what you see is what you get" environment it isn't easy to use. The interviewees state that they already make a lot of documents offline and mail them instead of using the Digital Workshop. They also use Google Wave.

Answer and analysis group 13:

Hm, **[Positive Statement:** Ja ik denk wel dat het handig is om gewoon een centrale plaats te hebben waar de meest recente versies van het document staan**]** en, uhm, dat zie ik wel als het grote voordeel maar ik zie het **[Negative Statement:** niet als iets om met een groepje tegelijkertijd te werken**], [Positive Statement:** meer als een soort opslagplaats.**]** (a) Ja, daar kan ik het mee eens zijn. (b)

One interviewee remarks that the Digital Workshop is useful as a central storage place. But in his opinion the Digital Workshop isn't something what you would use to work on a project with multiple people at the same time. The other interviewee agrees.

Do you think that you will use the discussion page's in the R&D 1 project? *Question about the discussion page function of the Digital Workshop.*

Answer and analysis group 2:

Yes, see answer on previous question about the discussion page.

Answer and analysis group 5:

(a):**[Discussion Page:** Ik had dit geprobeerd maar er werd door de medestudenten niet op ingegaan.**]**
(b) **[Discussion Page:** Ik wist niet van het bestaan af.**]** De discussies vinden nu plaats op de hoofdpagina. Dit is geen probleem omdat de hoofdpagina's al een rommeltje zijn.

(a) states that he tried but that the other group members did not participate. (b) states that there is little use since the main page is already a mess.

Answer and analysis group 13:

[Discussion Page: Nee, ik denk het niet.**]** (a) **[1.4** Denk dat we werk bespreken in de comments gaan doen.**]** Dat is wat beschikbaarder en wat sneller. (b)

The intrerviewees do not believe that they will use the discussion pages. (1) They prefer to use the comment function. (2)This is more available and faster in their opinion. (3)

Do you think you will use the comment functions to comment on each other's work in the R&D 1 project. *Question about task work communication. Primarily about the comment type of communication.*

Answer and analysis group 2:

Yes, see answer on the previous question about the comment function.

Answer and analysis group 5:

[Internal Comments: Ja, in andere projecten hebben we dit al gedaan.**]**

According to the summary, the interviewees answered that they already did this in previous projects and they would do the same in this project.

Answer and analysis group 13:

[Internal Comments: Ja, voor verbetering en inhoudelijke vragen over wat men net heeft gegeven,**]** uh, dat soort dingen. (a)

The interviewees use the comment functions to make improvements (1) or ask questions related to the subject.(2)

Do you look at the work of other groups, and if yes, for what purpose? *Question about the open nature of the Digital Workshop. Opening question followed by a more in dept question.*

Answer and analysis group 2:

[Look Around: Ja, uh, als we, als ik niet precies weet hoe ik het moet doen of uh, wat nou precies de bedoeling is dan kijk ik even hoe hebben die andere dat opgelost of hoe hebben die andere hun eerste opzet gemaakt..**]** kan ik daaruit wel meestal aflijden hoe we, hoe we verder moeten. **[Look Around:** En bij B&B voor die.., ja voor B&B heb ik het nog niet echt gebruikt, ja even kijken wat de

rest had voor uh,… voor hun onderwerp en zo..**]** **[Look Around:** Ja, ook wel een beetje om te kijken of ik het goed had**]** maar verder, ja, ja ga niet alle, als ik een opdracht had ga ik niet al die dingen door kijken maar gewoon als ik het, **[Look Around:** meestal doe ik het alleen als ik het niet snap en dan ga ik kijken van wat hebben andere gedaan.**]** (b) **[Look Around:** Ja. **]**(c)

The interviewees admit that they used the Digital Workshop to look at the work of others. They look at the work of others because they don't know how to solve a problem or what exactly the assignment is, so that they can continue with the project. In the B&B course they used the Digital Workshop to look at the subject of the projects of other groups and they used it to check whether their answers matched the answers of the others. If they were stuck they would also look at the work of others.

Answer and analysis group 5:

[Look Around: Ja, vooral om de indeling en structuur van het document te bepalen.**]** Maar we hebben het idee dat wij hierin verder zijn dan de andere groepjes en dat zij ons eerder afkijken dan andersom.

The summary states that the interviewees primarily look at other pages to help determine what division and structure they will use for their own pages. They believe that they ahead of other groups since the other groups often copy their division and structure.

Answer and analysis group 13:

Eh, nee, **[Look Around:** ja, het is meer om te kijken hoe ver de andere zijn**]** en **[Look Around:** hoe ze dan hun logboek bijhouden**]** en **[Look Around:** of je net zo ver bent als de rest en niet achterloopt. **]**(a)

The interviewees look at the work of others to find out how far the other groups are with their work (1) so that they can check if they are behind. They also looked at how other groups kept their logs for inspiration.

Would you comment on or make improvements in the work of other groups? *Question about the relation between the open nature of the Digital Workshop and task work communication.*

Answer and analysis group 2:

[External Comments: Nee, eigenlijk niet.**]**(b) **[External Comments:** Ja, ik heb wel bij een ander groepje een commentaar toegevoegd omdat ik eh, toevallig informatie advies gevonden heb op, over het onderwerp waar zij mee bezig zijn, en dan heb ik ook een commentaar toegevoegd**]**maar **[External Comments:** echt corrigeren of zo iets, denk ik niet dat ik dat zou doen.**]** (c)

The interviewees don't voluntarily comment on the work of other groups. One interviewee made one comment because he incidentally encountered information that might have been relevant to another group.

Answer and analysis group 5:

[External Comments: Nee, de inhoud van de projecten verschild teveel van elkaar om inhoudelijk commentaar te kunnen geven.**]** **[External Comments:** Commentaar op het gebied van spelling of

structuur is niet nuttig omdat groepjes daar zelf wel achter komen.**] [External Comments:** Verder maakt dit soort commentaar je er niet populairder op bij de andere groepjes.**]**

The summary states that the interviewees believe that the subject of the different projects differ to much from each other to make useful comments. Comments about spelling mistakes or suggestions for improvement of the structure of pages are viewed as useless and something that makes you unpopular amongst the other students.

Answer and analysis group 13:

Uhm, **[External Comments:** Ik denk feitelijk niet**]**, uhm, **[Look Around:**ik zal kijken op andere pagina's van hoe men bezig is en hoe veel werk men al heeft verricht**]**,**[External Comments:** maar echt dingen veranderen of plaatsen, nee.**]** (a) Ik denk dat je daarvoor niet genoeg in andermans werk inleest dat je daardoor **[External Comments:** niet kan reageren omdat je er niet genoeg vanaf weet.**]** Je kunt dan alleen kleine layout dingen of zo doen, **[External Comments:** maar dat kunnen ze zelf ook.**]**(b)

The interviewees do not expect that they will comment on the work of other groeps. The main reason why they do not do this is because they do not know enough about the subject of the other group's work. They refuse to make changes in the layout of other groups since that is something the groups themselves should do.

Are you afraid that other group's might steal your work or ideas? *Question regarding concerns with the open nature of the Digital Workshop.*

Answer and analysis group 2:

[Positive towards Openness: Nee, iedereen heeft zijn eigen onderwerp dus denk niet dat dat heel makkelijk**]**.. ja, nee, ben er niet echt bang voor, **[Positive towards Openness:** denk ook niet dat het zo snel zou gebeuren**]**, zou het eigenlijk 3: niet weten of iemand het doet. (b) Would you care if someone copied youre work? **[Positive towards Openness:** Ja nee, niet echt.**]**(b) Ja, als ze kijken of het mijn manier wij werken dan uh profiteren zij alleen en wij hebben geen verlies, dus uh, **[Positive towards Openness:, 3.7** ja waarom zouden zij niet kijken.**]** (c)

The interviewees are not afraid that students might copy their work. The assignments have different subjects so not much can be copied. They don't know if anybody actually does copy information. They don't really care either. One interviewee remarks that they don't lose anything when someone copies their work.

Answer and analysis group 5:

[Negative towards Openness: Bij kleine opdrachten die door meerdere groepjes worden gemaakt word dit weleens gedaan.**] [Positive towards Openness:** Maar niet bij dit project omdat de opdrachten teveel verschillen.**]** Zelf hebben wij er weinig problemen mee. Het kan mensen die de stof niet begrijpen helpen om naar het werk van andere te kijken. Dan kunnen ze vanuit dit werk een eigen oplossing bedenken. (b): **[Look Around:** Dit heb ik zelf ook weleens gedaan.**] [Positive towards Openness:** De studenten zijn volwassen genoeg om geen plagiaat te plegen.**]**

According to the interviewees this only happens in smaller assignments that are done by multiple groups. For R&D 1 the assignments differ too much to copy anything useful. They have little trouble

with people copying work as long as they use it to better understand the problem so they can create their own solution. (b) states that he did exactly this. (b) also believes that students are mature enough to refrain from stealing.

Answer and analysis group 13:

[Look Around: Nou, bij dit project is dit onmogelijk**]**, maar bij B&B bijvoorbeeld of domeinmodelering, ja het is mogelijk om af te kijken maar **[Positive towards Openness:** daar heb je weinig aan bij een groot project**] [Negative towards Openness:** is het wel pech voor je want dan heb jij er tijd in gestoken terwijl de ander dit niet deed**]** maar, uh, ja opzich (b) Ja, ik zie ook niet zo van, dat mijn copyright erop zit ofzo, **[Positive towards Openness:** maar het is niet dat het waardevol is, je wilt er iets van leren, die cursus halen en kopiëren daar heb je dan niet zo veel aan.**]** (a) Do you believe this actually happens? **[Look Around:** Ik denk niet dat jij gaat kopieren, ik denk wel dat je, uhm, hoe zeg je dat, ideeën opdoet door te kijken bij andere mensen, als je, uh, niet weet van hoe zou ik dit opzetten dan kun je bij andere mensen kijken hoe zij het hebben aangepakt**]**, **[Positive towards Openness:** daar help je jezelf zeg maar meer mee verder.**]**(b)

The interviewees believe that it is impossible to steal the work of other groups in the R&D 1 course. but that it is possible in the B&B and DM course. One interviewee states that it is touch luck when this happens since you put time in your work but another person didn't. Both interviewees agree that copying isn't usefull since you won't learn anything. They don't believe students actually copy work but they do look at the work of other people for inspiration.

Questions about communication within the project group

Do you make all your documents directly in the Digital Workshop? *Question about the publishing of work.*

Answer and analysis group 2:

[Publishing Media: Ik doe het meestal gewoon meteen in de werkplaats**]** maar **[Publishing Media:**ik weet wel dat sommige mensen het eerst in Word doen en dan het in de werkplaats plakken.**]** Ja, ja ik doe het zelf niet.(b) Nee, **[Publishing Media:** ik doe het ook direct in de werkplaats .**]** (c) **[Publishing Media:** Het enige waar wij uhm , ja uhm, een Word of zoiets doen is bij een verslag of zo maar. 3: En als je natuurlijk als je een pdfje maakt of zo..**]** (b) Do you use the export function of the Digital Workshop? Ja die is er wel maar dan, dan, als je toch al iets, 4: gewoon iets moet maken in is dat in Word makkelijker in kan typen met alle opmaak dingen die je daar hebt, **[Negative towards Openness:** dan doe ik dat eerder dan dat je in die werkplaats al die stomme codes moet gaan intypen.**]**(b) Do you experience any technical problems and what combination of operating system and browser do you use? **[Positive towards Openness, Negative towards Openness:** Nee, ja hij is langzaam soms.**]**(b) Ik gebruik Firefox. Uh, Windows. (c) Ja ik doe Firefox onder Windows. (b) Ja, Firefox en soms Opera. (a)

The interviewees create all their documents in the Digital Workshop except when they need to create a report (2) or when they need to make a pdf type document. They don't use the export function (4) because they dislike making a layout in the Digital Workshop. The only technical issue the interviewees have with the Digital Workshop is that it can be slow. They all use the Firefox browser under windows and one interviewee occasionally uses Opera.

Answer and analysis group 5:

[Publishing Media: Nee, meestal worden de documenten eerst offline gemaakt en samengevoegd waarna een persoon het resultaat in de Digitale Werkplaats zet.**]** Ook word het werk vaak eerst buiten de werkplaats besproken.

Group 5 makes most of their documents offline and these are merged and then copied into the Digital Workshop. Documents are also discussed outside the Digital Workshop.

Answer and analysis group 13:

[Publishing Media: Ik maak ze normaal eerst in de wiki**]** maar **[Publishing Media:**als het om een af te leveren product gaat dan maak ik het liever in een document zoals een pdf.**]**(b) **[Publishing Media:** Ik vind het zelf ook makkelijker om het eerst op te slaan, dan gaat het werken gemakkelijker.**]** (a) Did you experience any technical issues and what operating system and browser do you use? 4: Windows. Chrome. (b) Linux. Firefox. (a) **[Positive towards Openness:** Nee**]**, uhm, **[Negative towards Openness:** ik vind hem alleen iets te traag.**]** (a)**[Positive towards Openness:** Nee**]**, **[Negative towards Openness:** ik vind de documentatie een beetje, ja ik weet niet of het slecht is, maar ik kan niet snel vinden hoe ik iets moet doen.**] [Look Around:** Ik moet dit afkijken op andere pagina's.**]** Dat kan maar, ja, ik mis wel documentatie. (b)

The interviewees make all their work in the Digital Workshop except deliverables. They use Windows and Linux as OS and Chrome and Firefox as browser. The interviewees do not experience any technical problems. One interviewee comments that the Digital Workshop is a bit slow. The other interviewee comments that there is no easily accessible documentation. He needs to look at the work of other people to find out how they made a certain special object in the Digital Workshop.

Which medium do you believe will be used most to evaluate the work of other group members? *Question about commenting, questioning and replying to questions and comments regarding group members work.*

Answer and analysis group 2:

Ja,**[Discussion Media:** als het alleen over werk gaat dan meestal via de werkplaats**] [Scheduling Media:** maar om aan iets te herinneren of uh, ja, iets uhm te bespreken want waneer de volgende bijeenkomst is dan meer via e-mail.**]** 2: Ja inderdaad.

The interviewees evaluate each other's work in the Digital Workshop but reminders about meetings are done through e-mail.

Answer and analysis group 5:

[Discussion Media: Google Wave word waarschijnlijk het meeste gebruikt.**]** Dit komt ook omdat het project van R&D1 zich bezig houdt met Google Wave. **[Discussion Media:** Skype (internet telefoneren) word daarna het meeste gebruikt. Mail en MSN worden ook gebruikt.**]**

Google Wave is used most. The interviewees states that this is the case because their project is about Google Wave. Skype, mail and MSN are also used.

Answer and analysis group 13:

[Discussion Media: Dat is denk ik wel de wiki**]** want als iemand dan een onderdeel maakt dan krijg ik automatisch dan een mailtje van de wiki dat er iets verandert is. **[Internal Comments:** Dan kan ik het lezen en er dan een comment erbij zetten**] [Face-to-face Meetings:** of daarna bespreken we het een keer face-to-face.**]** (a)

The interviewees evaluate each other's work in the Digital Workshop. One interviewee remarks that he likes the fact that the Digital Workshop can sent an e-mail to him once a change in a page has been made. Then he can discuss these comments face-to-face.

Which medium do you believe will be used most to make appointments? *Question about scheduling.*

Answer and analysis group 2:

In the previous question you hinted that you use mail for this. Is this true? **[Scheduling Media:** Ja.**]**(a)(b)(c)

The interviewees confirm that they primarily use mail to make appointments.

Answer and analysis group 5:

[Scheduling Media: Face-to-face communicate.**]**

Most appointments are made face-to-face.

Answer and analysis group 13:

[Scheduling Media: Mail (a) Ja, Mail (b)**]**

The interviewees state that they use mail to make appointments. (1)

How often a week does the group come together to meet face-to-face? *Question about meeting face-to-face.*

Answer and analysis group 2:

Uhm, **[Face-to-face Meetings:** een keer in de twee weken misschien, soms wat vaker soms.**] [Face-to-face Meetings:** Als we een deadline hebben dan moeten we soms vaker bij elkaar komen om iets af te maken.**]** (b) Is it difficult to schedule meetings since one group member does a different education? Ja soms, omdat Mirjam dan twee andere vakken heeft, is soms wel lastig maar over het algemeen lukt het wel.(b)

The interviewees meet once every two weeks and more when a deadline approaches. The fact that one group member follows a different education makes scheduling more difficult but they still manage to make appointments.

Answer and analysis group 5:

[Face-to-face Meetings: Dit varieert sterk per week.**]** De geïnterviewden durven geen schatting te maken van een gemiddelde. Sommige weken helemaal niet, sommige weken meerdere keren.

The number of face-to-face meetings a week varies greatly. The interviewees do not dare to give an estimate. Some weeks they don't meet at all, sometimes they meet multiple times a week.

Answer and analysis group 13:

Ja, 1wat we heel vaak doen is zeg maar, **[Face-to-face Meetings:** met colleges dan even snel een klein ding doorspreken, vlak voor en vlak na van hoe we het aan gaan pakken**]** en dan achteraf een mailtje sturen om het vast te stellen. maar dat is uh, **[Face-to-face Meetings:** wekelijks zeg maar. **]**(b)

The interviewees often discuss their work during classes, either before or after them and then they send an e-mail to confirm their discussion. They meet once a week.

Do you use any other online project environments, like Google Docs, for this project? *Question about the webpage medium.*

Answer and analysis group 2:

[Collaboration Software: In ieder geval niet voor R&D.**]** (b)

The students do not use any other online project environments in the R&D 1 course.

Answer and analysis group 5:

[Collaboration Software: Wij gebruiken Google Docs om de presentaties bij het project te delen en bekijken.**]**

The interviewees use Google Docs to share and view presentations related to the project.

Answer and analysis group 13:

Uhm, **[Collaboration Software:** nog niet**]** maar **[Collaboration Software:** als we code moeten gaan schrijven gaan we dit wel op een SVN opslaan.**]** (a)

The interviewees plan to use an SVN repository to store the code of the programs they will develop.

Interview 2

The tags for the indicators are:

- Exchange of viewpoints in the Digital Workshop
    - Frequency of reflection in the Digital Workshop: **[Frequency of Reflection:]**
    - Does reflection lead to an exchange of viewpoints: **[Reflection and Viewpoints:]**
    - Media used for exchange viewpoints: **[Media and Viewpoints:]**
    - Do questions lead to an exchange of viewpoints: **[Questions and Viewpoints:]**
    - Do conflicts occur between group members and have these been resolved (which requires an exchange of viewpoints): **[Conflicts:]**
- Transfer of knowledge in the Digital Workshop
    - Is knowledge verbally shared (exchange of viewpoints, explanation): **[Knowledge Sharing:]**
    - Does internalization occur within the groups: **[Internal Internalization:]**
    - Does internalization occur outside the groups: **[External Internalization:]**

- Reduction of cognitive load
    - How much task division is there: **[Task Division:]**
    - Are all students aware of what their group members do: **[Task Awareness:]**

Questions about reflection and negotiation

Q:Does the group evaluate all new additions to the work on or outside the Digital Workshop? *Questions asks about the frequency of reflection.*

Answer and analysis group 2:

Als ik een mail krijg dan meestal uh, kijk ik er dan niet echt na. Ja, later een keer maar soms, ja, hangt er vanaf,[**Frequency of Reflection:** ja als het met een werkstuk is, waar ik net ook mee bezig ben geweest, iemand veranderd iets, dan kijk ik wel even van oh ja, wat heeft die gedaan], [**Frequency of Reflection:** maar meestal heb ik zo iets van ja zal wel, komt wel goed.] (a)

Answer and analysis group 5:

[Frequency of Reflection: Een beetje in de werkplaats, ja, dan heb je ook nog die discussiepagina voor maar**]** (a) Meestal vragen we wel aan elkaar of iemand wat doet en dan uh, wijzen we een plaats toe waar dat werk dan kan in komen. (b)

Answer and analysis group 13:

Uhm, meestal wel, uh, we voegen meestal iets toe en dan is het zo van, **[Frequency of reflection:** dan gaan ze 't nalezen en dan en dan denk je, van ja waarom is dan eigenlijk en dan vragen ze dat na want meestal doe je dat,**]** doen wij dat in ons eentje, zo'n stukje schrijven, stukje onderzoek, **[Frequency of Reflection:** en dan gaat de ander gaat de ander zeggen ja waarom is dat dan zo en dan heb je dus meteen dat je elkaar een beetje in de gaten houd. **]**(b)

Q:Do you discuss the mistakes found in these evaluations in the whole group? (The discussion should be about finding out why mistakes were made and how they can be fixed?) *Questions asks whether evaluation actually results in reflection.*

Answer and analysis group 2:

[**Reflection and Viewpoints:**Ja, denk dat ik er, ja meestal zet ik er wel gewoon commentaar bij, ja, eigenlijk wel en dan, …, ja], nee als er gewoon iets kleins is, iets wat ie net heeft geschreven, dan staat er gewoon commentaar bij, dan verander ik het gewoon met commentaar erbij maar dan ga ik [**Reflection and Viewpoints:** ja, later spreken, ja dan praten we er misschien nog wel over maar in eerste instantie zet ik er wel commentaar bij]. [**Reflection and Viewpoints:** (a) Ja (b, c)]

Answer and analysis group 5:

Je krijgt er meestal, als je samenwerkt aan een pagina krijgt iedereen een mailtje als iemand een bewerking maakt. (a) <u>En checken jullie dan ook nog of die bewerking wel goed is of..</u> **[Frequency of Reflection:** Ik kijk meestal wel even als ik zo'n mailtje krijg wat er veranderd is.**]** (a) Ik ook (b) <u>Jullie hebben regelmatig een evaluatie, een paar keer per maand met Erik, bespreken jullie de resultaten daarvan in jullie groep.</u> Uhm, Ja (a) **[Reflection and Viewpoints:** Gewoon tijdens het gesprek horen

we wat er mis is en dan bespreken we dat met hun en met elkaar hoe het beter kan**]**, en dan veranderen we het snel thuis.(c)

Answer and analysis group 13:

[Reflection and viewpoints: Uhm, meestal is het zo, ik heb het aangepast met deze rede en dan, als je daar iets op aan te merken hebt kun je daar weer op reageren**]** maar …. *(b)*

Q:What medium do you use to hold these discussions? *Inquiry about the use of media in the groups communication.*

Answer and analysis group 2

[**Media and Viewpoints:**Eigenlijk doen we het vooral hier (op de Uni)] [**Media and Viewpoints:** en we mailen maar verder,] ja we hebben elkaar op MSN maar ik zit er sowieso niet zo vaar op. (a)

Answer and analysis group 5

Uh, nou **[Media and Viewpoints:** meestal is het zo dat we op een andere manier zoals Skype**] [Media and Viewpoints:** of gewoon op de Unie, gewoon een discussie houden**]** en dat we dan daarna op de werkplaats zetten wat eruit is gekomen. (c) **[Media and Viewpoints:** Waarom zou je moeilijk doen als je gewoon kan bellen of een berichtje kan sturen dat live is**]**. (a)

Answer and analysis group 13:

[Media and Viewpoints: Ja, het commentaar meestal in de wiki meer soms,**] [Media and Viewpoints:** soms mail als er wat grotere dingen zijn, commentaar ja, **] [Negative statement:** word zo onoverzichtelijk**] [Media and Viewpoints:** en ja soms gewoon face-to-face.**]** (b)

Q:What medium do you use to ask questions regarding project work and are these always adequately answered by other group members? *Question asks whether people dare to ask questions and whether other members are willing to explain answers. Also asks what media are used?*

Answer and analysis group 2:

[**Questions and Viewpoints:** Ik zet ze sowieso niet op de werkplaats, als ik ergens een vraag over heb, dan of ik mail iemand of ik vraag het hier op de uni,] hangt er een beetje vanaf of ik het meteen moet weten, dan mail ik het, als ik thuis zit in ieder geval, als het niet echt heel veel uitmaakt dan stuur ik of een mail of [**Questions and Viewpoints:** wacht ik tot ik hem de dag daarna hier op de uni zie, en dan uh, vraag ik het.] (a) [**Questions and Viewpoints:** Als er een docent bijvoorbeeld David of uh, ja iemand anders heb die vaak op de, ja uh, wiki kijkt dan schrijf ik wel een vraag op de wiki maar meestal stuur ik toch een mail of zo.] (c)

Answer and analysis group 5:

Uhm, het groepje waar wij dingen aan vragen, die contacteren wij persoonlijk. (b) <u>En ook binnen de groep zelf?</u> Ja (b) Ik vind het eigenlijk een beetje asociaal om andermans pagina te gaan aanpassen. **[Questions and Viewpoints:** Daar vragen op te gaan stellen, een beetje alsof ik 'm aan het bekladderen ben**]**. (a) <u>En vragen op jullie eigen pagina, zetten jullie die ook ooit ergens bij zoals hoe het nu verder moet?</u> **[Questions and Viewpoints:** Ja dat zetten we, dat zet ik meestal wel op mijn

eigen pagina als reactie of zo**]**. (a) Ja, ok. En daar word ook meestal op geantwoord of.. K.: Hmmm, ik heb het nog niet echt gedaan maar zo zou ik het doen. (a) **[Questions and Viewpoints:** Het komt ook niet echt in je op om er wat op te zetten want waarschijnlijk ziet iemand het pas na een paar weken of zo als er weer de werkplaats gaan bijwerken omdat er weer over gezeurd is dat het nu moet.**]** (c) Waarom, ja, jullie zijn natuurlijk gewend om mail of dergelijke te gebruiken, is het daarom dat jullie de werkplaats eigenlijk relatief weinig kan omdat je bijna nooit op de werkplaats kijkt, zou je er meer kunnen als ie gewoon echt persoonlijke berichtjes zou kunnen sturen of dat er een chatbox in zou zitten, zou je dan vaker op de werkplaats kijken of.. Dat weet ik niet, want ik denk dat, ja, mensen toch, dat het moeilijk is om dat goed lopend te krijgen omdat… (c) **[Negative Statement:** Niemand heeft de zin en tijd om te gaan werken op die rottige werkplaats.**]** (a)

Answer and analysis group 13:

Uhm, meestal **[Question and Viewpoints:** als we als het over iets gaat, een stukje dat we al geschreven hebben dan meestal in commentaar op de werkplaats of, als we een stukje plannen of zo dan doen we dat stukje ook op de werkplaats met commentaar**]** maar **[Question and Viewpoints:** meestal als het over iets anders gaat of iets nieuws gaat of groepsbespreking of zo dan is dat via de mail. **]**(b)

Q:Have there been any disagreements related to project work in the group and how have these been resolved? *Asks whether negotiation occurs and if the group members take the time to understand each other's points.*

Answer and analysis group 2:

Tja, we hebben eigenlijk alles met zijn allen in gewoon een groep besproken, van tevoren, wat we gingen doen, [**Conflicts:**dus de aanpak hadden we, ja, de aanpak was wel in overeenstemming met elkaar.] (a) Ja (b,c) We hadden daar dus niet echt problemen mee, hooguit met de, ja, als er iets was van [**Questions and Viewpoints:** ja, dat snap ik nog niet helemaal, dat je dan commentaar zet op de wiki en dan ja, vragen of die nog even kan aanpassen] [**Conflicts:** maar niet qua aanpak of zo, daar hebben we gewoon zelf uh, van tevoren besproken met ze allen.] (a) Dus jullie waren het wel eens over de aanpak? [**Conflicts:** Ja, denk het wel ja.(a) Ja, anders hadden wij het wel anders gedaan (b)]

Answer and analysis group 5:

[Conflicts: Dat is weleens gebeurd ja, dat er een opmerking werd geplaatst, gewoon in de pagina zelf, en daar werd een klein gesprekje in gevoerd. **]**(a) Ja, wel dat er discussie was ja over hoe we dan iets aan moesten pakken maar uh, **[Media and Viewpoints:** dat gaat meestal via Skype of zo, dan halen we er een derde bij en dan uh, **]**(b) Wat voor derde halen jullie er dan bij? **[Knowledge Sharing:** Ander groepje.**]**(b) Docent is toch moeilijk omdat , die hebben relatief weinig tijd, dan moet je weer een afspraak gaan maken, die hebben dan wel veel expertise maar niet in waar het project over gaat. (b)**[Media and Viewpoints:** En inderdaad als ze moeilijk te bereiken zijn, met een ander groepje ga je gewoon een keer in de pauze of zo loop je er heen met Hey, we hebben dit en dat **]**, en inderdaad wat T al zij, dan moet je helemaal een afspraak maken en dan is het pas volgende week ergens. (c)

Answer and analysis group 13:

[Conflits: Ja en nee want ikzelf vond het moeilijk om een bibliotheek te schrijven omdat ik met me hooft zat met programma's maken en een bibliotheek is totaal iets anders eigenlijk want die doet niks dus ik had meestal zoiets van oh, waarom doen we dat niet zo, maar ja het is, krijg je als tegenargument, ja het is een bibliotheek geen programma weet je wel dus niet echt meningsverschillen maar wel ook, uhm, ja onderling ruzie zullen we maar zeggen.**]** (b) Maar hoe werd het uiteindelijk opgelost of.. **[Conflicts, Knowledge Sharing:** Uhm, door gewoon uh, mijn partner heb ik gewoon heel rustig uitgelegd van ik ga nou helemaal uitleggen wat het principe is en toen ging het vanzelf eigenlijk, begon ik het wel door te krijgen.**]** (b)

Questions about the transfer of knowledge

Q:Are there any new things you learned from looking at how other group members solve problems? *Question asks whether the transfer of knowledge occurs within the group and whether the group members are aware of this.*

Answer and analysis group 2:

[**Internal Internalization** Niet bij R&D 1. (a) Niet echt.] (b) Niet echt nee, ja want, [**Internal Internalization**ja je werkt heel veel samen en 't is niet zo dat je allemaal,] ja eigenlijk is het meer je hebt een [**Task Division:** werkverdeling dus iedereen werkt ergens anders aan] of je doet samen is, maar meestal doe je dat dan op de uni, en als je iets, ja, als je iets anders doet dan, ja, omdat je niet dezelfde opdracht maakt, dan is het ook niet van, ja ik kom hier niet uit dus ik kijk even bij die ander. **[Internal Internalization:** Want ja, het heeft weinig met elkaar te maken, je loopt niet tegen die problemen aan dus dan ga je er ook niet naar kijken.] (a)

Answer and analysis group 5:

T.: Nou, ik niet binnen het groepje. (b) Over andere of gewoon dingen die je van andere geleerd hebt? (c) Niet over andere.. Oh, (c) Hoe jullie dan van mij geleerd hebben hoe je (a) Van jou, maar niet over jou.. (c) Nee, van jou bedoel ik.. **]Knowledge Sharing:** Oh, Ja, ik heb van K. wat dingen gehoord over hoe protocollen werken en dat sommige wel, dingen die niet door de client zouden mogen worden **]**Maar… **[Knowledge Sharing, Internal Internalization:**Daar wist ik bijna niks van en nu meer, en ook niet alleen door lezen maar ook wel door wat ze hebben verteld.**]** (C) En niet dat je snel ziet van uh, oh hij heeft dit en dit op de werkplaats gedaan, of je leest gewoon een antwoord en ziet iets technisch in de werkplaats en dat je daar naar kijkt en denkt oh, zo moet dat. **[Knowledge Sharing:** Eh, meestal word dat wel tijdens discussies verteld.**]** (c)

Answer and analysis group 13:

[Internal Internalization: Ik denk dat iets is wat niet echt heel erg uh, iets is van ons groepje, uhm, nee niet echt eigenlijk.**]**(b)

Q:Are there any new things you learned from looking at how other groups solve problems? *Previous question applied to inter-group knowledge transfer.*

Answer and analysis group 2:

Ja dat we, nou wat minder [**External Internalization:** maar zeker in het begin wist ik niet hoe ik zo'n tabel moest maken, dan keek ik wel bij anderen,]maar das ondertussen.. ondertussen kan ik dat wel, ja maar, bij andere groepjes, hebben we ooit bij andere groepjes gekeken? (a) [**External**

Internalization: Als ik uh, op de wiki naar andere mensen of naar groepjes kijk, dan, mja, omdat ik uh, problemen met de syntax of wat dan ook met de wiki heb, niet echt met mijn opdracht.] (b)

Answer and analysis group 5:

[External Internalization: Ik heb uh, niet naar de pagina's van de andere, niet echt naar de pagina's van andere groepjes gekeken hoogstens naar hoe ver zij dan wel niet zijn met hun verslag maar vaak is het zo dat twee uur voor de deadline in ene keer boem en dan staat alles erop en dan uh**]**.. maar vaak is het zo dat de echte informatie die zit allemaal hier (wijst naar zijn hoofd) en uh, die staat op bronnen. (b) Ja (a)Het is meer het zoeken van uh, het bij elkaar zoeken van dat soort dingen en **[Knowledge Sharing:** dat vraag je dan gewoon mondeling.**]** (b)

Answer and analysis group 13:

[External Internalization Uhm, nou niet bij dit vak maar wel bij een ander vak wel bijvoorbeeld uh, beweren en bewijzen moeten we een werkstuk maken en dan is het wel handig te kijken van hoe doen die dat..**]** ja**[Internal Internalization:** daar eigenlijk wel maar bij R&D niet zo..**]** (b)

Questions about the reduction of cognitive load

Q:(How) are tasks divided within the group? *Questions asks about the approach to the reduction of cognitive load.*

Answer and analysis group 2:

[**Task Division:**Dat hebben we in het begin uitgebreid gedaan, ja eigenlijk doen we het sowieso wel,] [**Task Division:** nou vrij uitgebreid? Ik weet niet wat uitgebreid is maar we geven wel gewoon iedereen een taak en]. (a) Ja (c) [**Task Division:** Bij fase 1 heeft M. ontworpen en P. heeft uh, alles gedigitaliseerd en die, taakverdeling hebben we wel.] (a)

Answer and analysis group 5:

[Task Division Ja, we hebben wel van jij doet dat onderwerp en jij doet dat onderwerp, jij doet dat onderwerp, we hebben een tijdje gewoon wat onderwerpen neer gezet die per dag gedaan moesten worden en dan kon je kijken wat je ging doen en dan. **]**(c)

Answer and analysis group 13:

[Task Division: Uhm, in het begin in de pilot fase hadden we wel een kleine taakverdeling van uhm jij gaat onderzoek daar in doen en jij daar in de literatuuronderzoek vooral, **]**uhm **[Task Division:** maar het is daarna eigenlijk vervaagt, meestal zo ja van kun jij dit eventjes gaan doen nu en dan zeg je van ok ik ben helemaal klaar en dan moet dit gebeuren, kan jij dat effe doen en zo**]**..(b) op het moment zelf effe.. **[Task Division:** Ja, precies**]** (b)

Q:Do you know and understand what each individual group member is doing or has done? *Questions asks whether group members still are involved with other members work. If this isn't the case, task division might have gone too far and collaboration might be changing into cooperation.*

Answer and analysis group 2:

[**Task awereness:** Wij allemaal, meestal doet die die 't, van wie we verwachten dat hij het of zij het het best kan.] (b) Ja (a, c) [**Task awereness:** Maar in principe zou iedereen alles kunnen doen.] (b)

Answer and analysis group 5:

Dan is de vraag of jullie nog steeds wel zicht hielden op wat iedereen deed of dat er gewoon een heel rigide werkverdeling… **[Task Awareness:** Nee, nee, nee**]**(c)

Uh, ja, uh zijn uh, hoe belangrijk zijn die tussentijdse evaluaties van Erik. Hebben jullie daar nog dingen uitgeleerd of.. Nou, het houdt het vooral een beetje aan de gang.(c) Anders dan zou je waarschijnlijk vlak voor de deadline.. Ja, ja, en nu hoor je ook van andere groepjes en zo , het is wel een beetje druk om weer aan het werk te gaan. (c)

Answer and analysis group 13:

Begrijpen jullie van elk groepslid wat ze aan het doen zijn als je het over een taakverdeling hebt maar die is bij jullie niet zo heel erg aanwezig dus dat kan dan geen probleem zijn. **[Task Awareness:** Ja **]**(b)

Logs of external communication

All groups

Formulas	Percentage	Absolute Number
Face-to-face	36,84%	7
E-mail	57,89%	11
Chat messages	5,26%	1
Telephone	0,00%	0
Webpage	0,00%	0
All media		19
Group Management	43,48%	10
Publishing of Work	13,04%	3
Question	4,35%	1
Comment	4,35%	1
Reply	8,70%	2
Meeting	26,09%	6
All communication		23

Group 2

Log

Date and time	Medium	Category
19-04-10 0:35	E-mail	Group Management
19-04-10 0:45	E-mail	Group Management
19-04-10 9:30	E-mail	Reply

19-04-10 13:15	E-mail	Reply
20-04-10 11:40	Face-to-face	Meeting
26-04-10 17:00	Chat Messages	Group Management
26-04-10 17:10	E-mail	Group Management
26-04-10 21:27	E-mail	Group Management
27-04-10 15:30	Face-to-face	Group Management
27-04-10 16:15	E-mail	Group Management
4-05-10 22:00	E-mail	Publishing of Work

Analisys

Formulas	Percentage	Absolute Number
Face-to-face	18,18%	2
E-mail	72,73%	8
Chat messages	9,09%	1
Telephone	0,00%	0
Webpage	0,00%	0
All media		11
Group Management	63,64%	7
Publishing of Work	9,09%	1
Question	0,00%	0
Comment	0,00%	0
Reply	18,18%	2
Meeting	9,09%	1
All communication		11

Group 5

Log

Date and time	Medium	Category
4-02-10 12:30	Face-to-face	Meeting
9-02-10 13:30	Face-to-face	Meeting
10-02-10 16:30	Face-to-face	Meeting
23-02-10 15:15	Face-to-face	Meeting
2-03-10 12:45	Face-to-face	Meeting
9-03-10 14:30	Face-to-face	Meeting
17-03-10 12:45	Face-to-face	Meeting
19-03-10 21:25	Telephone	Meeting
20-03-10 19:45	Telephone	Meeting
22-03-10 20:00	Telephone	Meeting
23-03-10 12:45	Face-to-face	Meeting
30-03-10 10:30	Face-to-face	Meeting
31-03-10 10:45	Face-to-face	Meeting

13-05-10 12:45	Face-to-face	Meeting
19-05-10 15:15	Face-to-face	Meeting
26-05-10 12:30	Face-to-face	Meeting
9-06-10 14:45	Face-to-face	Meeting

Analisys

Formulas	Percentage	Absolute Number
Face-to-face	82,35%	14
E-mail	0,00%	0
Chat messages	0,00%	0
Telephone	17,65%	3
Webpage	0,00%	0
All media		17
Group Management	0,00%	0
Publishing of Work	0,00%	0
Question	0,00%	0
Comment	0,00%	0
Reply	0,00%	0
Meeting	100,00%	17
All communication		17

Group 13

Log

Date and time	Medium	Category
21-04-10 15:30	Face-to-face	Group management
22-04-10 12:30	Face-to-face	Meeting, Publishing of work.
26-04-10 12:30	Face-to-face	Meeting
28-04-10 12:30	Face-to-face	Group management
12-05-10 10:30	Face-to-face	Publishing of Work, Meeting, Question, Comment
15-05-10 12:30	E-mail	Meeting
17-05-10 18:00	E-mail	Meeting
17-05-10 18:00	E-mail	Group management

Analysis

Formulas	Percentage	Absolute Number
Face-to-face	62,50%	5
E-mail	37,50%	3
Chat messages	0,00%	0
Telephone	0,00%	0

Webpage	0,00%	0
All media		8
Group Management	25,00%	3
Publishing of Work	16,67%	2
Question	8,33%	1
Comment	8,33%	1
Reply	0,00%	0
Meeting	41,67%	5
All communication		12

Study ino inter-rater agreement

Rater 1 vs Rater 2

Interpersonal Communication	Interpersonal Communication	1	1	1	1	1
Correction	Correction	1	1	1	1	1
To-do, Comment	Comment	2	1	2	1	0,5
Structural Addition	Content Addition, Structural Adjustment	1	3	3	0	0
Comment	Comment, Reply	1	2	2	1	0,5
Comment	Correction	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Comment	Correction, Comment	1	2	2	1	0,5
Correction	Correction	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Content Addition	Content Addition, Structural Addition	1	2	2	1	0,5
Correction, Content Adjustment	Reply, Comment	3	2	2	0	0
Reply	Reply	1	1	1	1	1
Comment	Correction	1	1	1	0	0
Comment	Comment, Reply	1	2	2	1	0,5
Correction	Correction	1	1	1	1	1
Comment	Reply	1	1	1	0	0
Structural Addition	Content Addition, Structural Addition, To-Do, Question	1	4	4	1	0,25
Structural Addition	Structural Addition	1	1	1	1	1
Delete	Delete	1	1	1	1	1

Structural Addition Content Addition	Structural Addition, Content Addition, Structural Adjustment	2	3	3	2	0,666667
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Correction	Correction, Content Addition, Structural Addition	1	3	3	1	0,333333
Structural Addition, Content Addition	Content Addition	2	1	2	1	0,5
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Correction	Correction	1	1	1	1	1
Structural Adjustment, Structural Addition	Structural Addition, Content Addition	2	2	2	2	1
Structural Addition	Structural Addition	1	1	1	1	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Correction	Structural Adjustment, Content Addition	1	2	2	0	0
Content Addition, Structural Addition	Structural Addition, Content Addition	2	2	2	2	1
Schedule, Structural Adjustment	Schedule	2	1	2	1	0,5
Correction	Content Adjustment	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Schedule, Structural Adjustment	Schedule	2	1	2	1	0,5
Schedule, Structural Adjustment	Schedule	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Schedule, Structural Adjustment	To-do, Schedule	2	2	2	1	0,5
Correction	Correction	1	1	1	1	1
Structural Adjustment	Correction, Structural Adjustment	1	2	2	1	0,5
Schedule, Structural Adjustment	Correction	2	1	2	0	0
Schedule, Structural Addition, Correction	Schedule, Structural Adjustment, To-Do	3	3	3	1	0,333333

To-Do	Structural Adjustment, Content Addition, Schedule, To-Do	1	4	4	1	0,25
Schedule, Structural Addition	Schedule, Comment	2	2	2	1	0,5
To-Do, Structural Adjustment	To-Do	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule	Schedule	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule, Structural Addition	Schedule, Structural Addition	2	2	2	2	1
To-Do, Schedule, Delete, Structural Adjustment	Structural Adjustment, Delete, Content Addition, Correction	4	4	4	2	0,5
Schedule, Structural Addition	Structural Addition, Content Addition, Schedule	2	3	3	2	0,666667
Schedule	Schedule	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Addition	Structural Adjustment	1	1	1	0	0
Delete	Delete	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition	Question	1	1	1	0	0
Structural Addition, Content Addition	Structural Addition, Question	2	2	2	1	0,5
Content Adjustment, Comment	Comment	2	1	2	1	0,5
Correction	Content Adjustment	1	1	1	0	0
Structural Adjustment, Structural Addition	Structural Adjustment	2	1	2	1	0,5
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Addition	Content Addition	1	1	1	0	0
Comment, To-Do	Comment	2	1	2	1	0,5
Comment	Content Addition	1	1	1	0	0
Content Adjustment	Content Adjustment	1	1	1	1	1
Content Addition	Structural Addition, Content Addition	1	2	2	1	0,5
Structural Addition	Structural Addition	1	1	1	1	1
				ej		0,653333

Rater 1 vs Rater 3

Author 1	Author 3	n1j	n3j	nmax	enj	ej13
Interpersonal Communication	Interpersonal Communication	1	1	1	1	1
Correction	Correction	1	1	1	1	1
To-do, Comment	To-Do, Comment	2	2	2	2	1
Structural Addition	Structural Addition	1	1	1	1	1
Comment	Comment, Reply	1	2	2	1	0,5
Comment	Correction	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Content Addition	Content Addition, Structural Addition	1	2	2	1	0,5
Correction, Content Adjustment	Comment, Content Adjustment, Reply	2	3	3	1	0,333333
Reply	Reply	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Comment	Reply	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Comment	Comment, Reply	1	2	2	1	0,5
Structural Addition	Structural Addition, Content Addition, To-Do	1	3	3	1	0,333333
Structural Addition	Structural Addition	1	1	1	1	1
Delete	Delete	1	1	1	1	1
Structural Addition Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Correction	Correction, Content Addition	1	2	2	1	0,5
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1

Correction	Correction	1	1	1	1	1
Structural Adjustment, Structural Addition	Structural Adjustment, Structural Addition	2	2	2	2	1
Structural Addition	Structural Addition	1	1	1	1	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Correction	Structural Adjustment, Content Adjustment	1	2	2	0	0
Content Addition, Structural Addition	Structural Addition, Content Addition	2	2	2	2	1
Schedule, Structural Adjustment	Schedule, Structural Adjustment	2	2	2	2	1
Correction	Content Adjustment	1	1	1	0	0
Correction	Correction	1	1	1	1	1
Schedule, Structural Adjustment	Schedule, Correction	2	2	2	1	0,5
Schedule, Structural Adjustment	Schedule, Structural Adjustment	2	2	2	2	1
Correction	Correction	1	1	1	1	1
Schedule, Structural Adjustment	Schedule	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Schedule, Structural Adjustment	Structural Adjustment	2	1	2	1	0,5
Schedule, Structural Addition, Correction	Schedule, Structural Adjustment, Correction	3	3	3	2	0,666667
To-Do	Schedule, To-Do	1	2	2	1	0,5
Schedule, Structural Addition	Schedule, Comment	2	2	2	1	0,5

To-Do, Structural Adjustment	To-Do	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule	Schedule	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule, Structural Addition	Schedule, Structural Addition	2	2	2	2	1
To-Do, Schedule, Delete, Structural Adjustment	To-Do, Correction, Structural Adjustment, Delete	4	4	4	3	0,75
Schedule, Structural Addition	Schedule, Structural Addition	2	2	2	2	1
Schedule	Schedule	1	1	1	1	1
Structural Adjustment	Structural Adjustment	2	2	2	2	1
Structural Adjustment	Structural Adjustment	2	2	2	2	1
Structural Addition	Structural Adjustment, Structural Addition	1	2	2	1	0,5
Delete	Delete	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition	Question	1	1	1	0	0
Structural Addition, Content Addition	Structural Addition, Question	2	2	2	1	0,5
Content Adjustment, Comment	Comment, Content Adjustment	2	2	2	2	1
Correction	Content Adjustment	1	1	1	0	0
Structural Adjustment, Structural Addition	Structural Adjustment	2	1	2	1	0,5
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Comment, To-Do	To-Do, Comment	2	2	2	2	1
Comment	Comment	2	2	2	2	1

Content Adjustment	Content Adjustment	1	1	1	1	1
Content Addition	Content Addition	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
					ej	0,807778

Rater 2 vs Rater 3

Author 2	Author 3	n2j	n3j	nmax	enj	ej23
Interpersonal Communication	Interpersonal Communication	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Comment	To-Do, Comment	1	2	2	1	0,5
Content Addition, Structural Adjustment	Structural Addition	2	1	2	0	0
Comment, Reply	Comment, Reply	2	2	2	2	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction, Comment	Comment	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Comment	Comment	1	1	1	1	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Reply, Comment	Comment, Content Adjustment, Reply	2	3	3	2	0,666667
Reply	Reply	1	1	1	1	1
Correction	Comment	1	1	1	0	0
Comment, Reply	Reply	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Reply	Comment, Reply	1	2	2	1	0,5
Content Addition, Structural Addition, To-Do, Question	Structural Addition, Content Addition, To-Do	4	3	4	3	0,75
Structural Addition	Structural Addition	1	1	1	1	1
Delete	Delete	1	1	1	1	1
Structural Addition, Content Addition, Structural Adjustment	Structural Addition, Content Addition	3	2	3	2	0,666667
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1

Correction, Content Addition, Structural Addition	Correction, Content Addition	3	2	3	2	0,666667
Content Addition	Structural Addition, Content Addition	1	2	2	1	0,5
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Correction	Correction	1	1	1	1	1
Structural Addition, Content Addition	Structural Adjustment, Structural Addition	2	2	2	1	0,5
Structural Addition	Structural Addition	1	1	1	1	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Content Addition, Structural Addition	Content Addition, Structural Addition	2	2	2	2	1
Structural Adjustment, Content Addition	Structural Adjustment, Content Adjustment	2	2	2	1	0,5
Structural Addition, Content Addition	Structural Addition, Content Addition	2	2	2	2	1
Schedule	Schedule, Structural Adjustment	1	2	2	1	0,5
Content Adjustment	Content Adjustment	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule	Schedule, Correction	1	2	2	1	0,5
Schedule	Schedule, Structural Adjustment	1	2	2	1	0,5
Correction	Correction	1	1	1	1	1
To-do, Schedule	Schedule	2	1	2	1	0,5
Correction	Correction	1	1	1	1	1
Correction, Structural Adjustment	Structural Adjustment	2	1	2	1	0,5

Correction	Structural Adjustment	1	1	1	0	0
Schedule, Structural Adjustment, To-Do	Schedule, Structural Adjustment, Correction	3	3	3	2	0,666667
Structural Adjustment, Content Addition, Schedule, To-Do	Schedule, To-Do	4	2	4	2	0,5
Schedule, Comment	Schedule, Comment	2	2	2	2	1
To-Do	To-Do	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule	Schedule	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Correction	Correction	1	1	1	1	1
Schedule, Structural Addition	Schedule, Structural Addition	2	2	2	2	1
Structural Adjustment, Delete, Content Addition, Correction	To-Do, Correction, Structural Adjustment, Delete	4	4	4	3	0,75
Structural Addition, Content Addition, Schedule	Schedule, Structural Addition	3	2	3	2	0,666667
Schedule	Schedule	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Adjustment	Structural Adjustment, Structural Addition	1	2	2	1	0,5
Delete	Delete	1	1	1	1	1
Structural Addition	Structural Addition	1	1	1	1	1
Question	Question	1	1	1	1	1
Structural Addition, Question	Structural Addition, Question	2	2	2	2	1

Comment	Comment, Content Adjustment	1	2	2	1	0,5
Content Adjustment	Content Adjustment	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Structural Adjustment	Structural Adjustment	1	1	1	1	1
Content Addition	Structural Addition	1	1	1	0	0
Comment	To-Do, Comment	1	2	2	1	0,5
Content Addition	Comment	1	1	1	0	0
Content Adjustment	Content Adjustment	1	1	1	1	1
Structural Addition, Content Addition	Content Addition	2	1	2	1	0,5
Structural Addition	Structural Addition	1	1	1	1	1
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