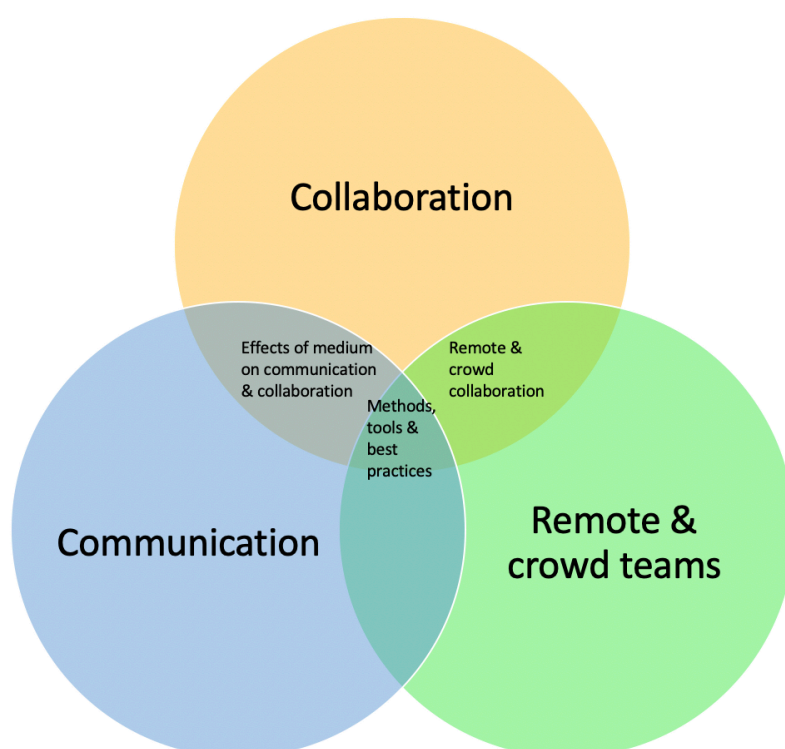




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The effects of the communication medium on collaboration quality and satisfaction in crowd teams



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1. Introduction

1.1 Problem statement

Many studies that investigate the quality of crowd team collaboration to date have primarily focused on collaboration through text chat (Bradner, Kellogg & Erickson, 1999) (Valentine et al., 2017) (Lykourantzou, Kraut & Dow, 2017). Valentine et al. (2017) state that crowdsourcing ‘mobilizes a massive online workforce into collectives of unprecedented scale, which includes crowd teams’. Previous research on group and interpersonal effects of the communication medium do not cover the topic of crowd teams (Daft and Lengel, 1986) (Hinds and McGrath, 2006) (Andre, Kraut & Kittur, 2014) and some were published before new technologies, such as the smartphone or tablet, became common (Walther, 1997) (Erickson and Kellogg, 2000). However, technological innovations provide the ability to collaborate in new forms, such as videoconferencing (De Ruyter et al., 2011) (Kauff and Schreer, 2002). It is not clear in what way the communication medium affects the quality of the collaboration and the satisfaction that crowd team members experience. Given that teams nowadays need to work more remotely and involving different participants, it is important to examine this aspect.

1.2 Research question

Based on the acquired information above, the following research question was formulated:

How does the medium affect the quality of collaboration and the satisfaction of participants in crowd teams?

1.3 Research method

The study consists of a combination of a literature study and experimentation. The literature study mainly focuses on two aspects. One, the related work that has been performed on remote and crowd teams, as well as the methods and best practices that have been used in remote and crowd collaboration. This part helps define the research gaps on the particular topic of remote and crowd teams. Two, the related work on the effects of the medium on communication in general. This part helps identify potential best practices that can be transferred to the field of remote and crowd teams.

The experimental part of the study includes an exploratory survey to examine the willingness of people to use certain communication media, followed by a comparison of two experimental groups, of which the first group focuses on text editing for synchronous collaboration (using the text editing application Etherpad).

The task assigned to the participants is of the creative type, being that the participants collaborate on creating a short story based on two keywords. Creativity can be defined as ‘a product that is new or original and useful or adaptive’ (Díaz Suarez, 2015). A short story ensures that the participants collaborate in order to write a coherent story. In this study, the minimum size of 10 teams per group is strived for so that the teams per group is large in order to be able to identify significant differences between the two experimental groups.

1.4 Objectives & expected outputs

The objective of the study is to propose guidelines that incorporate best practices for collaboration in crowd teams according to the communication medium. These guidelines are based on the results of the performed experiments.

2. Literature Review

This section describes the literature findings that have been gathered on the subject. The literature review consists of two parts. The first part encompasses the related work on the effects of the medium on communication and was intended to identify best practices that can be transferred to the field of remote and crowd teams. The second part describes the related work that has been performed until now on remote and crowd teams. Additionally, it also describes the methods and tools that have been used in remote and crowd collaboration. This part was intended to help define the research gaps on the remote and crowd teams. The figure below shows the concepts that are related to the research, with this research having a focus on crowd teams and the effect of the communication medium

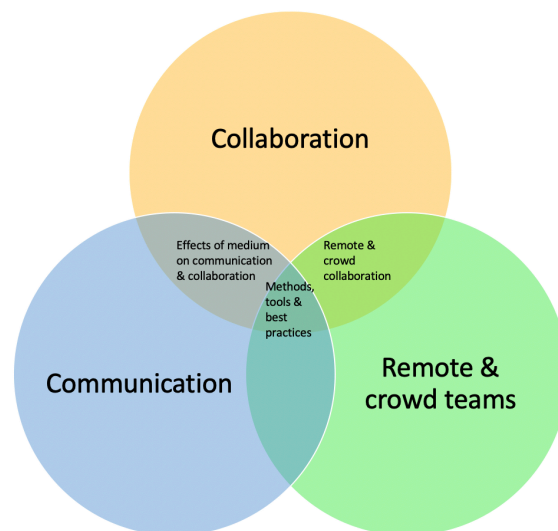


Figure 1: Concepts related to the research

2.1 Literature Research Protocol

For the literature search, a combination of two search methods was used, namely the Pearl growing method and the Snowball method. The Pearl growing method can be described as a literature search strategy that encompasses finding one relevant literature article and after that finding more similar literature (Libguides, 2019). This strategy was mainly used in the beginning of the literature search by making use of search terms in scientific search engines. Search terms used focused on the main concepts were, for instance, 'communication media collaboration', 'remote collaboration' and 'crowd team collaboration'. Furthermore, search terms were used that focused on particular communication media and collaboration, such as 'text editing collaboration', 'text chat collaboration', 'voice collaboration' and 'videoconferencing collaboration'. Later in the literature search, the focus shifted from gathering literature articles through a search engine with search terms to the literature articles that were already gathered earlier on in the search. The references of those articles were analyzed in order to gather additional literature on the subject by applying the Snowball method.

2.2 Effects of the medium on communication

In order to get a better overview of the literature and since there is a distinction in communication forms and communication media that are used, the matrix below shows the manner in which related work on effects of the medium on communication is classified.

Communication form	Communication medium
Asynchronous	Text, virtual environment etc.
Synchronous	Text, video, virtual environment etc.
Asynchronous & synchronous	Integrated communication platform

Table 1: Matrix classifying communication forms and media

Asynchronous

Text

Bradner, Kellogg & Erickson (1999) introduced a chat application called 'Babble', which is intended to make asynchronous communication possible between employees in the workplace. This study, however, does solely focus on Babble and was meant to explore the possibilities of text chat in collaboration. It does not compare text chat to other communication forms and how that affects collaboration quality. An interesting finding from this study is that the adoption of Babble was different between the different teams within the same organization.

An example of a study that examines crowd teams or remote teams and collaboration quality is a study by Valentine et al. (2017). In this study, 'flash organizations' are introduced and exist of crowds that are structured as organizations and are given the task of achieving complex and open-ended goals. The researchers used three flash organizations to conduct the experiments and each flash organization was given the task of creating an application using the system called Foundry, which enables text as well as video chat. The researchers concluded that, with flash organizations, it is possible for crowd teams to work in a more coordinated manner that makes it possible to achieve goals and collaborate in ways that were not possible before with crowd teams. However, it also became clear that flash organizations may not be suitable for all types of tasks. In addition, flash organizations must take into account cultural and time zone differences as a result of the collaboration of crowd team members around the world.

Another study that focused on collaboration using asynchronous text communication is the study by Kittur (2010). Participants of the experiment were asked to translate poems using the platform Etherpad. Participation of each user was shown in different colors. However, those tasks are relatively simple. The researcher states that future work should focus on rewards, motivation and the structuring of more complex work and that crowdsourcing still has limitations in what it can achieve in the current form.

Social media

The study by Begel, DeLine and Zimmermann (2010) examines how social media could be used in software engineering in order to collaborate and share information. Online communication can take many forms. For instance, online forums make it possible for software engineers to discuss new ideas for applications or requirements for working together. Furthermore, blogs can be used in a way that software engineers have the ability to call for other software engineers to solve certain technological or user problems in the software. Social media also has the benefit of receiving customer feedback, which is stated by the researchers to not be feasible before with other communication forms. Microblogs are mainly used in order to share ideas, knowledge and suggestions to other software engineers. Due to being more connected, according to the researchers the distribution of knowledge becomes more complete and lowers the chances of misunderstanding between team members. After a product is finished, a post-mortem takes place within teams which makes it possible to improve the processes and tools for future collaboration. However, social media also comes with challenges for communication between team members. It is also important that the privacy and reputation of teams are protected. Team members can get a reputation that is quite different than the goals and values of the team (Begel, DeLine & Zimmermann, 2010).

Synchronous

Text

Andre, Kraut and Kittur (2014) conducted a study on collaborative interdependent tasks and the effects of simultaneous and sequential work structures. The participants of the experiments were given the creative task of group limerick writing. The researchers, for these experiments, used a collaborative text editor tool called 'Etherpad' and concluded that the sequential work structure is more effective for increasing group sizes, while also concluding that there is no difference whether there is a realtime chatbox or not.

The study of Churchill and Bly (1999) considers the use of text-based MUDs (multi-user domains) for collaboration of teams, regardless of the time or distance between them. The text-based communication can either be synchronous or asynchronous. Within the organization where the experiments took place, it became clear that visual and auditory connections were not central to the collaboration, but that those are the informal conversations and the social relationships. However, more research is needed on how this compares in other (types of) organizations and if crowd teams are different in this respect.

Video

Bernstein et al. (2011) introduce two different techniques, namely the 'retainer model' and 'rapid refinement'. The retainer model technique means that participants are paid for waiting and to respond when that is necessary. On the other hand, rapid refinement means that, in synchronous crowds, agreements are sought and, according to that, the search is narrowed. This approach, in combination with the two techniques and systems, leads to recruitment of crowd workers within seconds and leads to better results. The study also concludes that synchronous crowds enable coordination and collaboration.

In the case of collaboration through video as a communication medium, privacy is a concern. However, it is possible to find a balance between the accuracy of the video material, while

also preserving the privacy of collaborators, as shown by the study of Boyle, Edwards & Greenberg (2000).

A study by Daft and Lengel (1986) does not focus on crowd teams, but on teams in an organization. One finding about communication media is that rich media have the ability to reduce equivocality and reaching agreements between team members.

An important conclusion from the study of De Ruyter et al. (2011) is that empathy plays a large role in availability judgments from video and silhouette representations. A higher empathy leads to the situation that a person has the ability to take the perspective of the other person and to judge the extent to which the other person is willing to interact and to collaborate.

Virtual environment

Benford et al. (1994) in their study performed an exploration of virtual environments in the context of collaboration. What can be concluded from this study is that virtual environments have the potential to support collaboration greatly because of the presence of space in virtual environments, making it easier for team members to interact with other team members through natural social skills.

Another study that explored virtual environments is the study by Furumo, de Pillis and Green (2009), in which the participants of the experiments were divided into two groups, namely participants who collaborated using the virtual environment and the other group collaborating face-to-face. The results of the experiments showed that there is a link between the performance, trust and satisfaction in virtual teams. It appears that trust and satisfaction were lower for virtual teams than for face-to-face teams. The reason for this is that the media richness is lower for virtual teams and makes it harder to communicate and solve problems. In order to overcome this, it is preferable that selected members of virtual teams are more trusting to other people, while not compromising other personality traits.

Asynchronous & synchronous

Integrated communication platform

While being rather an outdated study, the study by Cockburn & Greenburn (1993) is relevant because it introduces a flexible and customizable platform that integrates different communication media, such as text and digital phone. It was called Telefreek and was still in development at the time. Telefreek had the potential to make it easy for people to contact other people in a time that the World Wide Web was in its early stages. Another interesting finding is that it is explicitly stated that privacy was not taken into account, something that is required nowadays.

2.3 Classification of communication media

The table on the next page shows, for each type of communication media, the relevant literature review findings with the papers that support the findings.

	Literature Review Findings	
Type of medium	How does the medium affect remote teams in general (non-crowd)?	Supporting paper
Text chat (Slack, Microsoft Teams etc.)	<p>The number and roles of users that are needed for a sustainable communicative practice differ for practices.</p> <p>Informal conversations and social relationships become central to the collaboration, rather than visual and auditory connections. Text communication enables making new contacts and also maintaining existing contacts.</p>	<p>Bradner, Kellogg & Erickson (1999)</p> <p>Churchill and Bly (1999)</p>
Collaborative text (Etherpad, Google Docs, Wikipedia etc.)	<p>Despite the benefits of remote group work, remote collaboration can lead to motivation and coordination problems because of social process losses, which are motivational losses and coordination problems in the case of remote collaboration. Social process losses are higher for synchronous work structures than for sequential work structures. Real-time text chat does not have an effect when the design of a collaborative text takes place.</p> <p>Collabode, a web-based IDE, gives remote teams the ability to have instant participation by the team members that have a web browser installed. In addition, it provides user interfaces and visualizations that improve collaboration.</p> <p>The study by Shah, González-Ibáñez and Read (2015) investigated the impact of the spatial configuration on the collaborative writing process. The study showed that those pairs who collaborated remotely using text chat spent less effort than the pairs who worked in the same room. There were fewer social interactions, while the efficiency of writing was higher.</p>	<p>Andre, Kraut & Kittur (2014)</p> <p>Goldman, Little & Miller (2011)</p> <p>Shah, González-Ibáñez & Read (2015)</p>
Videoconferencing (Skype, Google Hangouts etc.)	<p>Video conferencing introduces privacy concerns among remote collaborators. The privacy can be protected by applying a blur and</p>	<p>Boyle, Edwards & Greenberg (2000)</p>

	<p>a pixelized filter to an appropriate level which also makes sure that the awareness is still preserved.</p> <p>Media richness (videoconferencing) has the ability to reduce equivocality and reaching agreements between team members.</p> <p>In videoconferencing, remote team members make availability judgments based on the empathy they have on the other person. Higher empathy means that a person is better able to take the perspective of the other person and to judge the extent to which the other person is willing to interact and to collaborate, decreasing the chance of misunderstandings.</p> <p>For physical tasks that need to be performed using video communication, a simple cursor is not sufficient enough to support collaboration. Representational and pointing gestures must be implemented in order for the collaborators to convey gestures. This greatly improves collaboration communication and performance and can be identical to local collaboration.</p> <p>Videoconferencing provides more flexibility for remote teams. In this study, a 3D-videoconferencing system is introduced, which provides immersive tele-presence and a natural representation of the team members, which increases the quality of human-centered communication. It also ensures good eye contact and shows the gestures that users make. For small teams, it provides the means for intense communication and effective collaboration.</p> <p>The study by Everitt et al. (2003) introduces a remote collaboration system based on video called Distributed Designers' Outpost, which uses post-it notes for interaction between the remote collaborators. Users of the system during the study stated that the system improved collaboration because spatial</p>	<p>Daft and Lengel (1986)</p> <p>De Ruyter et al. (2011)</p> <p>Fussell et al. (2004)</p> <p>Kauff and Schreer (2002)</p> <p>Everitt et al. (2003)</p>
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	<p>relationships are shown in real time. Another effect is that the presence awareness shadow was found important by the users as it felt as a frame of reference for the other remote collaborator. The study also showed that audio was of great importance for communication. This system helps to reduce the missing advantages of physical collaboration compared to remote collaboration in teams.</p> <p>Distributed teams have less opportunities to communicate informally but is necessary in order to achieve successful collaboration. For many communication technologies, it is hard to support informal communication because, with those technologies, the informal communication is brief. However, in order to have informal communication it is important to have communication channels that are both interactive and expressive. This study introduces a Mobile Remote Presence system (MRP) that integrates video and also supports informal communication between remote collaborators.</p>	<p>Lee and Takayama (2011)</p>
<p>Social Media/Forums</p>	<p>Online forums make it possible for software engineers to discuss new ideas for applications or requirements for working together. Furthermore, blogs can be used in a way that software engineers have the ability to call for other software engineers to solve certain technological or user problems in the software. Social media also has the benefit of receiving customer feedback, which is stated by the researchers to not be feasible before with other communication forms. Microblogs are mainly used in order to share ideas, knowledge and suggestions to other software engineers. Due to being more connected, according to the researchers the distribution of knowledge becomes more complete and lowers the chances of misunderstanding between team members.</p> <p>In requirements-centered social networks, the most important reason for team members of distributed teams to interact is the communication of changes. Distance does not</p>	<p>Begel, DeLine & Zimmermann (2010)</p> <p>Damian, Marczak & Kwan (2007)</p>

	affect the awareness of remote team members. However, distance does have an impact on how accessible other team members are. Moreover, distributed teams lack communication depth. Remote team members are for that reason unable to know who is working on the same task and to whom changes should be communicated. A collaborative system should be able to facilitate and coordinate those aspects.	
Voice only	Phone calls do not support spontaneous communication too well because one team member is not able to determine if the other team member is available to take the call or not. However, a phone call in itself can be undistinguishable from face-to-face conversation even though there is no existence of visual elements. This is compensated in communication by adding more verbal backchannels.	Hinds and Kiesler (2002) chapter 6

Table 2: Classification of communication media and literature findings

2.4 Remote teams and crowd teams

Next to studies that examine specifically the communication medium for communication and collaboration, there are also studies that focus on crowd, remote and distributed teams, which can be relevant for team building and coordination of communication. For example, Gilley et al. (2010) in their study present an integrated theoretical model for building effective teams. It is built on team-building philosophy and a number of different theories. Theories that have been separate before are integrated into one framework in this study. This framework provides a better way to design, develop, manage and build effective teams, which leads to better (organizational) results as a result of higher quality teams.

A study by Walther (1997) discusses the group and interpersonal effects in international computer-mediated collaboration. Even though the study can be considered outdated, the study contains some interesting findings, such as that diversity in a team can be advantageous, but that it can be a potential problem for long-term collaboration since in that case unity of the team is more important than the differences between the team members.

Next to the effectiveness of teams, the meaningfulness of a task given to crowd team members is of great importance, as shown by a study in 2013 by Chandler and Kapelner. The frame in which a task is described influences the effort that the workers will put in. An increase in meaningfulness will increase the output quality of the work. However, it shows no increase in collaboration quality.

Much of the research that has been done on crowd, remote or distributed teams focused on relatively simple tasks. However, the research by Kittur et al. (2011) introduced a framework

called CrowdForge, which enables the accomplishment of complex tasks in crowdsourcing. The framework supports breaking down tasks into subtasks and helps to manage the dependencies that exist between those subtasks so that crowd workers with a limited amount of time and effort are able to finish the tasks.

Next to CrowdForge, Kittur et al. (2013) introduced another framework in order to overcome the challenges that future crowd work will face. As stated by the researchers, there is a chance that crowd work will not be able to meet the potential and will only be suited for simple tasks, instead of also being suitable for more complex tasks that require more time and work effort from more crowd workers.

An example of a study that examines crowd teams or remote teams and collaboration quality is a study by Valentine et al. (2017). In this study, 'flash organizations' are introduced and exist of crowds that are structured as organizations and are given the task of achieving complex and open-ended goals. The researchers used three flash organizations to conduct the experiments and each flash organization was given the task of creating an application using the system called Foundry, which enables text as well as video chat. The researchers concluded that, with flash organizations, it is possible for crowd teams to work in a more coordinated manner that makes it possible to achieve goals and collaborate in ways that were not possible before with crowd teams. However, it also became clear that flash organizations may not be suitable for all types of tasks. In addition, flash organizations must take into account cultural and time zone differences as a result of the collaboration of crowd team members around the world.

Hossain (2012) researched motivation and the role that motivation has in users to participate in crowdsourcing projects online. Motivation can be categorized into two different types, namely intrinsic motivation and extrinsic motivation, which also in itself can be divided into the three types financial, social and organizational motivation.

Another study that focuses on motivation is the study by Rogstadius et al. (2011). The results tell that extrinsic motivators do not influence the quality of output by the workers. The intrinsic motivators, however, do increase the quality of output by the workers. Factors that can increase intrinsic motivation is framing a task in such a way that it becomes clear other people are helped when the task is performed.

A study by Allahbakhsh et al. (2013) introduces a framework that introduces quality-control to crowdsourcing. A possibility always exists that the skills of one or more team members will be insufficient for the task that needs to be accomplished. Quality is characterized by two different dimensions, namely the workers' profile and the task design.

The study by Araujo (2013) focuses mainly on design contests in crowdsourcing on the service '99designs' and the influence financial incentives have on the quality of the outcomes. It can be concluded that a higher amount of money does not lead to designers working harder, but that the eventual quality of the design will be better because of the fact that a larger number of designers will apply for the contest.

Erickson and Kellog (2000) state that the technology during that time period acted as a barrier between users that use digital media to communicate and collaborate. In order to create opportunities with digital media, it is of great importance to understand how to imitate human behavior by, for instance, being able to 'observe' the other person you are interacting with.

Another study (Park et al., 2013) examined crowd teams in a way that the competition element was introduced between different crowd teams, which leads to more motivation across participants and has the ability to crowdsource crowdsourcing itself and results in lower costs. Within the crowd teams, communication took place through text and figures, with the leader of the team coordinating the communication.

Lykourantzou et al. (2016) have studied personality types in crowd teams. For this study, a personality assessment tool was used in order to make a distinction between different personalities. Balanced and imbalanced teams were formed, both with the task of creating an advertisement. From the study, it appears that teams with balanced personalities lead to better quality collaboration. Collaboration was performed asynchronously using text comments in Google Docs.

Hinds and McGrath (2006) concluded that an informal hierarchical work structure is most appropriate for distributed teams with technologies that are used to collaborate. Additionally, a knowledge management system is suitable to coordinate knowledge sharing in distributed teams. It is also of great importance that the communication network of team members coincides with the work network, which encourages team members to communicate with the people they are supposed to collaborate with.

Horton and Chilton (2010) introduce a model that encompasses crowd workers that who work in crowdsourcing projects. In addition, the research introduces a reservation wage, which is the average minimal amount of money that a crowd worker is willing to take for the work and which plays a central role in the model. Even though the model cannot act as an exact prediction for wages for employers, it can still be useful as an approximation. There are also other limitations. Firstly, the model only predicts the amount of crowd workers who take the task and not the entire amount of people who have looked at the work offer and, secondly, the model does not make a distinction between different tasks. Some tasks require more experience than other tasks and, as the researchers state, that is something that could be studied in future work.

Mason and Watts (2009) have investigated financial incentives and the way that this influences the performance of the crowd workers. The results of the two performed experiments show that the quality of work does not improve when the financial incentives increase. However, the quantity of work does increase.

Mathieu et al. (2008) investigated team effectiveness in the time period of 1997-2007 and also specifically the technological advancements and what the future could look like. The researchers state that virtuality results in different combinations of team members and future research should determine if that is in fact advantageous to teams that are not distributed. Another finding is that four dimensions of virtuality, namely geographic dispersion, electronic

dispersion, structural dynamism and national diversity appear to have negative consequences for team innovation.

Muller et al. (2012) have shown that diversity among online teams influences the way that social software tools are adopted in the teams that are used to collaborate. Therefore, the researchers state it is important to adapt the design of online communities, the design of services for people searching for online communities and lastly, the design of organizations.

A study by Yang, Adamic and Ackerman (2008) investigated strategic user behavior on Taskcn, a Chinese crowdsourcing platform. Users are stated to be willing to take on a task if there is a chance that they will win the payment. Future work should, according to the researchers, for instance focus on the interface and how that could be changed in such a way that users who have won payments continue to be present on the platform. Additionally, the interface could also be improved so that there is a higher chance that users are matched to tasks that corresponds to the users' expertise.

The research by Lykourantzou, Kraut and Dow (2017) introduces a method called 'team dating', which encompasses a group of people performing small tasks before starting to perform more time-consuming and complex tasks together. Through team dating, people can indicate what people they prefer to work with. The results showed that the collaboration quality increases when the participants worked with the people they preferred working with. In the study, the researchers used synchronous communication through text-based chat as the form of communication between the participants. This is done in order to accommodate to people with slow internet connections and with privacy concerns in mind. Further research, however, is needed to study effects of richer environments on collaboration quality.

According to a study by Stokols et al. (2008) two aspects related to technology, namely technologic readiness and technologic infrastructure readiness, greatly impact both remote collaboration and collocated collaboration. Factors determining the technologic readiness of an organization, such as bandwidth and networking infrastructure are of great importance to support collaboration. In addition, technologic readiness, such as effectiveness of communication tools and style are also major factors that determine the success of collaboration.

Chapter 6 of the book 'Distributed Work' by Hinds and Kiesler (2002) discusses distributed teams and the effect the proximity of the team members has on collaboration. The study reveals that collocated collaborators need little effort to initiate conversation because of physical presence and also a visual channel. Communication is often initiated when people catch each other's eye. Many types of media do not support this. Physical proximity leads to more communication because of a higher chance of encounters between team members. In the case of video conferencing, this depends on the resolution of the video images. Phone calls also do not support this spontaneous communication well because one team member is not able to determine if the other team member is available to take the call or not. Text chat, on the other hand, offers the means to show availability by team members by showing team members who is online after starting the chat application. Additionally, chatrooms can be organized according to a certain topic or a work team that is working on the same project. This co-presence leads to the situation that team members are forming personal relationships

with each other, even though they are not able to see each other, because spontaneous communication will take place (Hinds and Kiesler, 2002). Another interesting finding from the book by Hinds and Kiesler (2002) is that the language that is used between team members is affected by a foundation of knowledge that the team members have, which is called mutual knowledge or common ground. Prior knowledge of another team member can indicate common ground even before collaboration has taken place. With the term grounding, the researchers formulate the process of determining what the team members do and do not understand while building common ground. An important result of the study regarding common ground is that the grounding costs for communication media are different. In the book, the authors also state that conversations that are interrupted are less successful because that increases the chances of ending the conversation earlier on and in that case the quality of communication is lower as well. While there is no visual channel for telephone communication, it is greatly suitable for grounding. The reason for this is that telephone communication has proved to be indistinguishable due to the fact that the lack of the visual channel is compensated by using more verbal backchannels (Hinds and Kiesler, 2002). On the other hand, with asynchronous text communication, such as e-mail, there is no existence of feedback during communication because there is a delay between messages. In order to avoid misunderstandings, it is important to be more explicit when making use of text-based communication, especially for e-mail for which it is more difficult to give feedback and correct a mistake compared to text chat (Hinds and Kiesler, 2002). Distributed team members have the tendency to choose collocated collaboration when they need to reach consensus, but choose e-mail when coordination is needed when the team members have the possibility to choose a communication medium (Hinds and Kiesler, 2002). Furthermore, it is stated in the book *Distributed Work* that, for videoconferencing, seeing the other person is insignificant for communication and collaboration. Video used for sharing data is more important than video that is used to just communicate with the other team member. A virtual environment is greatly suitable in the case of an object that is the subject of communication and if that object is within that virtual environment. Lastly, sharing screens can be satisfactory for some tasks during collaboration (Hinds and Kiesler, 2002).

According to Hinds and Kiesler (2002), there are a number of affordances that can be distinguished in the context of communication media, as shown in Figure 2 on the next page and with each affordance a definition.

Affordance	Definition
Audibility	Participants hear other people and sounds in the environment.
Visibility	Participants see other people and objects in the environment.
Tangibility	Participants can touch other people and objects in the environment.
Copresence	Participants are mutually aware that they share a physical environment.
Mobility	People can move around in a shared environment.
Contemporality	Participants are present at the same time.
Simultaneity	Participants can send and receive messages at the same time.
Sequentiality	Participants take turns, and one turn's relevance to another is signaled by adjacency.
Reviewability	Messages do not fade over time but can be reviewed.
Revisability	Messages can be revised before being sent.

Figure 2: Affordances of communication media (Hinds and Kiesler, 2002)

3. Hypotheses

Based on the findings that have resulted from the literature search (see section 2) and experiment design (see section 5) regarding the communication medium and the effect on collaboration and communication, the following hypotheses can be formulated:

Hypothesis	Hypotheses grounding in the literature
<ul style="list-style-type: none"> • H1: <i>There will be significant differences in the collaboration quality as measured by short story quality across different communication media</i> • H1a: <i>There will be significant differences in the characterization of short stories across different communication media</i> • H1b: <i>There will be significant differences in the image of short stories across different communication media</i> • H1c: <i>There will be significant differences in the story of short stories across different communication media</i> • H1d: <i>There will be significant differences in the voice of short stories across different communication media</i> • H3a: <i>The richer the communication, the higher the expressiveness will be among team members.</i> 	<ul style="list-style-type: none"> • In order to have informal communication it is important to have communication channels that are both interactive and expressive (Lee and Takayama, 2011). • Pairs who collaborate remotely using text chat spend less effort than the pairs who work in the same room. Less social interactions take place, while the efficiency of writing is higher (Shah, González-Ibáñez and Read, 2015).
<ul style="list-style-type: none"> • H2: <i>There will be significant differences in the satisfaction of collaboration by individual team members across different collaboration media.</i> • H3b: <i>The richer the communication medium, the higher quality social relationships will be built among team members.</i> 	<ul style="list-style-type: none"> • A balance is necessary in remote, distributed and crowd teams between building social relationships/common ground and the effort that is needed in order to get the actual task done effectively (Churchill and Bly (1999), Damian, Marczak and Kwan (2007)). • There are less misunderstandings in teams when common ground has been built (De Ruyter et al. (2011)). • Informal conversations and social relationships become central to the collaboration, rather than visual and

	<p>auditory connections. (Churchill and Bly, 1999).</p> <ul style="list-style-type: none"> • In order to have informal communication it is important to have communication channels that are both interactive and expressive (Lee and Takayama, 2011).
<ul style="list-style-type: none"> • H3: Medium richness affects collaboration. • H3c: <i>The richer the communication medium, the higher the quality of communication will be among team members.</i> • H3d: <i>The richer the communication medium, the higher the empathy will be among team members.</i> 	<ul style="list-style-type: none"> • In videoconferencing, remote team members make availability judgments based on the empathy they have on the other person. Higher empathy means that a person is better able to take the perspective of the other person and to judge the extent to which the other person is willing to interact and to collaborate, decreasing the chance of misunderstandings (De Ruyter et al., 2011). • Text chat offers the means to show availability by team members by showing team members who is online after starting the chat application. Additionally, chatrooms can be organized according to a certain topic or a work team that is working on the same project. This co-presence leads to the situation that team members are forming personal relationships with each other, even though they are not able to see each other, because spontaneous communication will take place (Hinds and Kiesler, 2002). • In requirements-centered social networks, the most important reason for team members of distributed teams to interact is the communication of changes. Distance does not affect the awareness of remote team members. However, distance does have an impact on how accessible other team members are. Moreover, distributed teams lack communication depth. Remote team members are for that reason unable to know who is working on the same

	<p>task and to whom changes should be communicated. A collaborative system should be able to facilitate and coordinate those aspects (Damian, Marczak and Kwan, 2007).</p>
<ul style="list-style-type: none"> • H3e: <i>The richer the communication, the higher the stereotyping will be among team members.</i> • H3f: <i>The richer the communication medium, the higher the distraction will be among team members.</i> • H4: <i>There will be a significant willingness to use richer communication media for collaboration.</i> • H4a: <i>There will be a significant willingness to collaborate writing a text with strangers using a text editor.</i> • H4b: <i>There will be a significant willingness to collaborate writing a text with strangers using a word processor with text chat functionality.</i> • H4c: <i>There will be a significant willingness to collaborate writing a text with strangers using voice communication.</i> • H4d: <i>There will be a significant willingness to collaborate writing a text with strangers using videoconferencing.</i> 	<ul style="list-style-type: none"> • Video conferencing introduces privacy concerns among remote collaborators (Boyle, Edwards & Greenberg, 2000). • The study by Shah, González-Ibáñez and Read (2015) investigated the impact of the spatial configuration on the collaborative writing process. The study showed that those pairs who collaborated remotely using text chat spent less effort than the pairs who worked in the same room. There were fewer social interactions, while the efficiency of writing was higher. • Videoconferencing provides more flexibility for remote teams. In this study, a 3D-videoconferencing system is introduced, which provides immersive tele-presence and a natural representation of the team members, which increases the quality of human-centered communication. It also ensures good eye contact and shows the gestures that users make. For small teams, it provides the means for intense communication and effective collaboration (Kauff and Schreer, 2002).
<ul style="list-style-type: none"> • H3g: <i>The richer the communication, the higher the presence awareness will be among team members.</i> 	<ul style="list-style-type: none"> • A phone call in itself can be undistinguishable from face-to-face conversation even though there is no existence of visual elements. This is compensated in communication by adding more verbal backchannels (Hinds and Kiesler, 2002). • The study by Everitt et al. (2003) introduces a remote collaboration system based on video called Distributed Designers' Outpost, which uses post-it notes for

	<p>interaction between the remote collaborators. Users of the system during the study stated that the system improved collaboration because spatial relationships are shown in real time. Another effect is that the presence awareness shadow was found important by the users as it felt as a frame of reference for the other remote collaborator. The study also showed that audio was of great importance for communication. This system helps to reduce the missing advantages of physical collaboration compared to remote collaboration in teams.</p>
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Table 3: Overview of research hypotheses

Since the hypotheses have a focus on the type of the communication medium and the medium richness, as well as the effects of the communication media on the quality of collaboration and satisfaction, these hypotheses can be linked to the following research question:

RQ: *How does the communication medium affect the quality of collaboration and the satisfaction of participants in crowd teams?*

4. Exploratory Survey

The exploratory survey was intended to determine the willingness of crowd workers to collaborate using different types of communication media, since research has shown that video conferencing, for instance, raises privacy concerns among remote collaborators (Boyle, Edwards & Greenberg, 2000). Additionally, in this research it is hypothesized that there is a significant willingness to use richer communication media in crowd teams (see section 3). For the questions in the exploratory survey a 5 Likert scale was used in order to give the participants the ability to either give a degree of agreement or disagreement or to remain neutral. The answer 1 in the scale represents completely disagree, while the answer 5 represents completely agree. Shown below are the questions and statements that were answered by the participants.

Questions

Q1: *Have you ever collaborated with other people online and remotely?*

- Yes, with people that I already knew
- Yes, with both people I knew and strangers
- Yes, only with strangers
- No, I have never collaborated with other people remotely

Q2: *If yes, how often?*

- Frequently
- Sometimes
- Rarely

Q3: *I would be willing to collaborate writing a text with strangers using a text editor. A text editor is, for example, Google Docs.*

Q4: *I would be willing to collaborate writing a text with strangers using a word processor with text chat functionality. A text editor with chat functionality is, for example, Etherpad (<https://etherpad.org/>).*

Q5: *I would be willing to collaborative writing a text with strangers using voice communication. A medium for voice communication is, for example, Skype.*

Q6: *I would be willing to collaborate with strangers using videoconferencing as the communication medium. A medium with videoconferencing is, for example, Skype Video or Google Hangouts.*

Q7: *Once I have built a social relationship/common ground with that other person, it will be easier for me to collaborate with them.*

Q8: *Richer communication media (e.g. videoconferencing or a virtual environment) would help me express myself more easily to my collaborator.*

Q9: Richer communication media (e.g. videoconferencing, or a virtual environment) would help me understand better what my collaborator is doing during our work together.

Q10: Could you give us some examples from your own experience to justify your answers above?

4.1 Results and analysis

The experiment was performed using an online crowd platform called Figure Eight. A total of 30 (N = 30) people filled in the survey from countries around the world, such as the United States, Venezuela, Germany and India. Using this online crowd platform, it was possible to gather the 30 responses in a little more than an hour.

The results show that, out of 30 (N = 30) people, only three have stated to never have collaborated with other people online and remotely. Two participants have stated to only have worked with strangers before, while 17 participants have worked only with people they already knew beforehand. Only eight participants have worked with both people they knew beforehand and strangers. It can be concluded that the majority of people have collaborated online and remotely, but only with people they knew beforehand. From the participants that have collaborated online and remotely, only two participants collaborated frequently, whereas 15 participants collaborated sometimes. 10 participants stated to have collaborated rarely. These results show that the majority of participants that collaborated online and remotely collaborated sometimes.

For each statement, the results are shown using a bar chart and a box plot chart. The bar chart shows the amount of answers from the participants for each answer in the Likert scale. The box plot chart shows a number of different things. Firstly, the cross within the rectangle shows the mean of the answers. Secondly, the horizontal line within the rectangle shows the median of the answers. Thirdly, the part of the rectangle below the median represents the first quartile, while the part above the median represents the third quartile. Lastly, the horizontal lines outside the rectangle show the outliers.

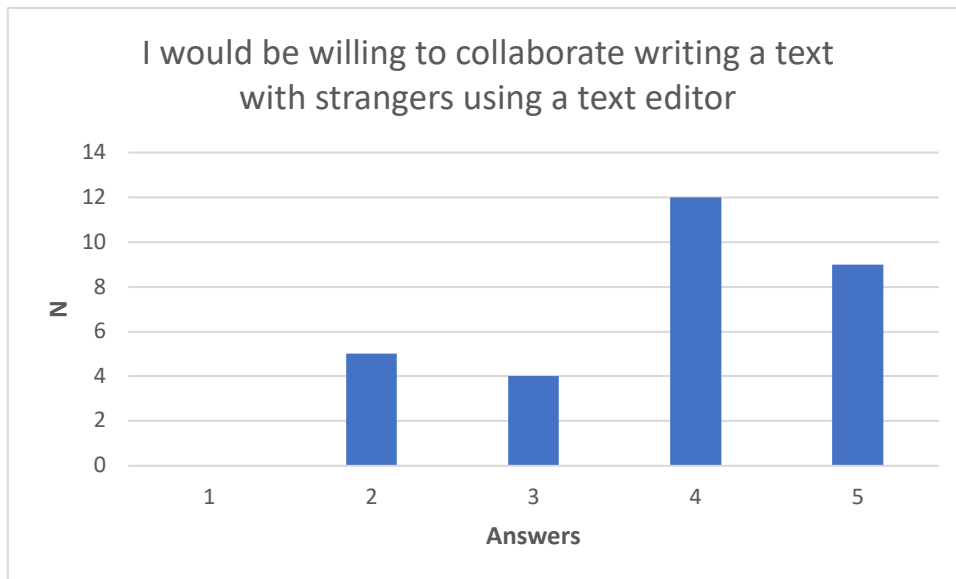


Figure 3: Bar chart showing results for collaborative text editing

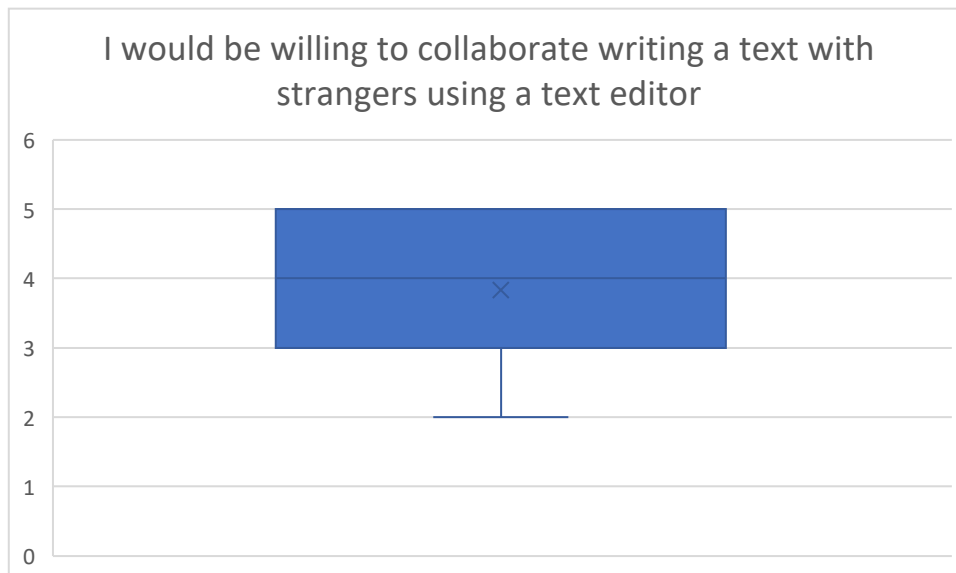


Figure 4: Box plot showing results for collaborative text editing

The two figures above show that a large part of the participants, namely 21 participants, would be either willing or completely willing to collaborate with strangers using a text editor. Four have stated to be neutral regarding this statement, while only five participants would not be willing to collaborate with strangers using a text editor. In order to form conclusions based on these results, the next step was to investigate the statistical significance. For this, the following hypothesis was used:

H4a: *People will not show a significant preference to collaborate writing a text with strangers using a text editor*

This hypothesis was then tested against a hypothetical mean of 3, which is neutral in the case of the scale used in the survey. Therefore, the null hypothesis is $H_0 \leq 3$ and the alternative

hypothesis $H1 > 3$. The hypothesis was then tested using a one sample t-test. The statistical test shows that $t(29) = 4.334$, $p < 0.001$. This shows that, with $p < 0.001$ the null hypothesis is rejected and that the result is extremely statistically significant. *People will show a significant preference to collaborate writing a text with strangers using a text editor.*

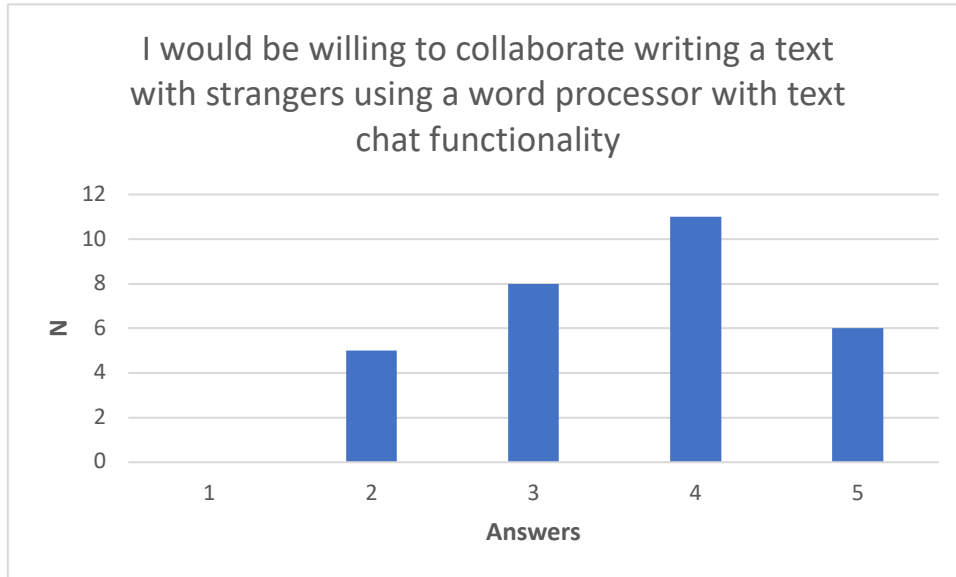


Figure 5: Bar chart showing results for text editing with text chat

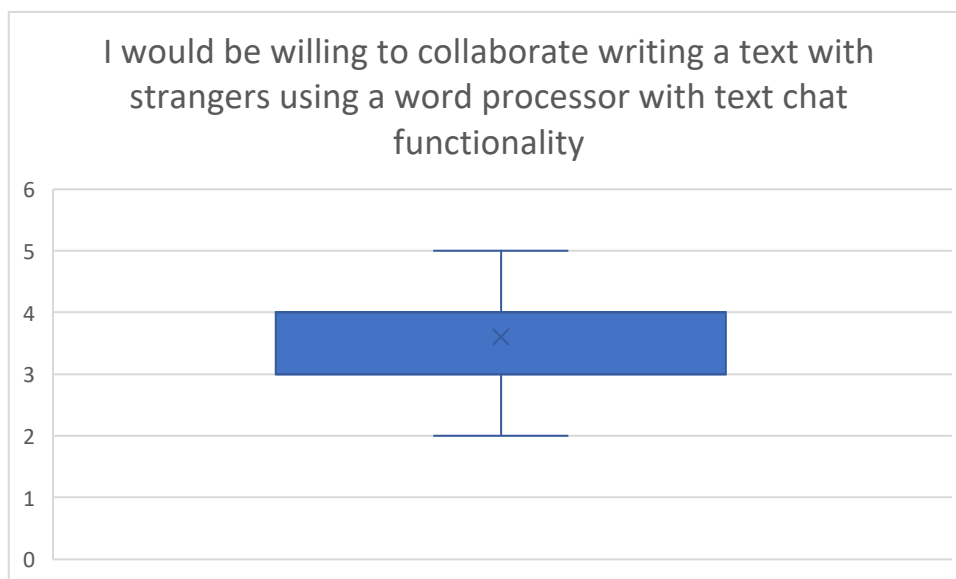


Figure 6: Box plot showing results for text editing with text chat

For collaboration using a word processor with text functionality, 17 participants either agreed or completely agreed. Five participants disagreed. However, eight participants stated to be neutral to this statement. For the testing of the statistical significance, the following hypothesis was used:

H4b: *People will not show a significant preference to collaborate writing a text with strangers using a word processor with text chat functionality*

Similar to the previous hypothesis, this hypothesis was tested against a hypothetical mean of 3, with $H_0 \leq 3$ as the null hypothesis and with $H_1 > 3$ as the alternative hypothesis. The one sample t-test shows that $t(29) = 3.275$, $p < 0.01$. This shows that, with $p < 0.01$ the null hypothesis is rejected and that the result is statistically significant. *People will show a significant preference to collaborate writing a text with strangers using a word processor with text chat functionality.*

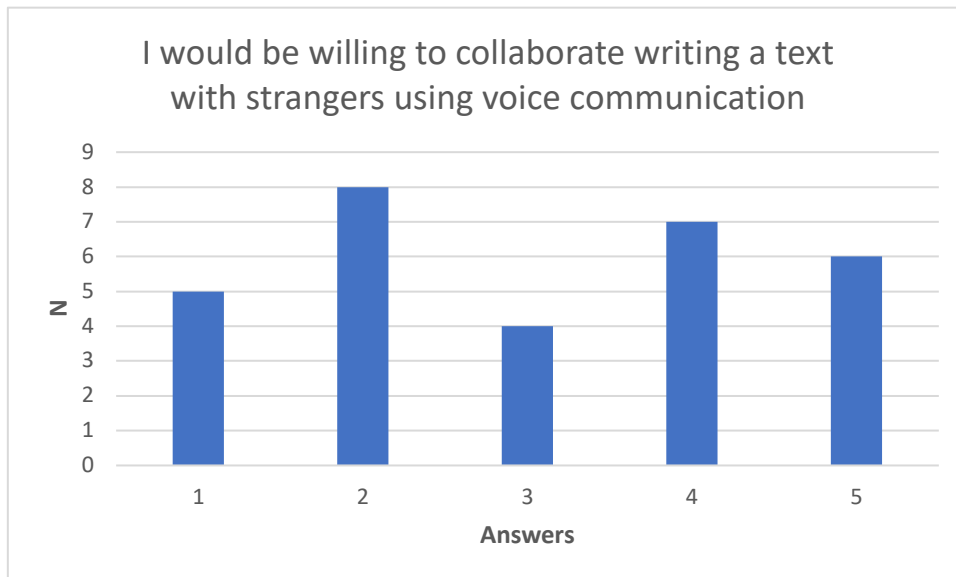


Figure 7: Bar chart showing results for voice communication

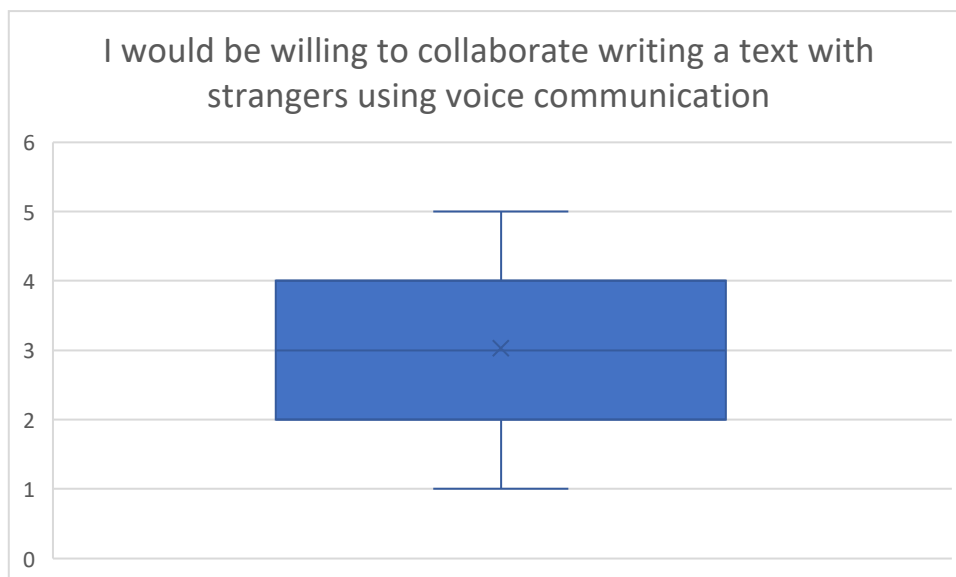


Figure 8: Box plot showing results for voice communication

Looking at the two figures above, it becomes clear that there is a lot of division between the participants about the willingness to collaborate with strangers using voice communication. Only four ($N = 4$) participants have stated to be neutral to this statement. Seven participants stated to agree with the statement, while six participants completely agreed. Furthermore,

eight participants agreed and five participants completely disagreed. It can, therefore, be concluded that the number of participants that either completely disagreed or disagreed and the amount that either completely agreed or agreed is equal. For the testing of the statistical significance, the following hypothesis was used:

H4c: *People will not show a significant preference to collaborate writing a text with strangers using voice communication*

This hypothesis was tested against a hypothetical mean of 3, with $H_0 \leq 3$ as the null hypothesis and with $H_1 > 3$ as the alternative hypothesis. The one sample t-test shows that $t(29) = 0.128, p > 0.05$. This shows that, with $p > 0.05$ the null hypothesis is not rejected and that the result is not statistically significant. *People **will not** show a significant preference to collaborate writing a text with strangers using voice communication.*

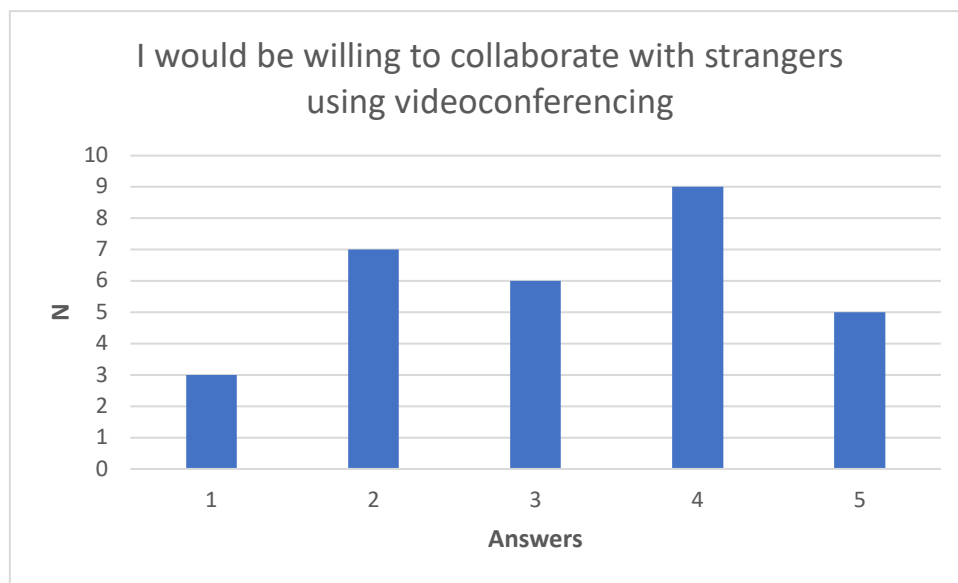


Figure 9: Bar chart showing results for videoconferencing

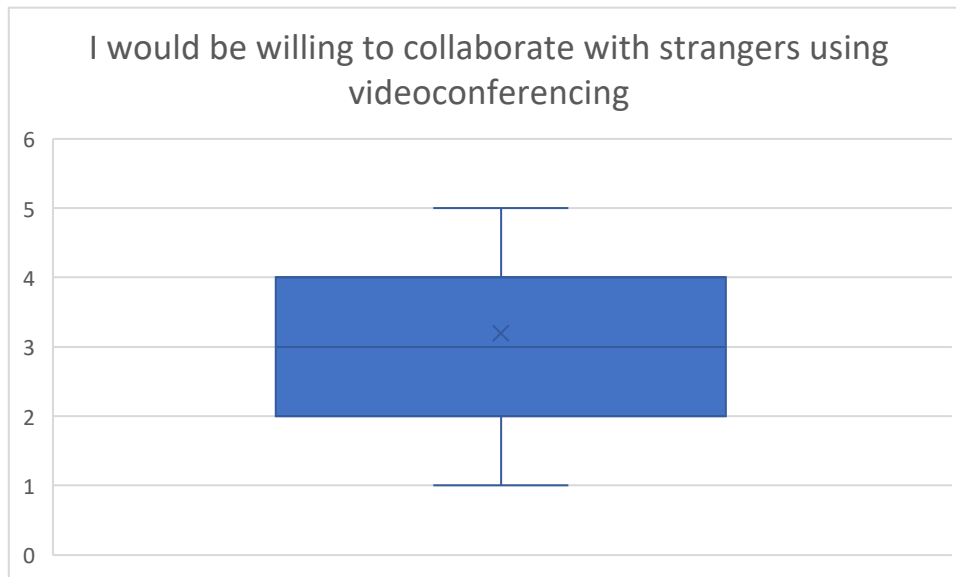


Figure 10: Box plot showing results for videoconferencing

The two figures above show that 10 participants are not willing or completely not willing to use videoconferencing as a communication medium for videoconferencing. Six participants are neutral about videoconferencing for collaboration. Additionally, nine participants agree to the statement, while four participants completely agree. For the testing of the statistical significance, the following hypothesis was used:

H4d: People will not show a significant preference to collaborate writing a text with strangers using videoconferencing

This hypothesis was tested against a hypothetical mean of 3, with $H_0 \leq 3$ as the null hypothesis and with $H_1 > 3$ as the alternative hypothesis. The one sample t-test shows that $t(29) = 0.862$, $p > 0.05$. This shows that, with $p > 0.05$ the null hypothesis is not rejected and that the result is not statistically significant. *People **will not** show a significant preference to collaborate writing a text with strangers using videoconferencing.*

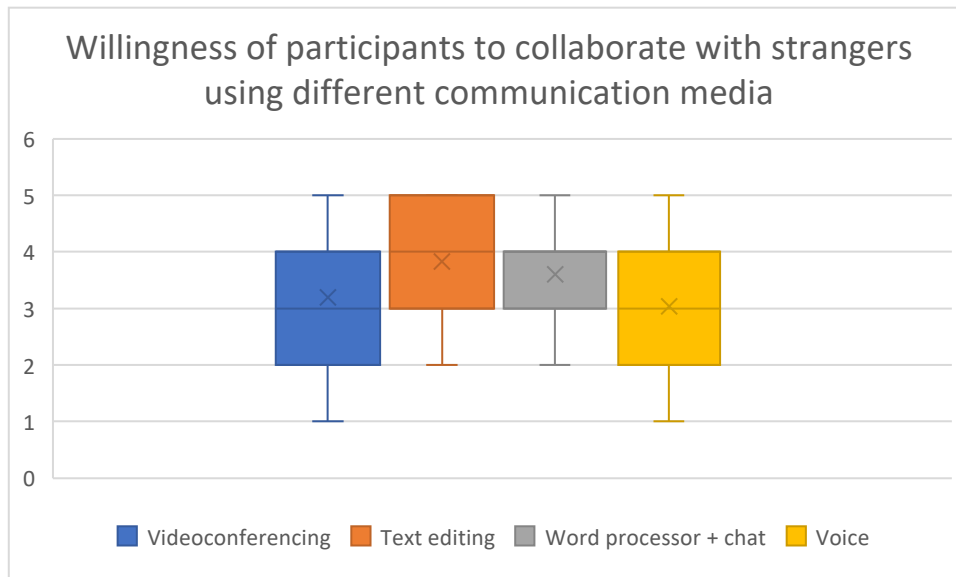


Figure 11: Box plot comparing the four communication media

The box plot chart above shows a comparison of the results of the different communication media covered in the exploratory survey. From the box plot it becomes clear that the participants are less positive to collaboration with strangers using a word processor with text chat functionality compared to text editing only. However, the participants did show a significant willingness to collaborate using text editing only and a word processor with text chat. Additionally, the participants did not show a significant preference to collaborate using voice communication or videoconferencing compared to collaboration using a word processor with chat functionality. Lastly, the participants were more positive to videoconferencing compared to voice communication, with an equal number of participants agreeing and disagreeing with the statement for voice communication.

5. Experiment

This section provides a description of the experiments that were performed in order to determine the effect of the communication medium on collaboration quality and satisfaction. For the experiments, people on crowd platform Figure Eight were asked to participate. People who were willing to participate were asked to open a link to join one of the groups described below.

5.1 Experimental groups

Two participants together formed one team and each team was assigned to a group. The results of the exploratory survey (see section 5.1) showed that, only for collaboration using text editing only and for collaboration using a word processor with text chat, a significant preference was shown to use these communication media to collaborate. Therefore, it was decided to use the following two groups:

- 1) Collaborative text editing only group → This group wrote a text without having text chat as an additional functionality. This was done using the text editor Etherpad.
- 2) Collaborative text editing + text chat group → This group wrote write a text with text chat as an additional functionality. Similar to the first condition, Etherpad was used, but with the ability to send text messages turned on.

5.2 Task description

People that were interested to participate received instructions of the experiment first. The task that was assigned to the participants was the same for each group, but the manner in which the task had to be finished differed depending on the assigned condition.

The next step in the experiment was the task itself. Each group had exactly 10 minutes to collaborate synchronously to finish the task. A time constraint was applied on the experiment so that the experiment stopped when the given time was over and so that each group had exactly the same time to do the task. A study by Ocker & Yaverbaum (1999) concluded that people are less satisfied with asynchronous collaboration than with synchronous face-to-face collaboration. Since this experiment is in the context of remote and crowd teams, it was decided to use remote synchronous collaboration for the experiment. However, Galegher and Kraut (1994) describe intellectual teamwork, which consists of working together over substantial periods of time and extensive information sharing and coordination, of which those communication needs vary over time and tasks. A short story can be regarded as less complex and time demanding and, for that reason, it was decided to use one session of 10 minutes in which the participants could finish their task.

The task that the participants were asked to do was to collaborate with the other team member to write a short story. According to Galegher and Kraut (1994), *'to work together on complex projects, people must agree on a set of shared goals, coordinate the actions of contributors, and weave the components they have created independently into a unified whole.'* This also applies to writing a short story, in which the participants have to coordinate and make sure that the parts that they each have written fit together in the end. In order to

give a direction to the story and to make it easier to perform quality comparisons between the groups, the groups were given two keywords. One keyword, sailor, describes the character that the story should be about. The second keyword, an uninhabited island, is the location where the character is located or travelling to. The task of the two team members was then to collaborate to write a story based on the two keywords.

5.3 Variables

In order to evaluate the collaboration quality and satisfaction between the crowd team members, two types of variables were used:

- *Post-experiment survey.* The participants were asked to fill in a survey after the 10 minutes had elapsed. In this survey, the participants were asked to give their opinion on their perceived quality of the story they had written and the satisfaction of collaborating with their teammate, as well as their opinions on the quality of social relationships, empathy, quality of communication, distraction, stereotyping, expressiveness and presence awareness. The statements in the post-experiment survey are based on the hypotheses that are formulated in section 4.
- *Short story quality.* The quality of the written work was evaluated by crowd workers by analyzing the short story and filling in a survey afterwards. This quality analysis was based on the study of Díaz Suarez (2015) and Mozaffari (2013) on evaluating creativity and short stories.

5.4 Post-experiment survey

Questions

The post-experiment survey was mainly intended to determine the opinions on their perceived quality of the story and the satisfaction collaboration, as well as the effects of media richness. Similar to the exploratory survey, a 5 Likert scale was used, with answer 1 in the scale being completely disagree and 5 completely agree. Shown below are the questions and statements that were answered by the participants.

Q1: *I am satisfied with the quality of the story that has resulted from the collaboration.*

Q2: *I am satisfied with the collaboration with the other team member.*

Q3: *I felt that I was building a social relationship with my teammate during the collaboration.*

Q4: *I felt that I empathized with my teammate during the collaboration.*

Q5: *I am satisfied with the communication with my teammate during the collaboration.*

Q6: *I felt distracted during the collaboration.*

Q7: *Stereotyping of my teammate has influenced the collaboration.*

Q8: *I was able to express myself clearly during the collaboration.*

Q9: *I felt aware of what my teammate was doing/thinking.*

Q10: *The text chat functionality has benefited the collaboration (only if you were allowed to use it).*

Q11: *I would be better able to collaborate with the other team member if I were able to use the text chat functionality (only if you were not allowed to use it).*

Q12: *Do you have any other comments?*

Results

Similar to the exploratory survey, the experiment and post-experiment survey were performed using the online crowd platform called Figure Eight. A total of 69 (N = 69) people took part in the experiment. The results show that, out of 69 people, 41 participants took part in the text editing only condition, while 28 participants took part in the text editing with text chat condition. For each statement in the post-experiment survey, a comparison between the two groups is shown using a box plot chart, showing for instance the mean and median of the answers in Likert scale from the participants. The statistical significance of the results was tested using the independent-samples test, since there are two groups that are independent and that need to be compared. For the last two statements, however, the required statistical test was a one sample t-test since these statements were filled in by only one of the two groups.

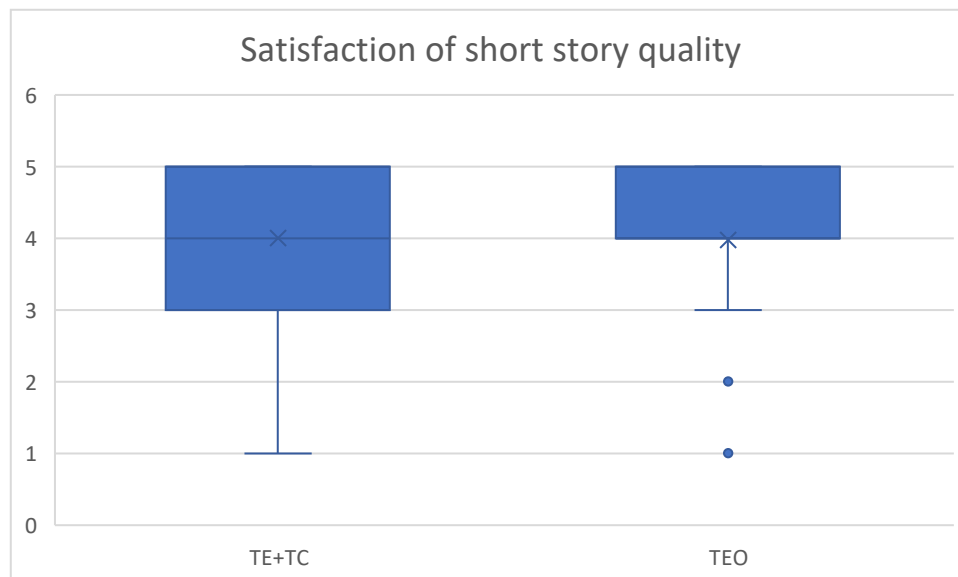


Figure 12: Box plot showing results for satisfaction of short story quality

Figure 12 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the satisfaction of the perceived short story quality of the participants. For the testing of statistical significance, the following null hypothesis was used:

H1: People will not show a significant difference in satisfaction of perceived short story quality when using text editing with text chat

The independent samples statistical test shows that $t(69) = 0.098$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. People **will not** show a significant difference in satisfaction of short story quality when using text editing with text chat.

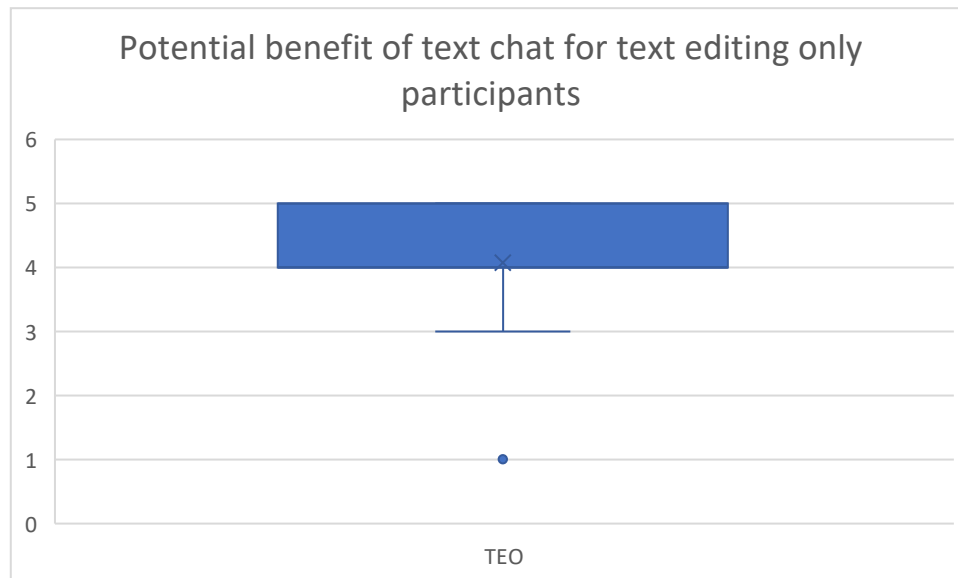


Figure 13: Box plot showing results for the potential benefit of text chat

Figure 13 above shows the box plot chart for the text editing only (TEO) condition for the potential benefit of text chat for the participants. For the testing of statistical significance, the following null hypothesis was used:

H1: People will not show a significance in that text chat would be beneficial when using text editing only

This hypothesis was tested against a hypothetical mean of 3, with $H_0 \leq 3$ as the null hypothesis and with $H_1 > 3$ as the alternative hypothesis. The one sample t-test shows that $t(41) = 7.166$, $p < 0.05$. With $p < 0.05$, the null hypothesis is rejected so the results in this case are statistically significant. People **will** show a significant difference in that text chat would be beneficial when using text editing only.

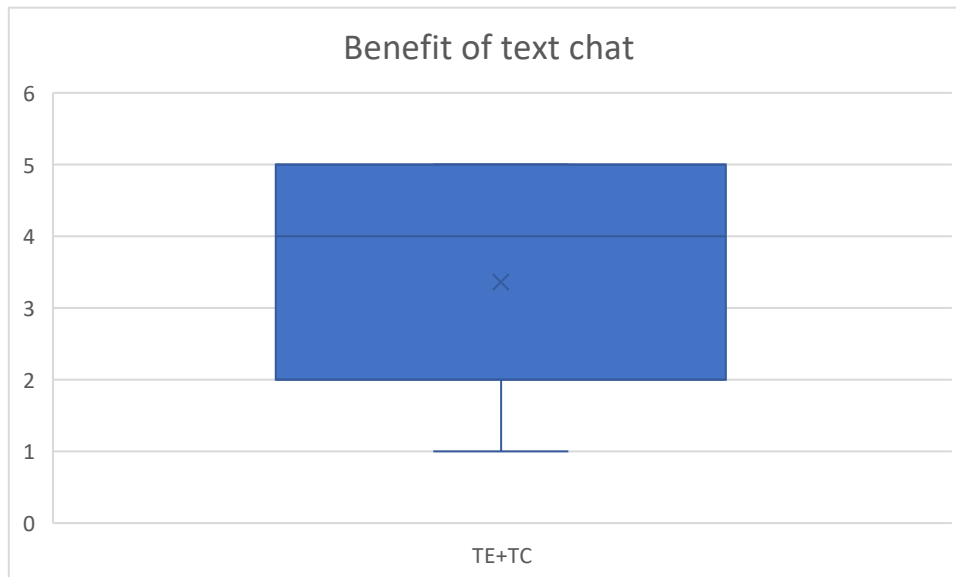


Figure 14: Box plot showing results for the benefit of text chat

Figure 14 above shows the box plot chart for the text editing with text chat (TE+TC) condition for the benefit of text chat for the participants. For the testing of statistical significance, the following null hypothesis was used:

H1: People will not show a significance in text chat being beneficial when using text editing with text chat

This hypothesis was tested against a hypothetical mean of 3, with $H_0 \leq 3$ as the null hypothesis and with $H_1 > 3$ as the alternative hypothesis. The one sample t-test shows that $t(28) = 1.243$, $p > 0.05$. With $p > 0.05$, the null hypothesis is not rejected so the results in this case are not statistically significant. ***People will not show significance in text chat being beneficial when using text editing with text chat.***

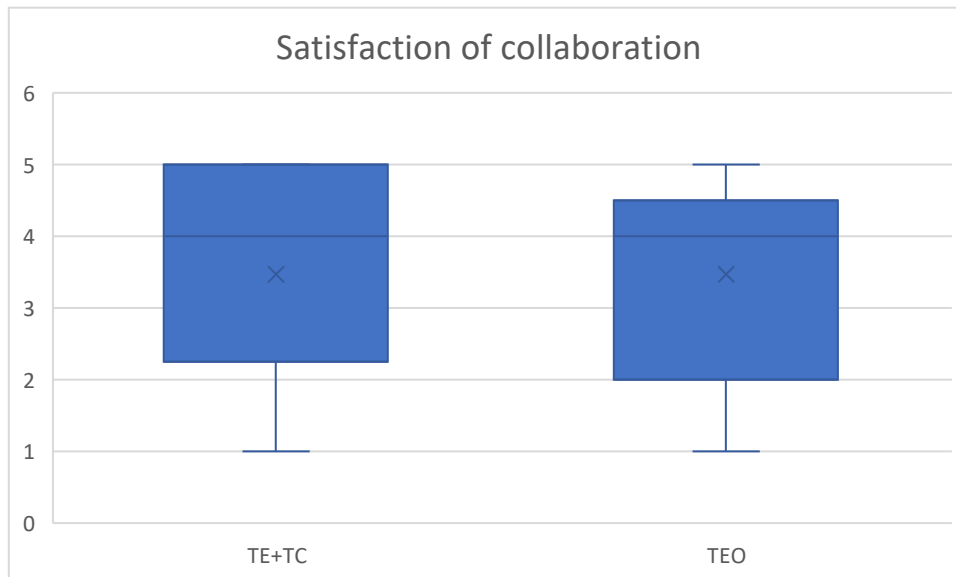


Figure 15: Box plot showing results for satisfaction of collaboration

Figure 15 above shows a box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for satisfaction of collaboration statement in the post-experiment survey. As can be seen in the box plot start, a Likert scale from 1 to 5 was used for the survey. For the testing of statistical significance, the following null hypothesis was used:

H2: *People will not show a significant difference in satisfaction of collaboration when using text editing with text chat*

The independent samples statistical test shows that $t(69) = 0.002, p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. **People will not show a significant difference in satisfaction of collaboration when using text editing with text chat.**

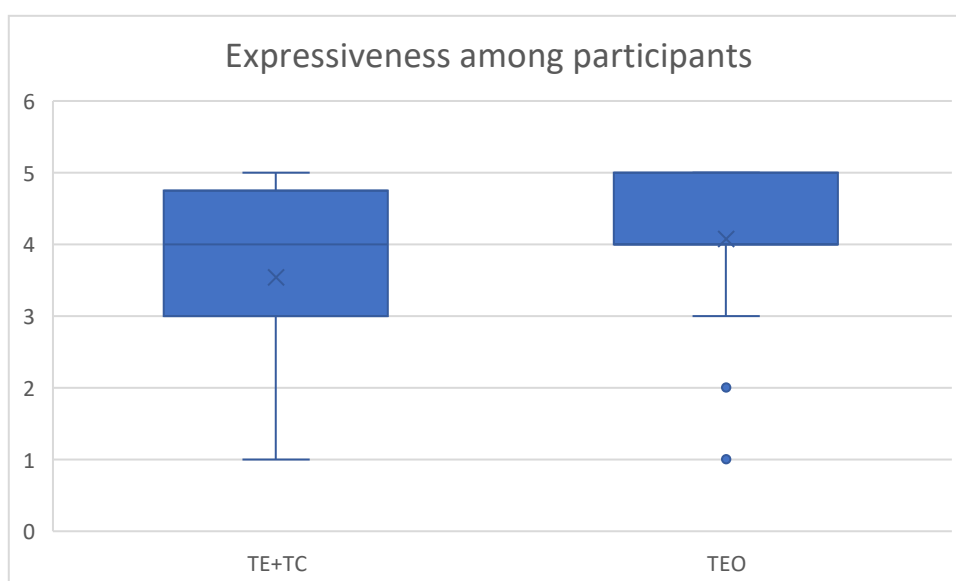


Figure 16: Box plot showing results for expressiveness among participants

Figure 16 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the expressiveness among the participants. For the testing of statistical significance, the following null hypothesis was used:

H3a: *People will not show a significant difference in expressiveness when using text editing with text chat*

The independent samples statistical test shows that $t(69) = -1.961$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *People will not show a significant difference in expressiveness when using text editing with text chat.*

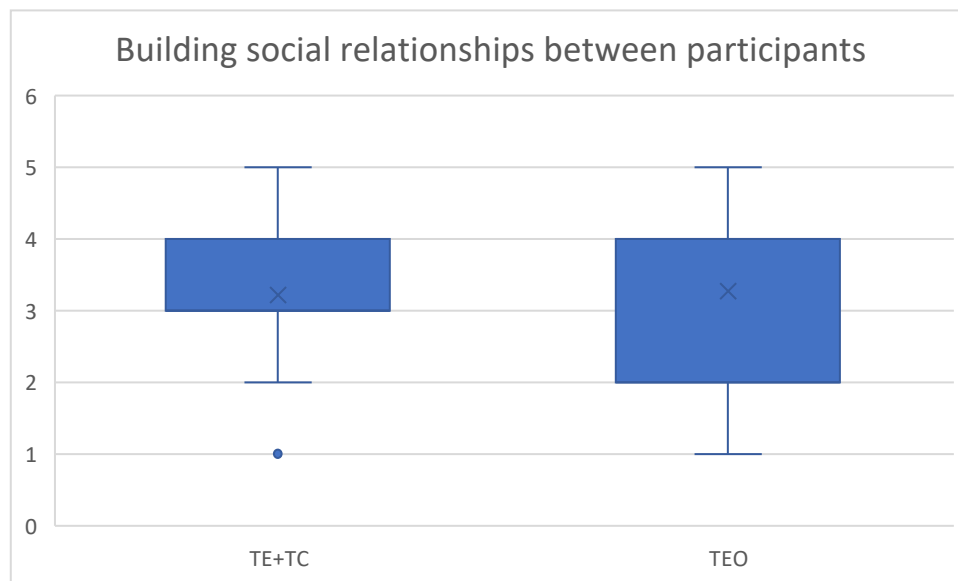


Figure 17: Box plot showing results for social relationships between participants

Figure 17 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the social relationships between the participants. For the testing of statistical significance, the following null hypothesis was used:

H3b: *People will not show a significant difference in building social relationships when using text editing with text chat*

The independent samples statistical test shows that $t(69) = -0.163$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *People will not show a significant difference in building social relationships when using text editing with text chat.*

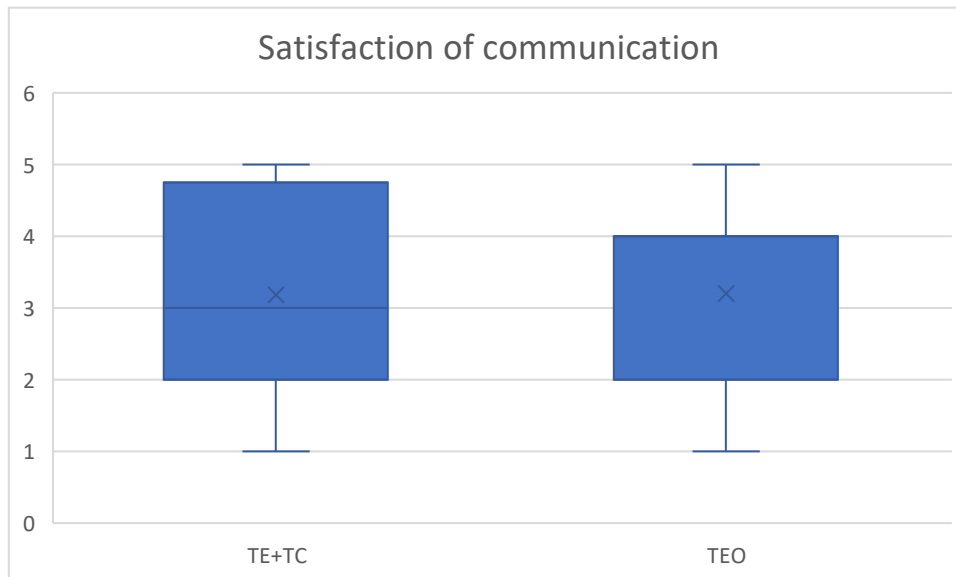


Figure 18: Box plot showing results for satisfaction of communication

Figure 18 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for satisfaction of communication. For the testing of statistical significance, the following null hypothesis was used:

H3c: People will not show a significant difference in satisfaction of communication when using text editing with text chat

The independent samples statistical test shows that $t(69) = -0.048$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. **People will not** show a significant difference in satisfaction of communication when using text editing with text chat.

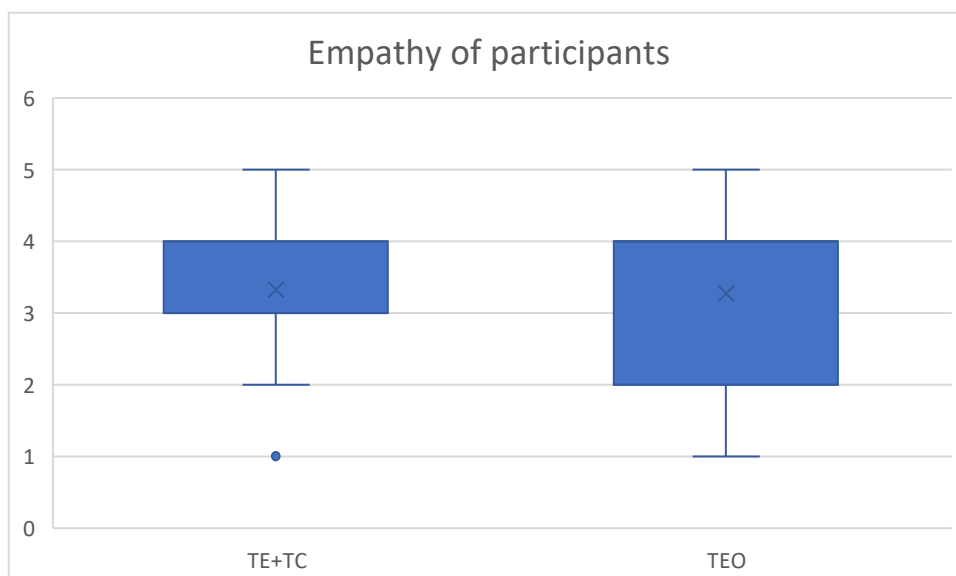


Figure 19: Box plot showing results for empathy of participants

Figure 19 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the empathy of the participants. For the testing of statistical significance, the following null hypothesis was used:

H3d: *People will not show a significant difference in empathy when using text editing with text chat*

The independent samples statistical test shows that $t(69) = 0.159$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *People will not show a significant difference in empathy when using text editing with text chat.*

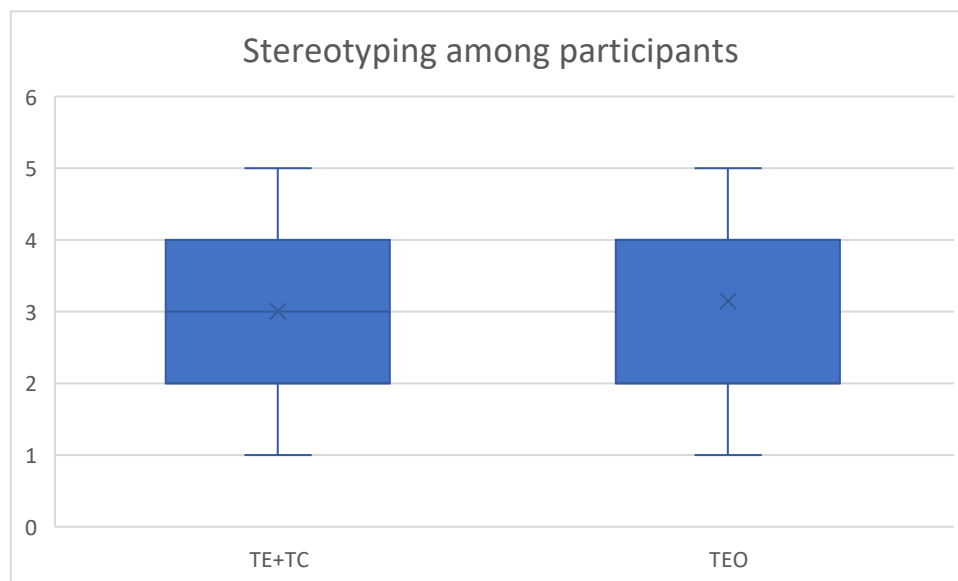


Figure 20: Box plot showing results for stereotyping among participants

Figure 20 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the stereotyping among the participants. For the testing of statistical significance, the following null hypothesis was used:

H3e: *People will not show a significant difference in stereotyping when using text editing with text chat*

The independent samples statistical test shows that $t(69) = -0.486$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *People will not show a significant difference in stereotyping when using text editing with text chat.*

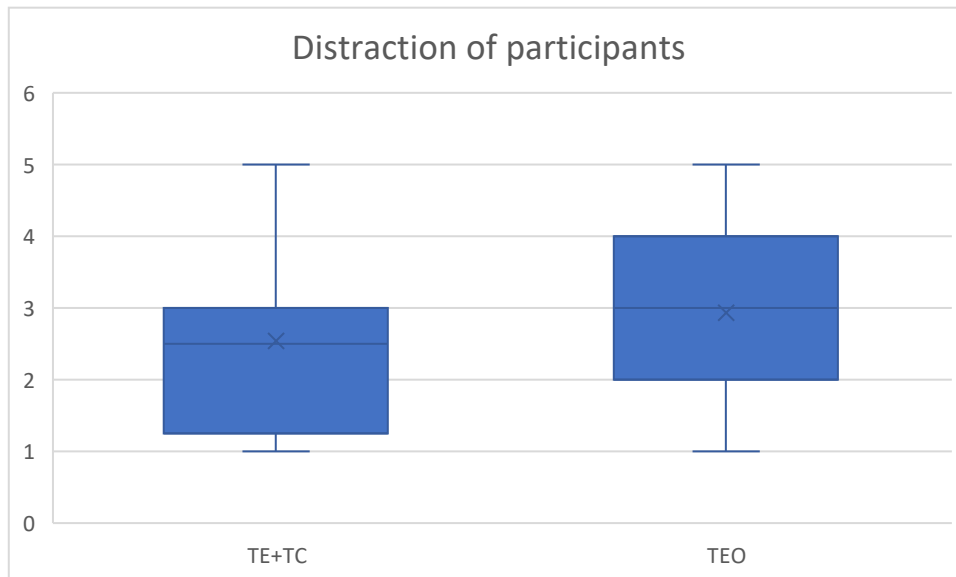


Figure 21: Box plot showing results for distraction of participants

Figure 21 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the distraction of the participants. For the testing of statistical significance, the following null hypothesis was used:

H3f: People will not show a significant difference in distraction when using text editing with text chat

The independent samples statistical test shows that $t(69) = -1.174, p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. **People will not show a significant difference in distraction when using text editing with text chat.**

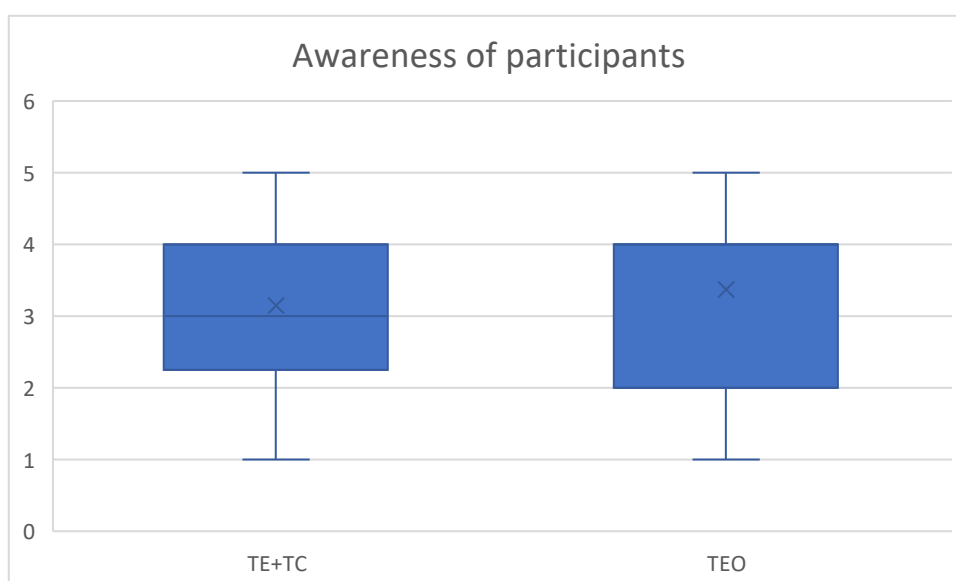


Figure 22: Box plot showing results for awareness of participants

Figure 22 above shows the box plot chart for the comparison between text editing only (TEO) and text editing with text chat (TE+TC) for the awareness between the participants. For the testing of statistical significance, the following null hypothesis was used:

H3g: *People will not show a significant difference in awareness of team members when using text editing with text chat*

The independent samples statistical test shows that $t(69) = -0.727, p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *People will not show a significant difference in awareness of team members when using text editing with text chat.*

5.5 Short story quality

By choosing for writing a short story as the task for the participants in the experiment, a task of the creative type was performed. To recall, creativity can be defined as a new or original product that is useful or adaptive (Díaz Suarez, 2015). Creating a short story was chosen to stimulate the participants to collaborate in order to write a coherent story based on two keywords. Collaboration, communication satisfaction and the effects of media richness on, for instance, expressiveness and distraction are aspects that can be asked to the participants. However, determining the quality of the short story, the product in this case, requires a more thorough analysis. Many rubrics that are created for evaluating creative writing have a number of problems, being that the criteria were too general or focused on aspects, such as punctuation, grammar, spelling and syntax as well as missing some important aspects (Díaz Suarez, 2015). Therefore, Díaz Suarez (2015) suggests the use of a creative writing rubric created by Mozaffari (2013), which overcomes the aforementioned problems (see Figure 23 below). Since creativity is central to the task given to the participants for this experiment, the rubric by Mozaffari (2013) served as a basis for the short story quality analysis task.

Criteria	4. Excellent	3. Good	2. Fair	1. Poor
Image	Maximal use of significant details (there is no or just 1 abstraction, generalization and judgment)	Several use of significant details (they are significantly more than abstractions, generalizations and judgments)	Minimal use of significant details (they are significantly less than abstractions, generalizations and judgments)	No use of significant details (sole use of abstractions, generalizations and judgments)
Characterization	Maximal use of characters' physical appearance, action, thought, symbol, etc. to reveal characters (complete indirect characterization)	Several use of characters' physical appearance, action, thought, symbol, etc. to reveal characters	Minimal use of characters' physical appearance, action, thought, symbol, etc. to reveal characters	No use of characters' physical appearance, action, thought, symbol, etc. to reveal characters (complete direct characterization)
Voice	Maximal use of images to make the voice appealing	Several use of images to make the voice appealing	Minimal use of images to make the voice appealing	No use of images to make the voice appealing
Story	The use of narrative to convey purpose.	-	-	No use of narrative to convey purpose (purpose is conveyed through formal statement)

Figure 23: Criteria of the creative writing rubric (Mozaffari, 2013)

Questions

The participants of the short story quality analysis were asked to answer the following survey questions, which are based on the creative writing rubric by Mozaffari (2013). Contrary to the exploratory survey and post-experiment survey, a 4 Likert scale was used so that the participants would give either a positive or negative answer and increasing the chances of finding significant differences between the text editing only and text editing with text chat groups. The answer 1 in the scale represents poor, while the answer 4 represents excellent.

Q1: *How would you rate the quality of the image of the short story?*

Q2: *How would you rate the quality of the characterization of the short story?*

Q3: *How would you rate the quality of the voice of the short story?*

Q4: *How would you rate the quality of the story of the short story?*

Q5: *What overall grade would you give the short story?*

Poor 1 2 3 4 5 6 7 8 9 10 Excellent

Q6: *Could you give us some justification for your answers above?*

Q7: *Do you have any other comments?*

Results

For the short story quality, the experiment was performed using the online crowd platform Figure Eight, similar to the exploratory survey and short story writing task. A total of 109 (N = 109) responses resulted from the experiment after cleaning duplicates, with 63 responses for the first condition text editing only and 46 responses for the second condition text editing with text chat. Each participant was given one short story to analyze from one of the two groups. For the statements in the short story quality survey, a box plot chart was used for showing the mean and median of the answers and to compare between the text editing only condition and text editing with text chat condition. The statistical significance of the results was tested using the independent-samples test, since there was one group for each of the two groups and that needed to be compared. Based on the rubric by Mozaffari (2013), a scale from 1 to 4 was used for the survey.

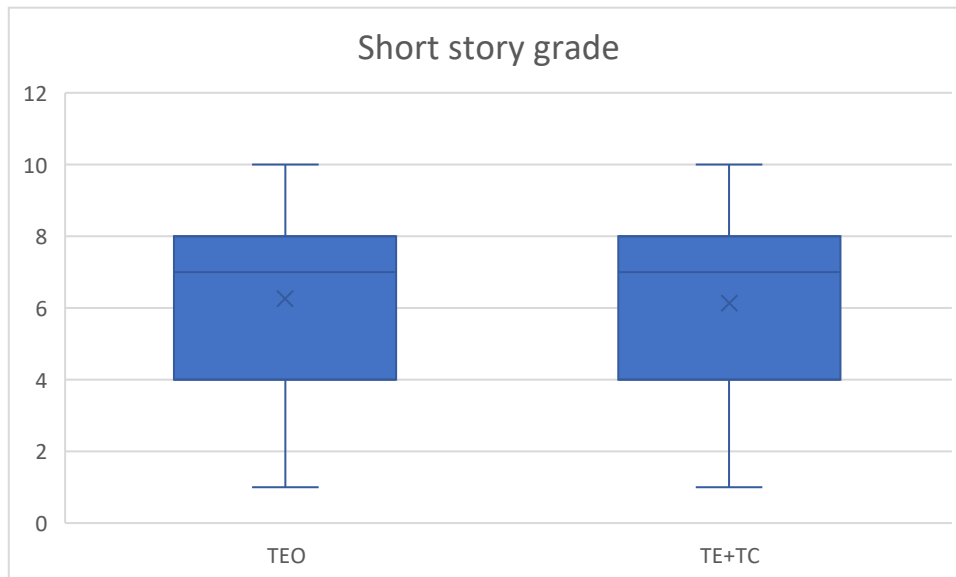


Figure 24: Box plot showing the grades for short stories for the two groups

The participants were also asked to give a grade to the short story they analyzed. As shown in the box plot chart in Figure 24 above, they could give a grade from 1 to 10. In the case of this question, the following hypothesis was used for testing statistical significance:

H1: A significant difference in short story grades will not be shown between text editing only and text editing with text chat

The independent samples statistical test shows that $t(109) = 0.272$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. A significant difference in short story grades **will not** be shown between text editing only and text editing with text chat.

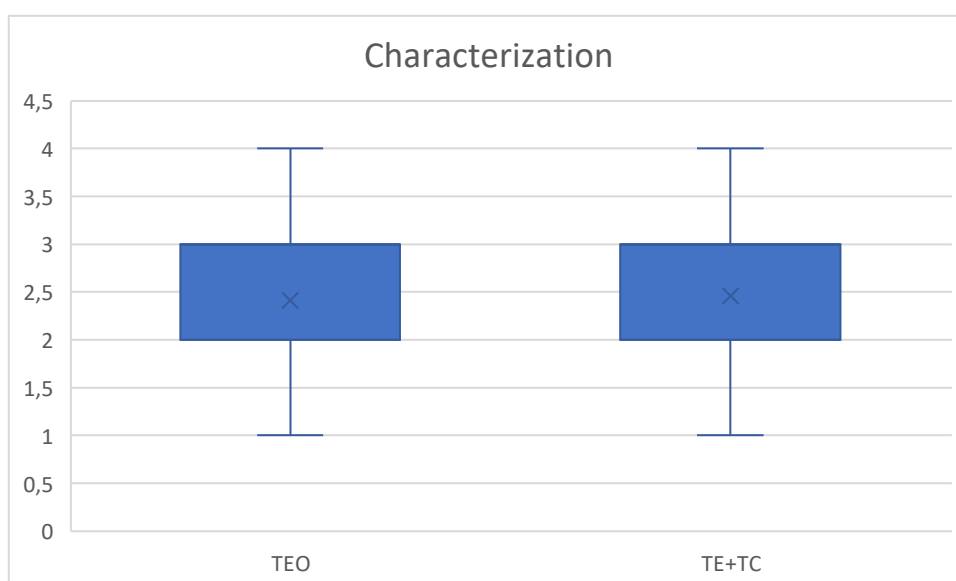


Figure 25: Box plot showing the results for the characterization of the short stories

The box plot chart above (Figure 25) shows the results of the experiment for the characterization of the short stories. The following hypothesis was used for testing statistical significance:

H1a: *There will not be a significant difference in the characterization of short stories between text editing only and text editing with text chat*

The independent samples statistical test shows that $t(109) = -0.254$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *There is not a significant difference in the characterization of short stories between text editing only and text editing with text chat.*

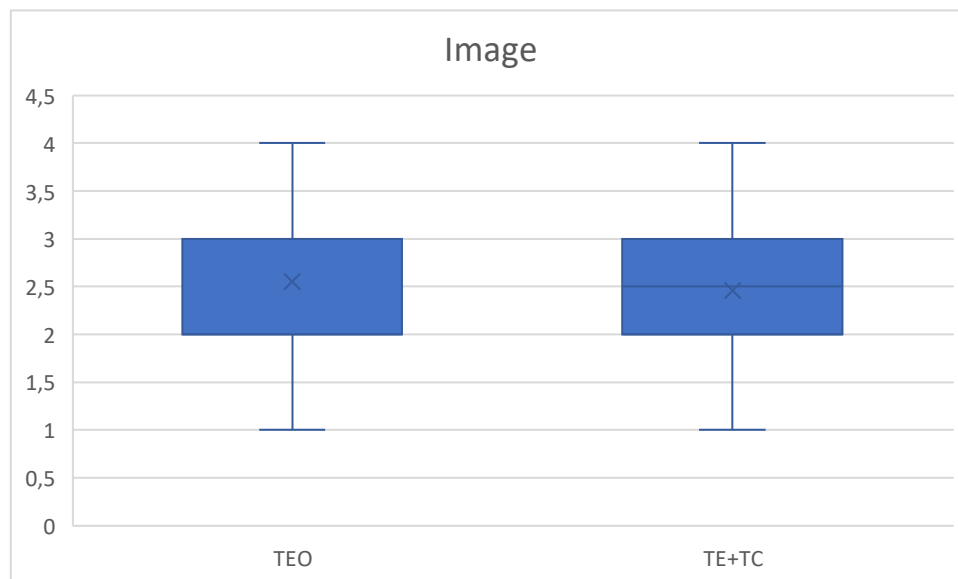


Figure 26: Box plot showing the results for the image of the short stories

Figure 26 above shows the results of the experiment for the image of the short stories. The following hypothesis was used for testing statistical significance:

H1b: *There will not be a significant difference in the image of short stories between text editing only and text editing with text chat*

The independent samples statistical test shows that $t(109) = 0.602$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *There is not a significant difference in the image of short stories between text editing only and text editing with text chat.*

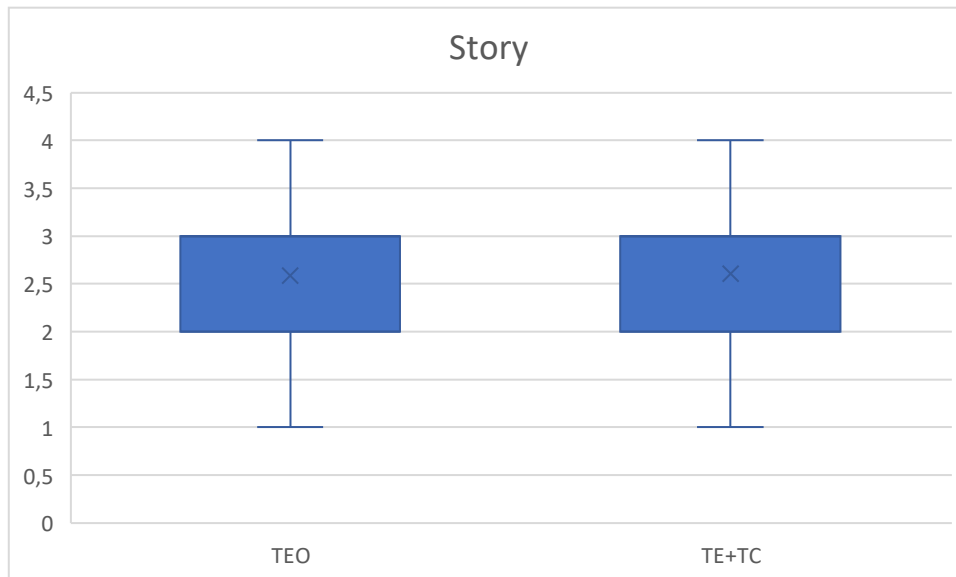


Figure 27: Box plot showing the results for the story of the short stories

Figure 27 shows the results of the experiment for the story of the short stories. The following hypothesis was used for testing statistical significance:

H1c: *There will not be a significant difference in the story of short stories between text editing only and text editing with text chat*

The independent samples statistical test shows that $t(109) = -0.118, p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *There is not a significant difference in the story of short stories between text editing only and text editing with text chat.*

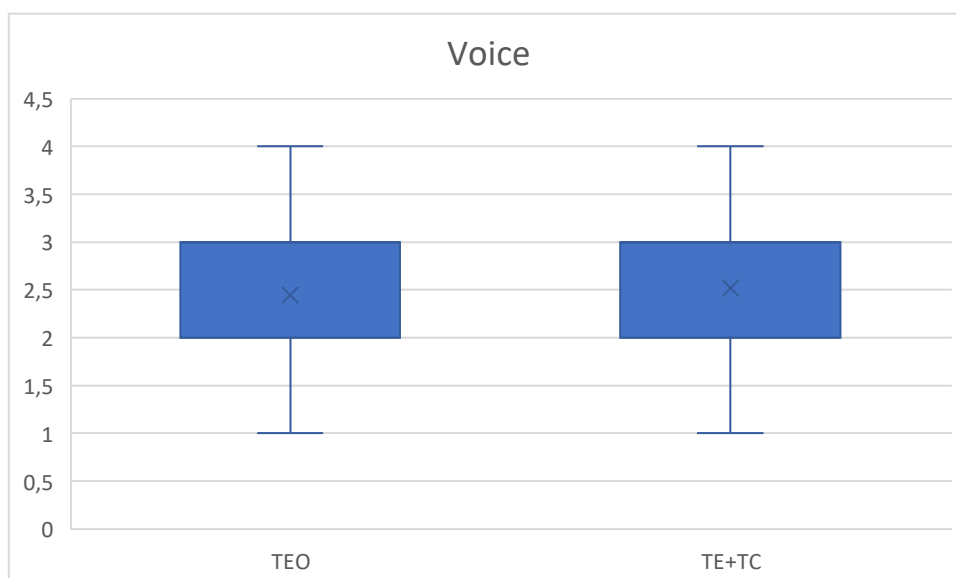


Figure 28: Box plot showing the results for the voice of the short stories

Figure 28 shows the results of the experiment for the voice of the short stories. The following hypothesis was used for testing statistical significance:

H1d: *There will not be a significant difference in the voice of short stories between text editing only and text editing with text chat*

The independent samples statistical test shows that $t(109) = -0.427$, $p > 0.05$. This shows that, with $p > 0.05$, the null hypothesis is not rejected and that the result is not statistically significant. *There **is not** a significant difference in the voice of short stories between text editing only and text editing with text chat.*

6. Conclusion and future work

This section describes the main conclusions of the research, as well as a discussion and what could be done in future work.

6.1 Conclusion

This research attempted to investigate the effects of the communication medium on collaboration quality and satisfaction in crowd teams. To reflect back, the following research question was formulated:

How does the medium affect the quality of collaboration and the satisfaction of participants in crowd teams?

For the literature study, a combination of two search methods was used, namely the Pearl Growing method and the Snowball method. From the literature study, it could be concluded that previous research on group and interpersonal effects of the communication medium do not cover the topic of crowd teams (Daft and Lengel, 1986) and some were published before new technologies, such as the smartphone or tablet, became common (Walther, 1997). A combination of two search methods was used, the Pearl Growing method and the Snowball method. From the literature study can also be concluded that informal conversations and social relationships are central to collaboration (Bradner, Kellogg & Erickson, 1999). Furthermore, richer media offers collaborators the ability to reduce misunderstandings and reach agreements (Daft and Lengel, 1986). Availability judgments are made based on the empathy people have with their collaborator. With empathy, one is better able to determine whether someone is willing to collaborate and take perspective from the other person, which decreases misunderstandings (De Ruyter et al., 2011). It is also stated in literature that communication of changes in the work is the most important reason to communicate for collaboration (Damian, Marczak & Kwan, 2007).

The exploratory survey as well as the experiment were conducted using the crowd platform Figure Eight. From the exploratory survey, it can be concluded that there is only a significant willingness to collaborate using text editing only and text editing with text chat for communication and no significant willingness to use voice communication and videoconferencing. For that reason, the experiment was narrowed down to focus on the two types of collaboration that the participants were willing to use in crowd teams. From the experiment, it can be concluded that there is no significant difference in satisfaction of collaboration and communication between participants from the text editing only condition and text editing with text chat condition. Additionally, no significant differences were shown in satisfaction of short story quality, awareness, distraction, empathy, stereotyping, expressiveness and building social relationships. However, significance was shown with the thought of text chat being beneficial when it is absent but, surprisingly, there was no significance in text chat actually being beneficial in the text editing with text chat condition.

From the perspective on collaboration quality also did not emerge any significant results. Based on the creative criteria rubric by Mozaffari (2013), it was shown that the short stories from both groups do not differ significantly on characterization, image, story and voice.

Moreover, the grades that the participants of the experiment were asked to give to the short stories did not differ significantly between the text editing only condition and the text editing with text chat condition. Therefore, from this research it can be concluded that, for crowd teams in particular, the communication medium has no significant effect on collaboration quality and satisfaction.

6.2 Discussion

Following the conclusions of the research, a number of threats to the validity of the results can be identified. Not all participants of the experiments are expected to have had the knowledge about the terms that were used in the questions in the surveys, such as social relationships, empathy, awareness etc. Secondly, there were instances in the experiments in which the participants worked alone or stories were written in other languages other than English, which could have made it impossible to understand for collaborators. These factors might have influenced the results of the experiment.

Next to threats of the validity of the results, possible explanations for the results can be explained. The fact that the participants of the exploratory survey were not willing to use the richer communication media voice communication and videoconferencing can be caused by privacy concerns as fellow crowd workers are not known beforehand and can be spread over different countries in the world. Apart from being a threat to the validity of the results of the experiments, the knowledge of the participants about the terms used in the questions might be a possible reason why no significance was found for differences between the text editing only and text editing with text chat groups. A possible explanation for the participants thinking that text chat would be beneficial without the participants in the text editing with text chat condition actually significantly stating that the text chat was beneficial is that the text chat communication medium might be beneficial for other tasks, such as more complex tasks, but that it is not beneficial for the task chosen for this research.

The findings that resulted from this research imply for Information Sciences is the importance of crowdsourcing systems for collaboration and society in general, given that teams work more remotely in recent years and involving different kinds of participants. Crowd teams are one example of teams that work remotely and allows companies to work in new forms by hiring people on the internet to do tasks. The findings suggest that crowdsourcing systems for collaboration should not be designed around the rich communication media videoconferencing and voice communication, but around text chat communication or no communication since the results showed that crowd workers prefer to use those two types of communication media. For society, the results imply that people that collaborate in crowd teams have to adapt their communication when using text chat in such a way that it minimalizes misunderstandings with their fellow workers, while rich communication media have the ability to decrease misunderstandings (Daft and Lengel, 1986).

6.3 Future work

Since the task that was given to the crowd workers for this research was relatively short and simple, future work could focus on longer and more complex tasks that might require several sessions in order to be finished and to investigate whether there are any differences in

communication quality and satisfaction in those cases. Moreover, since this research focused on a creative task, future work could also focus on a different type of task, one that requires even more collaboration and communication from participants. Regarding communication media, future work could investigate the willingness of crowd workers to use virtual environments, a new type of communication media which was not included in this research. Additionally, future work could shift the focus on larger teams instead of teams of two people for experimentation, since larger teams might require more communication and, therefore, in that case there will be a larger dependence on the communication medium. Lastly, future work could investigate the effects on collaboration quality and satisfaction in the context of a communication medium on different devices or in different places. Text chat, for instance, can be used on a computer as well as a tablet or smartphone and future work might lead to interesting findings on this aspect. Some of those devices can be used to collaborate in other places than an office, such as at home. Future work might focus on the effects of the atmosphere on collaboration quality and satisfaction when using a certain communication medium.

6.4 Acknowledgements

This research would not have been possible without the involvement and help of several individuals and, therefore, it is important to acknowledge their contributions to the research. Firstly, Ioanna Lykourantzou and Fabiano Dalpiaz from the University of Utrecht, The Netherlands have provided supervision of the research, with Ioanna Lykourantzou also conducting the experiment in the crowd platform Figure Eight. Secondly, the experiment was conducted with the help of a software prototype, which was designed specifically for this research by another master student, Mr. Kostas Papastathis from the University of Peloponnese in Greece.

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Appendix

Short stories

Condition 1 – Text editing only

Story 1

he story start with sailor has dis coversd un habited island
once he go to fishing with his partener have agood boat for fishing once aday he fished
agolden fish

his wife was very happy
so he go to sell it but one of the fisher at his
and tried to fake his but he was very careful for his golden fish and return to his boat and sail
to his uninhabited island who know what he will find there

once he sailed astorm shock the sea and the waves was ver big but he take his cereful and
float with his boat
sailor
uninhabited island

Story 2

A ship was sailing on the ocean on a stormy day and hit the rock near an uninhabited island. Most of the crews were lost in the sea except for one sole sailor who was lucky enough to get a hold of a barrel and drifted on the beach. He woke up and desperated. Pull himself together, he gather the remaining personal belonging and decided to try to keep on survive until the day he got rescued. He built a house with the wood from the shipwreck, and manage to gather fruit and hunt meat with a gun and a knife from what left of the ship. Each day he built a fire to use smoke to signal any ship that happened to sail by. By the third year, one ship saw the smoke and get to the island, only to find the desperate sailor just hang himself on the ceiling, just few hour before.

Story 3

in the sea there was a sailor ,stormy day and hit the rock near an uninhabited island. Most of the crews were lost in the sea except for one sole sailor who was lucky enough to get a hold of a barrel and drifted on the beach.

in the south pacific a merchant ship crewed by a hundred sailors was in the middle of a strong storm that damaged the ship severely what forced the crew to leave the ship in the middle of the chaos to board the lifeboats a sailor named Peter fell down the rail and was dragged by the current to an uninhabited island scared hurt and not knowing where he was Peter sought refuge from the storm in a cave that was on the island They spent days weeks and Peter found no sign of any person or their peers forced by the situation development

skill for the fish to be able to stay alive in such hostile island loneliness and isolation began to affect his mind Peter could no longer differentiate reality from fantasy

Story 4

Once upon a time there was an island inhabited by butterflies and little angels. One day a sailor stopped his ship on the uninhabited island and found the butterflies that talked with them: _ What are they doing here? And the sailor answered, \I have come to know the unknown. And they became friends, and the sailor took the butterflies home, showed his wife and children that they were very happy and happy. And they were happy forever. And the island was left uninhabited and over time they came back to reminisce. And so ends the story The End Thanks.

Story 5

One day Mark went to his friend John where they would go on an exploration trip to an uninhabited island on the high seas. It was gold and it was a very wonderful day and you enjoyed it where you saw the real world of the sea, dolphins, fish, coral reefs, chrysanthemum and sea beauty. And very interesting for the two friends Mark and John they return home told his family about the strange adventure he learned a lot of things from it He began to learn more about the sea world and began to tell what he learned clearly

Story 6

Érase una vez Jac un joven marinero estaba en el mar como de costumbre.

Jac ama a una chica muy hermosa llamada Anna

Jac dejó el puerto en el barco para ir a un nuevo día de su trabajo que ama mucho.\nEse día, Anna quiso que Jac no se fuera ese día, ya que escuchó en las noticias que el clima será malo, especialmente para navegar.

Desafortunadamente, Jac no escuchó a Anna, ya que tuvo que subir al barco ese día, así que fue al puerto y comenzó su viaje con la tripulación.

Jac tuvo el mal presentimiento de que algo malo pasará y no pudo eliminar las palabras de Anna de su mente

De repente, el clima comenzó a ser muy malo y las olas eran demasiado altas. \nEste fue el día más difícil que Jac ha visto

The only thing Jac was thinking about was Anna saying \I have to come bacj to her\" but the bad luck of Jac for almost more than 6 hours in the storm, they couldn't defend the ship in this storm

The next day Jac found himself in an uninhabited island he started to cry to look for his freinds but no one answered

He shouted louder and louder but no one responds to him

Jac started to cry as he wanted to be with Anna specially at this moment

So he diceided to start planning for a rreturn journey

Story 7

the story start with sailor has dis coversd un habited island

once he go to fishing with his partener have agood boat for fishing once aday he fished agolden fish

his wife was very happy

so he go to sell it but one of the fisher at his

and tried to fake his but he was very careful for his golden fish and return to his boat and sail to his unhabited island who know what he will find there

once he sailed astorm shock the sea and the waves was ver big but he take his cereful and float with his boat

sailor

uninhabited island

Story 8

The sailor's ships sink and are stranded in the middle of the sea. tries to find a place in the middle of the sea to look for. and this island strikes her eye and begins to swim towards her. finally manages to reach this deserted island. and takes a comfortable breath. After a little rest, he starts wandering around and tries to find water and food. but the island is very deserted and there is no living thing. he wanders helplessly. but he can't find anything. He finds a place to sleep, falls asleep and never wakes up.

Story 9

there was a three sailors was sailing in the sea when When the storm struck their boat and Their boat sank they found themselfe in uninhabited island with no food no water whith nothing they thouht what can we do they saw atree they think how can we make another boat suddenly they saw the trees they think and thenk then they buld aboat from the tree they make awood from the tree and they seal in the sea and they go bake to the city when they are from and save them selve and be safe in a safe place with a people they know

Story 10

There was a sailor who had a great and giant ship , and his crew consisted of 10 memebtrs , he decided to travel to Europe to work at trading to be able to make some money, while they were travelling the weather was good at the first day , but at the second day it started to turn bad , and a strong storm hit the ship and destroyed it , al the crew were dead and the saiolr had a life jacket which kept him on the top of the water but he was fainted , when he woke up he found himself on uninhabited island , he was so hungary so he went to search for food, he found some african people trying to build a building but they didn't know how to do this , and they were using old and primary methods, so he had some experience about civil engineering so he taught them and since that moment they loved him and made him their king . and he was very rich and earnet money more that he would earn if he reached Europe !

Story 11

It was long time ago. Old, dirty sailor in dark bar told story about his adventure. With glass of rum on his hand he began with words - uninhabited island. His memories about that island never disappears. There was nature so georgeous like most sweetest dream that he ever has. Clear water, rich sealife, sparking sands and music... Music of mermaids! He could never forget that melody what he hear while he was on the island he will never forget this good journey after long time he was came to a plcae lke rhis beauty island and he will cme again after 2 mnoths

Story 12

At a restaurant, Mary receives an SMS and reads the following message: \"Your life is in danger. Say nothing to anyone. You must leave the city immediately and never return. Repeat: say nothing.\" Mary thinks for a second and then i suddenly hurry up and call taxi driver go tshe stood up and went to the bathroom and then she looked from the opening of the door and she found a man entering the restuarnt with black hat and he looked in a hurry and he was confused so she suspected that he is the sender of the message so Marry was so afraid how to get out and leave. she called the waiter and asked him to tell the man wearing the hat that a woman called Marry need him to see if he know her ,

Story 13

This is the story of a depressed man.

One day, he wanted to klll himself, so he climbed the tallest building in the city.

Up there, he began to think about all the people he left behind and how they would feel about his suicide and how sad they would be.

With this, he had a second thought, and it was to go back and dont do this for the people who loves.

But when he was going back inside, he slided and felt down to the floor and killed by accident.

you only get one shot at life.

Story 14

Once a sailor tall, thin and with moustache decided it was time to retire to dedicate himself to his family, so he undertook what would be his last trip, what he did not know is that a tremendous storm awaited the boat where the sailor was traveling, so the storm sank him and the sailor could save his life by reaching a uninhabited island ... the day passed and the sailor had no trace of his crew, I try everything to have contact, at night I thought a lot There was once a sailor who was shipwrecked and came to an uninhabited island. The sailor was tall and corpulent, but by the days he was on that island without food, he became a small and thin man. There was only one coconut tree to eat and he spent all those days consuming only coconuts. In addition, he was alone and the island was quite small, so he finished exploring it in a short time, verifying that it was indeed uninhabited and he was the only person in that place.

The days and days went by and there were no signs of rescue anywhere. The sailor had to make a shelter with coconut palms to shelter from the rain and the sun. Until one day, he passed a boat near the island and the sailor began to make signs with the coconut palms waiting to be seen. Fortunately, the other sailors of the ship managed to see it, approaching the island and managed to be rescued

Story 15

a sailor was sailing one day on the open blue sea when he came upon a terrible storm which ended up shipwrecking him. once the chaos had ended the captain found himself stuck on an uninhabited island. he searched for survival and to make sure he could some day be found he gathered a bunch of things for his adventure. as the days went by he grew weary of being on this deserted island and wanted to leave, but he could not find a way to do that. as he grew older he realized he was going to die there.

Story 16

Selkirk là một thủy thủ phục vụ dưới quyền thuyền trưởng Thomas Stradling. Trong cuộc thám hiểm giữa chừng, thuyền trưởng đã dừng lại để tiếp tế. Selkirk bày tỏ mối quan tâm của mình về an ninh của con tàu với trọng lượng tăng thêm trên nó. Ông đã cố gắng và thất bại trong việc tập hợp những người khác không tiếp tục. Stradling sau đó quyết định để Selkirk một mình trên hòn đảo không có người ở Juan Fernández.

Selkirk turned out to be quite a skillful survivor. He lived in huts made of pimento trees. At first he remained where he felt safer along the shoreline. While waiting for someone to come to his rescue, the desperate castaway survived on oysters, shellfish and anything he could catch. That is until hungry sea lions wanted their territory back for mating season. This drove him deeper into the unbeknownst depths of the uninhabited island. There, Selkirk was lucky enough to come across feral goats which provided him milk, meat and clothing as well as feral cats that protected him against the ravenous rats that attacked him at nighttime. Trong những năm của chúng tôi và bốn tháng sau, cuối cùng anh ấy đã được cứu bởi một con tàu tư nhân. Câu chuyện của anh trở thành một cảm giác và Selkirk tiếp tục cuộc sống của mình như một thủy thủ, kết thúc sự nghiệp của mình với tư cách là trung úy trên tàu Hoàng gia Weymouth.

Story 17

in the old days, there was a young sailor who worked on a big boat with his friends. Over the years, he almost traveled all over the earth seas facing different sort of storms and other disasters. But the young sailor is not as young as he was and the time had done his effect on him. One day, a storm began in the middle af the sea and after hours facing, a wave shoot him away and something hit him on his head. He was in the sea but his friends rescue him. months after that he decided to live in an uninhabited island tel his death.

Story 18

ذات مرة كان يبحر في أعماق البحار. كان الطقس سيئًا. Osyters. كان هناك بحار يستخدم للإبحار في البحر بحثًا عن جدًا وكانت السماء تمطر بشدة. لقد كان خائفًا من أن يغرق قاربه وسوف يموت ، لكنه كان يتحكم بطريقة ما في قاربه

وهبط في جزيرة غير مأهولة. كانت الجزيرة صغيرة جدًا وكانت مغطاة بالنباتات والأشجار ذات المظهر الداكن. قرر البحار استكشاف جزيرة. بدأ استكشاف جزيرة وذهب بعمق داخل الغابة البرية. كان هناك الكثير من الحيوانات البرية المتجولة هنا وهناك. لقد ذهب إلى البحر أنا وامي وإبي وإخوتي وكانت السماء جميلة والبحر رائع وجميل والغيوم من

Story 19

I love a movie that's about a sailor called Frank and he was sailing with his friends to Italy on 1980. One of his friends is called Natalia she loves travelling among the sea and like adventures, and there was one called Dave he has phobia of the sea he was so afraid and praying to travel faster and one is called John he loves the sea and was trying to get some fishes to eat them on the trip suddenly there are a heavy wave which make them miss the compass of the sea and they suddenly sailed to unknown place they saw by telescope it was an uninhabited island Natalia was so excited while Dave was so feared and think they will die soon, Frank was trying to control the ship in order to not die and then it started to rain heavily and there were a lot of thunder they couldn't control the controller unit of the ship it was like few minutes and they will die then the ship hit strongly on the island and the ship was damaged so they could not sail with it any more so they tried to live on the island until a miracle happens and could save them or they will die on the island and that we will see on the next part.

Story 20

John was a sailor since he was 15 years old when the incident happened. He was on board a ship travelling to Nova Scotia when the ship encountered a storm. The ship was destroyed and wrecked on an uninhabited island. John along with 5 other people are the only survivors from the shipwreck that were left stranded on the island. When nightfall, John thought he saw something in the woods, near a swamp. He saw a light and he quickly ran to the woods. What he saw was a mystery that was left unsolved for many years even until today.

Story 21

My brother Manuj works in merchant navy as a sailor and he told me a very interesting and adventurous incident on how his ship once was halted on an uninhabited island due to some technical glitch in the ship. He said it was lush green and very beautiful island full of beautiful flowers and some animals he never saw before. He said they found some trees which had fruits and he tried some, they were tasty. The crew had veggies and meat with them and they all cooked and ate their along with some beers. He said being only few people on that island felt like they owned it. It felt like a king. He told me they all stayed on that island for two whole days. His best friend Manish was also on the ship and they both can never forget this experience.

Story 22

There was a sailor who always loved to explore the sea using his small boat. During one such trip there is a storm coming and he was forced to take his small boat to long distance and he came across an island filled with large trees. There wasn't any indication of any people on that island. All he heard was sounds of birds. Without having any clue of where he

was, he began explore the island . there were huge thunders and big rain was approaching. it was getting dark and he decided to spend the night on the island. he still like that when after one month a ship cam and throw it ba

Story 23

There once was a man called Dave, he was a bald haired and quite rotund sailor for the sacred rum pirate party. he loved to travel and he bought himself a supersonic ink propelled ship that was destined to travel to an uninhabited island to rescue the kwadjaca birds that had started to call this island their home. they had got themselves in a breeding quandry and ended up having three feet and two beaks. he had to fill his boat with these birds to rid the island of the new found specimens and take them to a kwadjaca specialist before their was an outbreak of some weird disease that would kill all of mankind. they reached the bird testing facility but as they were approaching the entrance, one of the kwadjaca birds escaped and swallowed the

yesterday i dreamt that me and my friend john are on a ship we were travelling to greece and the sailor is called novak he was sailing us to the west then suddenly there are a strong wave that took us to the east he miss the road and we found that we are going towards an island which appears as uninhabited island he couldn't do any thing untill we reach it,john was so afraid he didn't swim good so he think he will be dead, when we arrived the island the ship was damaged so we couldn't sail with it any more so every one start to explore the island and we divided each other some try to find water ,some try to find food ,some try to find people to help us and some to find flare gun to shot it when planes are above us then suddenly some pirates came and tried to took all we have and kill us one with us who are on the ship hit one of the pirates on his head then they got angry and killed novaaak with head shot he was dead !

then they are shooting towards me than i woked up from the bad dream.

Condition 2 – Text editing with text chat

Story 1

"There was a sailor named Rick Robinson. He fell into a sea catastrophe. After spending weeks on trying to find a treasure, one that is so big that was only believed to be a myth, he was stuck in an uninhabited island. There he was all alone. At first he thought he had it easy, he was able to hunt his food and live in a decent shelter he made for himself with wood. But soon the life in this uninhabited island became unbearable. He was on the verge of going mad. He would scream for hours to let his anger out, but since there was nobody to hear it, it would only make him angrier. He was saved by a friendship with a small monkey. He named her - Friday."

Story 2

"There was a sailor looking for adventure. One day he boarded his ship bound for an uninhabited island. On the island he was alone. Only monkey and birds leaves in island. The sailor did not have one eye, besides having a bad hearing. But he really wanted to live. And go back home. During his navigation he used the help of his inseparable friend parrot. One

was hard to survive. On the island, he got lost from his parrot. And he stayed days without knowing where he was, without feeding or drinking water. He became friends with one little monkey. When it was lonely, he talked to her. The little monkey fed him with fruit and gave the sailor water."

Story 3

"One of the sailors was riding his ship and with him the crew of the ship and if suddenly they lost their way and if the island is free of the population and have implemented their resources of food and decided to go down to the island and when they entered the island did not hear the voice and were abandoned and decided to camp and entered the night when they heard voices And they heard that there was a murderer who killed innocents on the island and fled. They decided to communicate with these voices until they knew the story and later discovered that the killer among them had brought them to the island to kill them, but they all gathered together and killed him."

Story 4

It was once a sailor named Cristian, who was always traveling all over the seas of the world, be it travel, adventure or because they hired him as a tour guide. Cristian is young and ambitious, just 28 years old, one day he was at home relaxed and beat hard on the door of the house, there was a big man and with a long coat, he said \"you are cristian, right?, I have an amazing adventure on an uninhabited island \", and he answered that yes, then that man proposed to go out to sea to look for new horizons when they are at sea a sailor shouts earth and when they are made and they get off the ship they begin to travel the island and there they realize that they were in a uninhabited island and I stayed for several days exploring the whole island to what we could find, until we decided to go back to the high seas and see if I found other islands near there

Story 5

There is a sailor who usually go to sea to take fishes from sea
One day a huge storm has occurred which damage the ship of the sailor .after that the sailor waked up on strange island he has no food no water no one found him
The sailor move and move until he found a strange gave and he listen to sound he discovered that the sound was human sound who found big treasure but can get out due to huge rock he damaged the rock and the people thank him giving him large amount to treasure and return to home with lots of money and the adventure end with happy ending

Story 6

It was a usual morning and there was a silense in the house. This silense was broken by a phone call and Sarah answered for this call. On the other side was a man voice and he said that she need to go to the docks and meet there a sailor because it is very important for her future. In the beginning she thought that it is a joke but she was curious and decided to check what would happen after meeting the sailor. On the docks sailor said that he can take

her to the uninhabited island and it is a good feasibility to find a treasure chest and he has a special map.

After several minutes they solve to go to that uninhabited island and start to make preparations.

During their journey started a big storm and boat was broken. All things including the map were drowned, but Sarah and the sailor were able to escape clinging to the wreckage of the ship. They did not find the treasure, but found something more - they found each other.

Story 7

Once upon a time, at a time that I do not remember and it is not necessary to comment, that a merchant ship left the port of Liverpool via Cape Town. Halfway there, the lookout spotted a small portion of land in the distance, an island that seemed uninhabited because it had no vegetation in it. But something brilliant was observed, as the ship approached the object became brighter and brighter.

A sailor asked the captain if they could check to see what that mysterious object was.

He gave him permission so the mariner called John with two more companions boarded a small boat and headed towards the island.

When they reached it and stepped on the sand, it broke under their feet and began to cover them with a dark fog, so dark that they saw nothing.

They began to hear sinister voices with dark songs around them.

John scared started screaming louder and louder until he felt a strong blow to his face, it was the cap that was waking him from his abitual drunkenness

Story 8

It was a usual morning and there was a silense in the house. This silense was broken by a phone call and Mary answered for this call. On the other side was a man voice and he said that she need to go to the docks and meet there a sailor because it is very important for her future. In the beginning she thought that it is a joke but she was curious and decided to check what would happen after meeting the sailor. On the docks sailor said that his name is Richard and he can take her to the uninhabited island and it is a good fesiability to find a treasure chest and he has a special map. After several minutes they solve to go to that uninhabited island and start to make preparations. During their journey started a big storm and boat was broken. All things including the map were drowned, but Mary and the sailor were able to escape clinging to the wreckage of the ship. They did not find the treasure, but found something more - they found each other. They lived happily and recalled with a smile how they met.

Story 9

a sailor had his name Dennis to an uninhabited island after an accident he lost his father when he was a teenager and became the sole owner of the ship, but he constantly missed his father. his father was a rickety long-haired man who smoked constantly Dennis had lost his father when he was young and he missed him very badly. for his father who was constantly doing tours looking for treasures, fighting pirates on behalf of his father he misses his father very much everything they do together walking around without money desert island didn't need them

Story 10

A tall, thin and blond sailor decided one night to leave the boat where he worked, to enter an uninhabited island. it is said that there were, dreads, animas en pena and dark legends, however the sailor was looking for a treasure, because he had a map so he entered the dark forest that same night and never left.three days lasted his companions looking for it and only got the map are written that said: \"help\". his friends were frightened leaving the island uninhabited behind and never returned, even hears the legend of the lost sailor on the uninhabited island.

Story 11

Mi nombre es Jason, soy un marinero de mi ciudad.

Un día, el alcalde me pidió que transportara un envío de sardinas a otra ciudad que estaba a miles y miles de millas de donde vivía, no pregunté nada e inmediatamente saqué mi gran bote al mar.

Todo fue perfecto hasta que una gran piedra salió de la nada y mi bote chocó con ella, partiéndola por la mitad y dejándome a mí y la carga para naufragar.

Pasaron los días, sin agua ni comida, colapsé y caí en un sueño, de repente me desbordé y me encontré en una isla deshabitada y junto a mí una parte de la carga de sardinas.

Story 12

YAKLAŞIK ÜÇ YADA DÖRT SENE ÖNCE BULGARİTANA GİTMIŞTİM. ORADA ISSIZ BİR ADA GÖRDÜM VE ORAYA GİTMEYE KARAR VERDİM. ANCAK ORAYA GİDEBİLMEM İÇİN ÖNCELİKLE DENİZDEN ANLAYAN BİR DENİZCİ BULMAM GEREKTİ. YAKLAŞIK 10 GÜNLÜK ARAŞTIRMAMADAN SONRA BİR DENİZCİYE ULAŞTIM. ERTESİ GÜN HEMEN O ADAYA GİTMEK ÜZERE YOLA ÇIKTIK .. O ADAYA ULAŞTIĞIM ÖYLE HARİKA BİR YERDİ Kİ ADETA HIÇ BALTA GİRMEMİŞ BİR YER. UNUTAMADIĞIM BİR ANIM OLDA BU. ÇOK GÜZELDİ. BENİM İSMİM KEMAL VE DENİZCİNİN ADI MARTİN İDİ.

my name is jefferson and I am a sailor since I have reason to use, I decided to embark on a great adventure to a mysterious and uninhabited island which commented that it was terrifying and was haunted ... equip my boat with food for a month and take my dog called spike and inseparable friend and we left for the mysterious island, armed with a video camera to document our adventure ...

Story 13

IT WAS MORE POSSIBLE TO VISIT, IT WAS THEN I, I WENT INTO THAT uninhabited ISLAND AND OPENED VARIOUS COVAS, THAT WAS LIKELY TO HAVE A LOT OF WATER, ARRUMAEI AKGUMAS EMBARCAÇÕES, VIREI SAILOR, I FISHED MANY FISH, THEN LITTLE OTHERS CAME SEEING AND WE HAVE MADE A COMMUNITY OF FISHERMEN,NOW WE LIVE IN PEACE IN THIS PARADISE, AND WE ARE MANY HAPPY, We will not leave this island any more.we have a lot of weight and we are happy like this,end with joy,five
end with joy,five

Story 14

three sailors who were stranded on a remote uninhabited island in the Pacific Ocean have been rescued after their \"SOS\" appeal in the sand was spotted by an aircraft. In at least the second such case this year, the couple, identified as Linus and Sabina Jack, were picked up from the tiny Micronesian island in Chuuk State on Friday after a US Navy aircraft crew saw their desperate appeal for help. The rescue was the culmination of a seven-day search by an international team that covered a total of 16,571 square miles. The man and woman had been missing for a week after their 5.4m-vessel failed to reach Tamatam island.

Both in their fifties, the pair had departed Weno island with limited supplies and no emergency equipment on Aug 17 and were expected to arrive the next day. When they failed to show up, the alarm was raised and the massive search began, involving 14 vessels, two aircraft crews and one police patrol boat. The breakthrough came on Wednesday when a ship spotted lights flashing from the area at night. A US navy plane was deployed and after the crew spotted the survivors on East Fayu island alongside the SOS appeal, a patrol boat was sent to pick them up.

"The Search and Rescue Operation for Linus and Sabina Jack has been successfully completed. They are found and are waiting for a ship to take them home,\" the US Embassy in Kolonia, the capital of the Federated States of Micronesia, said on Friday. Located about 2,500 miles southwest of Hawaii, the Federated States of Micronesia comprises 607 small islands in the Western Pacific. The case was similar to a rescue in April, when three men were saved from the island of Fanadik, hundreds of miles to the north of Papua New Guinea. They had spelled out a huge \"help\" sign using dark palm fronds on the white sand, which was spotted by the crew of a US Navy plane

Story 15

Mark was a former sailor who has lots of experience when it come to seas. On one of his journey, he saw a pirate ship landing on supposedly uninhabited island. He never told anyone what he saw that day but he was pretty sure that the pirates were carrying some boxes on the island. He jotted down what he saw in his journal. One year after he quit his

job as a sailor, Mark bought a ship and embarked on a journey to the uninhabited island. He was just few hundred metres from the island when he saw something move.

Story 16

I was a sailor, who undertook a great adventure towards an uninhabited island and that according to the stories of the people, that sailor who dared to visit this island did not return ... it was a kind of triangle of terrifying Bermuda shorts and countless horror stories capable of intimidating more courageous sailors but that does not matter to me and I took my boat and set out on my journey ...

my name is jefferson and I embarked with my puppy called pincho who was my inseparable friend and companion of adventures, we took enough food for a month and a camera to document our discoveries in the mysterious island.

A sailor and his wife went to an uninhabited island to spend a wonderful summer vacation and set up a tent for fun and while they were on the island, a man and his wife came to the island and were introduced to each other. The other couple were very poor while the sea was rich. The sea and his wife and escape by the great ship that was the king of the seas. We arrived to the island and it was a totally different aspect to the rumors, it was a beautiful island surrounded by an immensity of vegetation and a paradisiacal environment, the most beautiful thing I had ever seen in my life

Story 17

there is a sailor that is hunting fish through his small ship, once a day he is go in the morning to fishing and unusal huge storm is coming and he trying to fight the sea but he fail until he fainted , and when he wakeup he found him self on forward an uninhabited island , he swim to it, and get into the island , but there is no one in the island, he traying to finding any body but he fail and nothing except trees and plants , he still in that for one month eating from trees and plants until a ship is crossing in forward to the island and he make fire that they saw him and take him to home.