G.4 Considering Team Development Stages in Virtual Collaboration for Feedback Optimization

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1 Introduction

Learning collaboratively in virtual groups is seen as a promising alternative to the outcome of an individual (Breen, 2013). However, working in a virtual group does not guarantee a good solution and performance of the individuals. Rather, working in groups presents several hurdles that need to be overcome to realize the full potential of the group and allow it to focus on performance (Peters & Manz, 2008). Franceschi et al. (2007) also state that learning in virtual groups has a positive impact on student learning and engagement, but that there is a lack of pedagogical concepts to guide the groups on their way to performance. Also Gabelica et al. 2012 state:" providing teams with adequate support is needed to secure teamwork. Research on team learning and performance has increased our understanding of how teams learn but is still in its development phase and in search for leverage points that can be used to trigger team learning" (Gabelica et al., 2012, p. 124). Within this scope, Krause et al. (2009) make clear that groups use feedback more effectively than individuals and that this has a beneficial effect on the learning behavior of the group members. Concerning feedback research, it should be noted that feedback can have a positive effect on learning behavior and outcome, provided that it is implemented correctly (Shute, 2007). The pandemic situation and the resulting shift of work into the virtual space reinforces this need in our view. Due to the many novices, the relevance of feedback for virtual group work with a focus on supporting the group in improving their learning behavior is becoming more relevant, but it is not always clear what the needs of a group are at a particular stage of team development, in special in virtual learning environments. This research aims to explore this gap by using the basic linear team development model of Tuckman (1965) as a referenceto explore how the need for feedback in virtual group learning changes during the stages of team development. Therefore the following research questions are posed.

RQ1: How does the need for feedback in virtual and collaborative learning change in the phases of team development according to Tuckman?

RQ2: Which recommendations for the design of feedback in virtual collaborative learning can be derived from the results of the first research question?

To include multiple perspectives, an explanatory mixed methods approach from Hanson et al. (2005) with the support of Ivankova et al. (2006) has been chosen. In the first step, a superordinate quantitative survey was conducted among the students of the virtual collaboration case study work in the virtual classroom. The results of the survey have then been examined and explained in more detail by e-tutors in a qualitative focus group discussion to deepen the understanding. Subsequently, the results were classified and interpreted within the scope of recent feedback research. Based on the combination of a quantitative survey and the qualitative focus group discussion, seven concrete recommendations for the design of feedback guidelines in virtual group work were subsequently derived.

2 Theoretical Background

Feedback in the sense of instructional design refers to all information that is intended to improve the learner's learning behavior with respect to learning objectives and existing standards after an action has been performed (Narciss, 2013). Hattie & Timperley (2007) conceptualize feedback as information provided by an actor, such as a teacher, in relation to one's performance. For example, a teacher can provide corrective or constructive information to a student. Accordingly, feedback is a consequence of performance. Referring to Boud, the following conditions should be considered in the interplay between actors in the provision of feedback for an optimal outcome. Recipients must value the input, there must be a dialogue between sender and recipient, and trust must be built so that recipients ultimately improve their judgment to better assess the quality of their work (Boud, 2015). Hattie & Timperley (2007) emphasize that the impact differs regarding the type of Feedback whereas students who receive informative feedback about the task and how to solve it more effectively are the most affected. Lower effect sizes can be attributed to methods such as praise, rewards and punishments In more detail, it can be seen that feedback is most effective when it includes hints or reinforcement for the learner. The forms of video-, audio-, or computer-assisted feedback is particularly helpful in this regard (Hattie & Timperley, 2007).

Especially in a digital learning environment, it is important to provide performance information, motivate, and encourage focus of attention on further interaction with the system (Vasilyeva et al., 2008). Martinez-Arguelles et al. (2015) highlight that feedback in virtual learning is more important than in face-to-face teaching. The quality of the feedback given is given the greatest importance. It should be emphasized that in the digital context, new opportunities offered by this space are also preferred. For example, it turns out that students are less satisfied with simple written feedback and prefer other formats, such as feedback through videos (Martínez- Argüelles et al., 2015).

Within the module case-based learning in the virtual classroom, which is defined and described in more detail in the following chapter, students work together in groups in a digital learning platform to solve complex tasks in small groups from 4–6 participants. Therefore, it is particularly important to evaluate the impact of feedback on groups and how this should compare to feedback for individuals.

Already Nadler (1979) points out that feedback is beneficial and has effects on the degree of attraction to the group, pride in the group, motivation, defensiveness, and acceptance of problems in the group where group feedback reflects on the behavior and functionality of the group as a unit. Krause et al. (2009) also make it clear that groups use feedback more effectively than individuals, thus creating a beneficial effect for the learning behavior of group members. Dainton (2018) formulates as possible goals that feedback can change the dynamics of the group as targeted intervention can make a group more lively again, and a good mood also achieves a better learning effect. Krause et al. (2009) summarize that feedback is more effective for groups, but in their own research, they conclude that individuals handle feedback better than groups.

Feedback in virtual teams is considered to be helpful to improve the learning behavior of students but also needs trust as fostering factor (Peñarroja et al., 2015). To examine this and potential other effects of group feedback during the progress of the virtual module the team development model of Tuckman (1965) has been chosen. Tuckman's original model offers four phases called forming, storming, norming and performing which describe the steps a team makes on their way to performance (Tuckman, 1965).

3 The Lab: Case-based Learning in the Virtual Classroom

Virtual Collaborative Learning (VCL) is referred to as the learning arrangement of the Chair of Information Systems, especially Information Management, which has been regularly used and has been researched since 2001. It transfers the project work of small groups into the virtual space (Altmann et al. 2019, Bukvova et al., 2010). Thereby, the VCL format is composed of the following four design dimensions: Realistic Task Design, Professional Pedagogical Support, Technical Platform, and Learning Analytics (Altmann & Clauss, 2020; Schoop et al. 2020). In practice, the VCL project case study work in the virtual classroom was carried out in the winter semester of 2020, 2021 as a twelve-week virtual collaboration between TU Dresden and HTW Dresden. This involves the development of business ideas for e-mobility in the region of Dresden in the sense of a platform business model which should unite various actors from the energy and mobility sector.

After a virtual kick-off event, the approx. 70 students were divided into 12 groups which were supervised by qualified e-tutors. This was followed by an introductory week to get to know the other team members and exploring the virtual learning platform. Then, the first block of three tasks had to be completed, each with one week of processing time. Afterwards a synchronous (virtual) workshop has been conducted to present the interim results. Followed by the second virtual block, which also included three tasks, each with a one-week processing time, the students continued to develop their business ideas. After a short break over Christmas, a second workshop was held to present the results, followed by a final and third VCL phase, which was concluded by a final workshop with a transfer task (Schoop et al., 2021).

An important component within VCL is the pedagogical support of students by e-tutors. These are intended to maximize learning outcomes as individuals and as a group by providing support and feedback (Altmann & Clauss, 2020). Jödicke and Teich (2015) describe e-tutors in general terms as individuals who are employed to support students, or learners in general, in achieving learning objectives in e-learning arrangements. Besides the e-tutors who are instructed to give formative feedback to the groups during the virtual learning phases the module also offers content-related feedback by an experienced professor on request. Furthermore, in the beginning, middle and end of the module the groups received quantitative data from Learning Analytics which displayed their activity compared to the average of all groups.

4 Research Design

For the research design, the explanatory mixed methods approach according to Hanson et al. (2005) was chosen. In the explanatory design, first, a superordinate quantitative investigation is carried out, which in this case is realized as a survey among the students of the module under consideration. To better contextualize the data obtained and to better explain phenomena that occur, a subsequent qualitative investigation in the form of a focus group discussion according to Ivankova et al. (2006) with the e-tutors was conducted. The concrete procedure of this study according to the approach of Ivankova et al. (2006) can be described as by the following steps: Quantitative data collection, quantitative data analysis, combination of quantitative and qualitative phases, qualitative data collection, qualitative data analysis, and integration and interpretation of qualitative and quantitative results.

The standardized questionnaire for the dominant quantitative study was designed according to the guidelines of Döring & Bortz (2016). Single items and psychometric scales are used for the operationalization variants. The selection of the items for the first section of the questionnaire on perspective & understanding of feedback is thereby based on the literature review. All 18 items already exist as assumptions, theses, or proofs in the literature on feedback and are to be answered by the students of the course as well.

In the second part of the questionnaire, a psychometric scale according to Döring & Bortz (2016) is then used, with the 10 different items derived from a pre-selection. The items of the first mentioned general part are also single Likert items. The sample consists of 68 bachelor students, 33 of whom study at a university and 35 at a college. They were asked to complete the questionnaire at the end of the module. The questionnaire includes 3 main categories with items to answer. In the first part, 18 statements about the perceptions and effects of feedback were extracted from the literature. The five possible answers were graded from completely true to not true at all. The second part serves to answer RQ1. All statements should explicitly refer to the feedback given by the e-tutors. Therefore, the same ten items were selected for each of the four phases according to Tuckman. Through this consistency, a change in the students' perception can be measured. Before answering each of the ten items, students were asked to assess in which week of virtual collaboration they perceived specific features of each phase. These characteristics were briefly explained, and students then had the opportunity to click on the weeks in which the perception was particularly pronounced. In the last part of the questionnaire, students were able to provide open-ended comments.

First recognizable tendencies and results of the quantitative surveys can thus be visualized and serve as a basis for the creation of the interview guide for the focus group discussion that will take place afterwards. The organizational steps (participant selection, location & duration, moderation, reporting) were carried out according to Krueger & Casey (2015), and the structure of the focus group discussion guide was based on the approach of Döring & Bortz (2016). For the evaluation of the transcripts, the qualitative content analysis according to Mayring (2014) was chosen, in which inductive and deductive coding is applied in a mixed way, and thus already existing results from the previous study as well as new findings can be included. Three e-tutors who took the module were interviewed together shortly after the end of the module. The coding was done with MAXQDA. Finally, the qualitative focus group discussion and quantitative questionnaire results are compared in the discussion so that deeper insights could be gained.

5 Results

During the examined module, there were three different ways for students to receive feedback. When asked which form of feedback generally had the greatest impact on their performance as a group, 65% of students responded e-tutor, whereas 23% preferred the face-to-face consultation with a professor and 12% preferred the social learning analytics bot.

The second part of the survey was concerned with the change in the need for feedback in the phases of team development according to Tuckman. It was important to examine in advance whether the phases of team development were also perceived chronologically in the sequence as assumed in Tuckman's (1965) literature. Therefore, the students had to indicate in which week or task phase of the project work they felt they were in the respective phase of team development based on the characteristics and indicators of the four phases Forming, Storming, Norming, and Performing. When evaluating the individual question item the need for feedback was particularly high in this phase of collaboration, a clearer tendency in the results could be observed – see Figure 1. The mean values of all answers per phase of team development according to Tuckman were also initially considered. The values of the scale can be translated as follows: 5 = need for feedback very high, 4 = need for feedback high, 3 = need for feedback medium, 2 = need for feedback low and 1 = need for feedback very low. Accordingly, the need for feedback in this observation is highest in the forming phase and then decreases slightly in the subsequent phases.
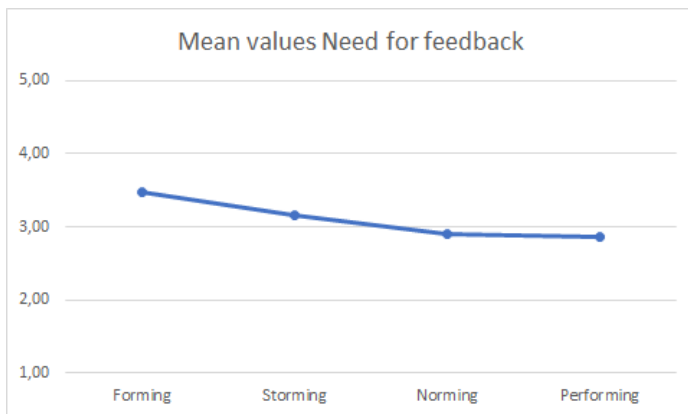

Figure 1: Mean values: Need for feedback

For the consideration of how the need for feedback looks not only in the four phases of team development according to Tuckman, but also in all nine processing phases of the case study work in the virtual classroom, these results were also evaluated. This evaluation is then relevant for answering the second research question, which recommendations for action can be given. To obtain the results, it was evaluated whether indicators of the phases of team development according to Tuckman were perceived in the respective processing phase (e.g. introduction week).

Thus, it is possible that a student did not perceive any of the four phases of Forming, Storming, Norming, or Performing in the first phase of the introductory week, to the other extreme, that he registered characteristics of all four phases and indicated this in the questionnaire. Accordingly, all mentions per processing phase were considered and the mean values were formed from them. These are shown below in Figure 2. A similar tendency can be seen here for the four phases of team development according to Tuckman. Particularly in the introductory week, the need for feedback is higher than in the other phases.
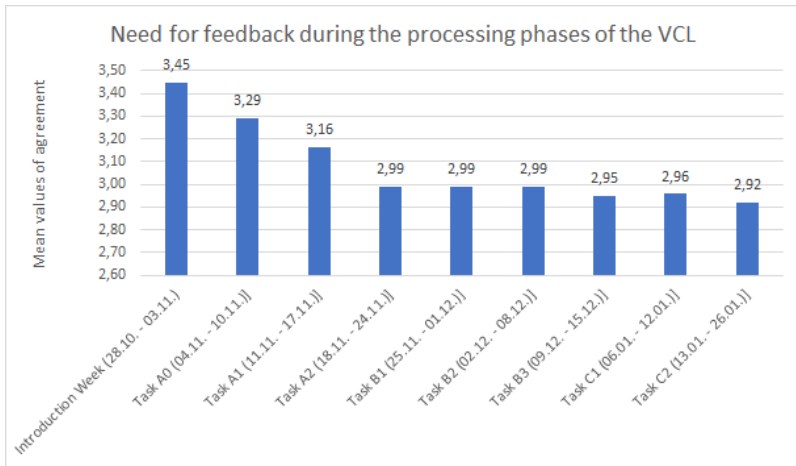

Figure 2: Need for feedback during the processing phases of the VCL

After the end of the processing time of the quantitative survey, the data were analyzed descriptively. Based on this, the interview guide was then developed so that the results of the questionnaire could be discussed in more detail by the e-tutors. In relation to the first research question the e-tutors were asked in which processing phase of the case study work in the virtual classroom they perceived the highest need. To these questions, all three interviewed e-tutors answered that this was clearly perceived at the beginning, i. e. in the forming phase. In this context, e-tutor B3 emphasized that this is mainly due to the fact that students do not know each other, different types of universities collaborate, and in general the situation of complex virtual collaboration is new for students in the Bachelor. The other two e-tutors were also able to confirm this statement, noting that there were many uncertainties with the digital learning platform and task instructions, for example the creation of protocols. Furthermore, it was noted that the organizational structuring within Microsoft Team was still relatively arbitrary and that there were general problems with intra-group communication.

The e-tutors were nevertheless unanimous in their opinion that the number of three obligatory feedbacks is sufficient, as feedback beyond this does not provide any real added value in their perspective.

6 Discussion of the results

The need for feedback is higher in the first phase of forming than in all three subsequent phases. The median response here is 3.5, which means that the need for feedback is between medium and high. This is since the students have to get used to the new digital learning environment with the Microsoft Teams platform, to the group as such and to the complex tasks. Tuckman (1965) describes this phase as the orientation phase, in which the group is formed, the members get to know each other, and roles are assigned. These characteristics also apply to virtual collaborative learning in groups, with the additional complicating factor of uncertainty in dealing with the digital environment and the new work platform. When looking at the mean values, a minimal decrease in the need for feedback can also be seen in the further phases of Storming, Norming and Performing, although this is not very pronounced and the median in each case is 3 = medium need for feedback. The first processing phase, the introductory week, should be particularly distinguished in terms of the level of feedback required. In this phase, the highest need for feedback can be seen in comparison to all of the following phases, which can partly be attributed to similar reasons as for forming explained above. In addition, it may also be due to the fact that no feedback has yet been given by the e-tutors after the introductory week. This took place for the first time after the development of the group contract, which was created in the second processing phase A0.

In relation to the second research question, the e-tutors found that an increase in motivation among students was evident. This effect is also described by Lipnevich and Smith (2009) and Mazarakis and van Dinther (2011), which helps explain this finding. Contrary to this, Hattie and Timperley (2007) do not conclude that praise or extrinsic factors have a significant effect on task performance and are thus motivational. The focus group discussion also shows that the e-tutors are of the opinion that they have noticed a positive effect of praise. A concrete recommendation for action on the part of the e-tutors in the focus group discussion is the provision of a concrete guideline for the preparation of feedback. A checklist of exactly how to proceed as an e-tutor can therefore be helpful, on the one hand, to ensure a better quality of feedback, and on the other hand to ensure that all students or groups in the virtual collaboration receive similar feedback. The timing, content and comprehensiveness of the feedback are particularly relevant. To achieve better comparability of feedback, it is also helpful for the responsible e-tutors to meet regularly.

7 Conclusion

Concerning RQ1, it can be stated that both in terms of the team development phases according to Tuckman (1965) and in the structuring according to the task phases of the module (see Figure 1), there is a higher need for feedback within the studied groups at the beginning of the collaboration. This decreases from the Forming phase, over the Storming and Norming phase and reaches saturation in the relationship between Norming and Performing and decreases only marginally (2.90 Norming; 2.87 Performing. This saturation is even more evident in Figure 2 of the processing phases so that it can be noted in the context of this investigation: The need for feedback is especially higher at the beginning of virtual collaboration.

For RQ2, the following design recommendations can be given for feedback for virtual collaborative learning. Especially at the beginning of group work, the increased need for feedback should be addressed. For example, by increasing the teaching presence as well as transparently communicating the possibilities for receiving feedback. If individual groups are already collaborating well, this should also be made visible through praise, for example. Furthermore, it is important to give the feedback by the e-tutors at eye level and to provide the opportunity for direct interaction with the feedback given. In order to achieve a consistent quality of feedback by e-tutors, a guideline for the provision of feedback by e-tutors should be created for future modules. Furthermore, regular meetings between e-tutors and course supervisors, e.g. in the format of a jour fixe, should be held to clarify current questions regarding conflicts, task instructions, tools and assessment. At the same time, this can also be helpful for new e-tutors, who can compare the status of the other groups with theirs, e.g. through a short status report that each e-tutor gives. If task related feedback is given, this should be done by an professionally suitable person in order to increase the acceptance of the groups. For future research, it is advisable to conduct a quantitative study with a larger sample, testing whether the results of the present thesis can also be applied to other forms of virtual collaboration. It is also advisable to conduct interviews with experts – for example, professors in the field of feedback research in e-learning. Further optimization of the feedback process in virtual collaborative learning can be investigated by testing how feedback can be partially automated or automated based on existing recommendations for action. In this way, frequently occurring questions and problems, especially in the initial phase of virtual collaboration, can also be supported with the help of technical support such as feedback chatbots or partly automated decision support systems.

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