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Perceptions Predict Problem Regulation? The Role of Homogeneous Problem Perception for Successful Regulation in Collaborative Learning

Laura Spang, Martin Greisel, Ingo Kollar
laura.spang@phil.uni-augsburg.de, martin.greisel@phil.uni-augsburg.de, ingo.kollar@phil.uni-augsburg.de
University of Augsburg, Germany

Abstract: Collaborative learning does not always yield positive results. One problem might be that group members have different problem perceptions and fall short in homogenizing them. Yet, little is known whether a homogenous problem perception and an awareness of the homo- vs. heterogeneity of their problem perceptions enhance the regulation process. In this study, *N*=310 pre-service teacher students collaborated online in a problem-based leaning scenario. Afterwards, they answered an online questionnaire to measure their problem perceptions, their awareness of the homo-/heterogeneity of their perceptions, and different indicators of regulation success. Path models indicated that homogeneous problem perceptions enabled regulation success. Learners should thus be scaffolded to achieve homogeneous problem perceptions.

Problem background

Despite its theoretical potential (e.g., Chi & Wylie, 2014), collaborative learning does not always lead to success (Weinberger et al., 2012). One reason is that the collaboration process may be aggravated by a range of problems that need to be regulated by the group (e.g., Järvenoja et al., 2013). To do so, learners first need to identify the problem (Borge et al., 2018). In collaborative learning, though, each group member has their own problem perception, and these problem perceptions may either be heterogeneous (i.e., group members have different perceptions of the current problem) or homogeneous (i.e., group members have the same perception of the current problem). The homogeneity or heterogeneity may affect the regulation process within the group (e.g., Melzner et al., 2020), and thus be decisive for whether the problem is regulated successfully. This paper thus explores how a homogeneous problem perception during collaborative learning influences different learning outcomes.

Problem regulation and homogeneity of problem perception

Problem perceptions of the individual group members may be similar (i.e., homogeneous) or different from each other (i.e., heterogeneous). If all learners believe that a limited productivity is caused by insufficient prior knowledge, they perceive the problem homogeneously. If, however, one group member believes that the unsuccessful learning session is caused by a lack of knowledge, while another group member attributes it to an uninteresting leaning content, the learners have a heterogeneous problem perception, which might hinder the regulation process, as the different group members may use different, possibly incompatible regulation strategies to overcome the problem. A homogenous problem perception, in contrast, might benefit group learning, as the selection of appropriate regulation strategies may be easier (e.g., Borge et al., 2018).

Awareness of a homogeneous problem perception

However, even if group members have the same perception on occurring regulation problems, learners could be unaware of their homogeneous problem perception. The same holds true for learners with heterogeneous problem perceptions. Although one group member might believe that the unsuccessful learning session is caused by a lack of prior knowledge, while another group member may attribute the slow progress to an uninteresting leaning content, both could be convinced that the other group members perceive the situation the same way they do. It is still rather unclear how learners homogenize such a heterogenous problem perception. If, however, learners know that the problem perception differs within the group, they could deliberately try to counteract these heterogeneous perceptions. More specifically, if a learner realizes that his or her own perception is different from the perception of another group member, he or she can initiate regulatory activities to achieve a more homogeneous view (Borge, et al., 2018). Consequently, it seems more likely that learners who are aware of potential discrepancies in the problem perceptions choose regulatory activities to deal with this situation on a group level.

Homogeneous problem perception and regulation success

Homogeneous problem perceptions and awareness of a homogeneous problem perception should increase regulation success (e.g., Melzner et al., 2020), which can manifest in different ways. According to Hadwin et al.

(2018), for example, regulation occurs when learners individually, as well as in interaction with each other, adjust their cognitions, motivations, and/or their emotions. To arrive at successful regulation, a homogeneous problem perception appears to be a necessary precondition. In other words, regulation success would be high if group members successfully solved their problems and improve their learning experience and/or their knowledge gain to a satisfying level. In this paper, we differentiate between four dimensions of regulation success: (a) satisfaction with the group's collaboration process, (b) perceived success of coping with the group's regulation problems, and (c) subjective, as well as (d) objective knowledge acquisition.

Research questions

This paper focuses on the association of (1) actual homogeneity regarding the individual problem perceptions (IPP), and (2) the awareness of the IPPs with regulation success measured by (a) satisfaction with the collaboration process, (b) perceived success of coping with the group's regulation problems, (c) subjective knowledge acquisition, and (d) objective knowledge acquisition.

Since both homogeneous problem perceptions (e.g., Melzner et al., 2020) and an awareness of the group learning process (Borge et al. 2018) seem to be important for group regulation, we hypothesized that homogeneity of IPPs, and accurate awareness of the problem perception within the group would be associated with higher (a) satisfaction with the collaboration process (H1a and H2a), (b) perceived success of coping with the group's regulation problems (H1b and H2b) and, (c) subjective (H1c and H2c) as well as (d) objective knowledge acquisition (H1d, and H2d). For a deeper understanding of the regulation process, we further exploratively analysed video recall interviews, which took place about one week after the group session.

Method

Sample. Initially, N=405 pre-service teachers (M_{age}=20.61, SD=5.01, 77.28 % female) participated. We embedded the study as a learning exercise into the course content of 15 seminars. All students participated on a voluntary basis. N=310 students provided data for the main data collection (t1) and the post-test (t2). N=111 collaborative learning groups from which at least two group members answered the questionnaire were included in the analysis.

Procedure. During the first session, students collaborated in small groups online via Zoom in a problem-based learning scenario in which they had to analyse a case vignette that described a difficult classroom situation. Each group was video recorded. After the group session, participants answered an individual questionnaire. In the second session, one week after collaboration, participants completed a knowledge test. In four groups at least two group members agreed to participate in a post-hoc video recall interview, one week after the knowledge test. During the interviews, we showed each member from the same group one identical video excerpt from their group session and asked them to describe the respective situation and estimate whether they believed their groups members would agree with their problem perception.

Instruments and Analysis. Participants rated the extent to which 33 problems occurred during their collaboration, on a 5-point Likert-scale (3 items per problem, e.g., „Single/multiple group members lacked prior knowledge of the learning content"; on average α=.78). We selected these problems based on prior literature (e.g., Järvenoja, et al., 2013). Then, we calculated the difference of the individual problem ratings of each single group member from the average problem ratings of the rest of the group for each of the 33 problems separately. As a measure of *actual homogeneity of IPPs*, we used the average mean of these differences across all problems and multiplied it by –1 to get a measure of homogeneity instead of heterogeneity. To determine *awareness of homogeneity*, first, participants had to rate their perceived homogeneity of IPPs with six adapted items from Menold (2006; e.g., „I believe that my problem perception is different from the problem perception of the others"; α =.70). Next, we calculated the absolute difference between the z-standardized homogeneity of the IPP and the perceived homogeneity of IPPs and multiplied the score with -1 so that learners whose perceived and actual homogeneity aligned more received higher scores. We determined regulation success with: (1) *satisfaction with the group's collaboration process* which was assessed with five adapted items from Glaesmer et al., (2011; e.g., "I am satisfied with our group work.".; α=.92), (2) *perceived success of coping with the group's regulation problems*, for which we adapted four items from Engelschalk et al. (2016; e.g., „My group managed to successfully solve the problems that arose during group work."; α=.93), (3) *subjective knowledge acquisition* which was measured by 9 adapted items from Ritzmann et al. (2014; e.g., „I have the impression that my knowledge of Piaget's/Selman's/Kohlberg's theories has increased. "; α=.94), and (4) a multiple-choice test consisting of 36 statements (1 point for each correct answer) to assess *objective knowledge acquisition*. For analysis, we used the manifest scale means of the self-report measures and the percentage of correct answers for the multiple-choice test in addition to the homogeneity variables described above. We calculated a path model (see Figure 1) with a maximum likelihood estimator using lavaan version 0.6.11 (Rosseel, 2012*).*

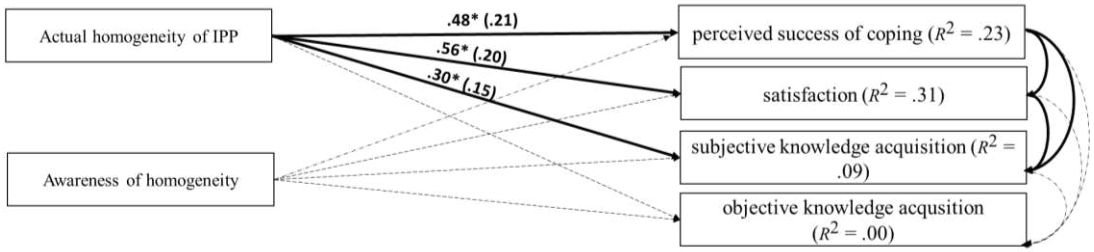
Results

Path model

The path model revealed that actual homogeneity of IPPs significantly predicted satisfaction with the collaboration process, perceived success of coping with the group's regulation problems, and subjective knowledge acquisition (see Figure 1). However, it did not significantly predict knowledge acquisition (H1d). Awareness of homogeneity neither predicted satisfaction with the group learning process, perceived success of coping with the group's regulation problems, subjective knowledge acquisition, nor objective knowledge acquisition (H2a-2d).

Figure 1

Path model with homogenous problem perception, awareness of homogeneity and regulation success



Note. Presented are only significant standardized coefficients (standard errors) *p < .001.

Interviews

For a deeper understanding of our results, we analysed two interviews of a group in which the group members had a rather heterogeneous problem perception based on the actual homogeneity of IPPs.

Excerpt from interview with group member A

I: Then I would like to ask you: Describe, what just happened.
L: I think we were unsure what exactly the task was, so we were unsure where to start working, how we could divide the group work, because we had no idea what exactly the goal was. (…)
I: What do you think how the others perceived the situation? Do you think that their perception coincided with yours?
L: Yes, I think so. Otherwise, somebody would have said something or helped me, or said whether we have to do it like this. But I think we as a group were on the same page.

Excerpt of interview with group member B

I: How would you evaluate this situation?
L: I think I evaluated it a little bit negative, because I had the feeling that the others had no real interest. (…) But I did not know, how to get these concerns across to the others or how to talk to them, to engulf them into a conversation that continues.
I: Do you think that the other group members perceived the situation like you?
L: I can imagine that it differed because everyone has different views and backgrounds, and I can only guess what they thought by the way they acted, but it is also possible that it is completely different.

Summary

The problem perception of the group members clearly differed. A mentioned that the group was unsure what exactly the task was. B, in contrast, expressed that the other group members did not feel like doing something. B realized that there might have been heterogeneous problem perceptions. However, he or she was still unsure how to regulate this situation. The group reported low regulation success compared to the overall sample (perceived success of coping with the group's regulation problems: M= *3.42, SD* = 1.63, satisfaction with the group's collaboration process: M= 3.40, SD=1.20; subjective knowledge acquisition: M= 3.00, SD= 1.20).

Discussion and practical implications

As expected (e. g., Melzner et al., 2020), actual homogeneity of IPP was associated with satisfaction (H1a), perceived success of coping with the group's regulation problems (H1b) and self-reported knowledge acquisition (H1c). Consequently, educators should develop ways to support groups in how to reach a homogeneous problem perception. However, instructors should consider that awareness of the homogeneity of the problem perception did not correlate with regulation success (H2a-2d). This finding indicates that even when learners are aware of their heterogenous problems perception, they might not try or be unable to regulate discrepancies and develop a homogeneous perception. The interview data supports this assumption. Here, even though a group member knew that the problem perception within the group was heterogeneous, he or she was still unsure on how to deal with this situation. Consequently, group members should not only be made aware of their different perceptions, but also be supported to achieve homogeneity. Potential support options might combine group awareness tools with prompts (e.g., Schnaubert & Bodemer, 2018).

Limitations and outlook

Analysis of video recordings might uncover the extent to which learners engaged in knowledge generating activities (e.g., Chi & Wylie, 2014) and consequently might explain why homogeneous problem perceptions did not significantly predict knowledge acquisition (H1d). Video analysis might also investigate if homogeneous problem perception indeed leads to a more coordinated selection and use of suitable strategies. Despite these limitations, our study helps to understand problem regulation and how it should be supported.

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