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Do all roads lead to Rome? An Expert Study to Assess the Immediacy of Strategies to Regulate Collaborative Learning

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Abstract: When students work collaboratively, a wide range of different comprehension-related, motivational-affective, coordination- and resource-related problems may arise. To learn and collaborate effectively, these problems need to be regulated with the help of appropriate strategies. Different regulation strategies can however be differently immediate for the solution of different problems. By aid of an online questionnaire, we therefore asked $N = 71$ international experts from research on Computer-Supported Collaborative Learning (CSCL) to assess for individual problem types to what extent they felt that different regulatory strategies would be immediately effective or not. As a result of the analysis of the respective median for the individual strategies, it became apparent that, according to the experts, primarily but not exclusively comprehension problems should be regulated with cognitive strategies, coordination problems with metacognitive strategies, motivation problems with motivational strategies and resource problems with resource-oriented strategies. This has important implications for future interventions designed to support groups in effectively regulating their collaborative learning processes.

Introduction

At university, many students consciously decide to form self-organized small study groups, e.g. to jointly prepare for exams. This decision is easy to understand in view of the well-documented positive effects of collaborative learning on knowledge acquisition (Springer et al., 1999). However, research on collaborative learning shows that students unfortunately do not always make full use of the potential of collaborative learning (Weinberger et al., 2012). According to previous research (e.g., Järvenoja et al., 2019), self-organized collaborative learning may evoke various problems that can be divided into at least four categories: comprehension problems, coordination problems, motivational-affective problems and resource-related problems.

For self-organized collaborative learning to be successful, groups must be able to cope with such problems by activating appropriate strategies. Theoretical models of self-regulated learning (e.g., Panadero, 2017) assume that the choice of a strategy that fits the learning goal is crucial for regulatory success. Accordingly, it is assumed that not every strategy is equally well suited to solve a particular regulation problem (e.g., Engelschalk et al., 2016). The question of the fit between problems and strategies is particularly important because learners should be instructed to adjust their approach as adequately as possible depending on the situation.

To specify this fit more precisely, we developed the concept of "immediacy": A strategy can be said to be immediately effective for a problem if the strategy is generally suitable for the problem to disappear completely after applying the strategy correctly and with sufficient intensity. E.g, in case of unstructured learning material that consists of a large number of unconnected individual texts which do not seem to have any common thread, an organizational strategy would be an immediate strategy. A non-immediate, yet possibly still helpful strategy might be to motivate each other to continue working by offering a reward. In this case, although the group would continue studying, the strategy can not be considered as immediate because the actual problem—the lack of structure of the learning content—would not be solved. Previous studies indicate that comprehension problems should mainly be regulated with cognitive strategies, coordination problems mainly with metacognitive strategies, motivational-affective problems with mainly motivational strategies and resource problems with mainly resource-oriented strategies (Melzner et al., 2020). The present study however takes a closer look and asks what kinds of specific strategies (even within the broad categories just mentioned) are more immediate than others to solve a given regulation problem. We approach this question by aid of an expert survey.

Method

Sample

For this expert study, we approached all $N = 2324$ authors and co-authors who published papers in the CSCL conference proceedings from 2019, 2017, 2015 and 2011 via e-mail and invited them to participate in an online survey. Of the contacted persons, $N = 71$ experts rated at least one problem. Age was distributed as follows:

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26–34 years = 25.4%, 36–45 years = 32.4%, 46–55 years = 28.2%, 56–65 years = 8.5%, and ≥ 66 years = 5.6%. About 47% of the study participants were male, and the average time participants had been working in science was $M = 17.29$ years ($SD = 10.94$). More than one fifth of the respondents were employed as professors (22.7%), almost one third (29.6%) as associate or assistant professors, and 16.9% were PhD students. The experts included in this study were all researchers who had first-authored at least one contribution in the field of collaborative learning, regulation in collaborative learning settings and/or individual self-regulated learning.

Procedure

After measuring socio-demographic information, participants received a short explanation of the concept of immediacy. Then, the survey presented 33 problems—based on previous problem typologies in the literature (Melzner et al., 2020)—that may occur during self-organized collaborative learning. For each problem, participants were asked to rate 27 strategies on a scale from 1 (*not immediately effective at all*) to 5 (*very much immediately effective*) which were based on strategy typologies from the literature (Melzner et al., 2020). Since participants were not expected to complete the whole questionnaire because of its length, problems were presented in randomized order to balance the number of responses for each problem. The number of respondents per problem varied between $N = 12$ and $N = 20$.

Analysis

We assumed that a strategy can be regarded as immediately addressing the respective problem if half of those who assessed it rated a strategy as at least somewhat immediately effective, i.e. strategies that had a median of 3 or greater (theoretical midpoint of the scale) were classified as immediate strategies for the problem at hand.

Results

An overview of the allocation of immediately effective strategies for the individual problems can be seen in Table 1. According to the experts, a percentage of $M = 33.44\%$ ($SD = 25.93\%$) of all assessed strategies was at least "somewhat immediately effective" (≥ 3); a share of $M = 20\%$ ($SD = 17.16\%$) were rated as ≥ 4 and thus seen as at least "rather immediately effective" and $M = 8.53\%$ ($SD = 11.16\%$) as "very much immediately effective" (= 5). Further, Table 1 shows that problems from one kind (e.g., motivational problems) were mostly regarded to best be regulated by strategies from the one category of strategies that best apply to them (in this case: motivational strategies). Yet, for all problem categories, also strategies from other categories were listed to be immediate (this applied in particular to comprehension and coordination problems).

Table 1. Possible problems in collaborative learning settings and regulation strategies immediately addressing these problems according to participants (median of experts' ratings in parentheses).

Problem	Regulation strategies rated as at least „immediately effective"			
	Cognitive	Metacognitive	Motivational	Resource-oriented
Comprehension Problems				
Unclear Task Definition		PRL (3)		
Unclear Procedure		PRL (4)		
Deficits in Prior Knowledge	CGP (5)			
Difficult Learning Content	OS (3), SIC (5), CGP (3), RDU (4)	PRL (3), REO (3)		ERM (3)
Too Complex Learning Content	OS (4), SIC (4), CGP (3)	PRL (3,5)		ERM (3)
Unstructured Learning Content	OS (4), SIC (3)	PRL (3)		
Coordination Problems				
Inefficient Use of Time		PRL (4)		TMC (5), AM (3), EM (3)
Unfair Distribution of Work Load		PRL (4)	HUG (3)	TMC (3), EM (3), FSA (3)
Lacking Procedural Fairness		PRL (3)	HUG (4)	FSA (3,5)

	Cognitive	Metacognitive	Motivational	Resource-oriented
Coordination Problems				
Differing Technical Understanding	SIC (3), RDU (5)			
Differing Goals	RDU (3)	PRL (4)	HUG (4)	FSA (3)
Incompatible Working Methods		PRL (4)		
Communication Problems		PRL (3), REO (3)	HUG (3)	TMC (3), FSA (4)
Poor Relationship Quality			HUG (4)	FSA (5)
Lack of Information Exchange		PRL (3.5)	HUG (4)	EM (3), FSA (3.5)
Motivation Problems				
Low Value of Learning Method			RS (3), SIT (3), HUG (4)	
Low Usefulness of Learning Content			SIT (3), IPS (4)	
High Costs of Learning Content			SIT (3), IPS (4)	
Low Intrinsic Value of Learning Content			RS (3), SIT (4), IPS (5)	
Low Personal Meaning of Learning Content			SIT (3), IPS (5)	
Procrastination		PRL (3)	RS (3), SIT (3) IPS (3)	TMC (3), EM (3)
Low Self-efficacy Expectation			MPS (3), AST (4)	
Resource Problems				
Lack of Time		PRL (4)		TMC (5), EM (3)
Unfavorable Surrounding Environment				EC (5)
Distraction				EC (4), AM (4)
Undesirable Private Conversations			SIT (3), HUG (4)	AM (5)
Lack of Learning Materials				KIM (4), ERM (4)
Physical Problems				TMC (3), EM (3), FSA (3)
Negative Emotions			SIT (3), MEC (4)	FSA (3)
Insufficient Technical Equipment				ERM (3), UAT (4), RTK (4)
Weak Technical Performance				UAT (5), RTK (4.5)
Lack of Technical Functionality				UAT (5), RTK (3), ATK (3)
Lack of Technical Skills				UAT (3), RTK (4), ATK (5)

Note. *Cognitive*: Organizational Strategies (OS), Strategies for Improving Comprehension (SIC), Strategies for Closing Gaps in Prior Knowledge (CGP), Strategies to Resolve Differences in Understanding (RDU); *Metacognitive*: Planning and Regulation of the Learning Process (PRL), Reflection and Evaluation of the Learning Outcomes (REO); *Motivational*: Reward Strategies (RS), Increasing Situational Interest (SIT), Increasing Personal Significance (IPS), Mastery and Performance-Related Self-Talk (approach and avoidance) (MPS),

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Ability-Related Self-Talk (AST), Highlighting Group Utility as a Goal (HUG), Management of Emotional Contagion (MEC); *Resource-oriented*: Time Management and Coordination (TMC), Environment Control (EC), Knowledge and Information Management (KIM), Attention Management (AM), Effort Management (EM), External Resource Management (ERM), Fostering a Positive Social Climate (FSA), Use of Alternative Tools (UAT), Recourse to Technical Knowledge for Handling Work Equipment (RTK), Acquisition of Technical Knowledge (ATK); *Only those regulatory strategies that were considered to be immediately effective for a problem at least once are listed.*

Discussion, limitations and conclusions

The purpose of the present study was to examine which regulatory strategies for different problems can be classified as immediately effective, according to experts from the CSCL community. By and large, we found that the common assumption (Melzner et al., 2020) that comprehension problems should best be regulated by employing cognitive strategies, motivational problems by motivational strategies, coordination-related problems by coordinative strategies, and resource-related problems by resource-oriented strategies was supported by the expert ratings. The theoretical assignments to the fit of problems and regulation strategies (e.g., Engelschalk et al., 2016), especially in collaborative learning settings (Melzner et al., 2020), were thus supported by the present results. Yet, we also obtained evidence that previous general classifications might be too simple in some cases. For example, in case of a procrastination problem, experts agreed that it would not be sufficient to use any motivational regulation strategy. Here, it may make sense to also resort to resource-oriented strategies such as Effort Management (EM) or the Planning and Regulation of the Learning Process (PRL) (metacognitive strategy).

In addition, the different size of the median for the individual assessments provides an indicator not only of whether, but also of the extent to which the strategies for the individual problems are—according to the experts' judgements—immediately effective or not, with higher medians indicating greater immediacy than lower medians. Consequently, our data indicates that for example the problem "Lack of Technical Skills" might be best regulated by the Acquisition of Technical Knowledge (ATK) (*Mdn* = 5), while the Recourse to Technical Knowledge for Handling Work Equipment (RTK) would be somewhat less immediately effective (*Mdn* = 4), and the Use of Alternative Tools (UAT) would still be usable, but least preferable (*Mdn* = 3).

In the present study, two decisions we made for the data evaluation might well be criticized: On the one hand, the median of 3 was used as a threshold value to distinguish immediate from non-immediate strategies. On the other hand, the expertise of the participants was solely tied to their first authorships. It would be conceivable to set a higher median for the examination of immediacy and to use the assessments of other indicators of expertise in the corresponding fields for the selection of suitable experts. Moreover, experts' self-reported judgements only provide hints to but are not equivalent to the actual effectiveness of regulation behavior in real learning settings.

Despite these limitations, our results bear important implications for the design of scaffolds to support self-organized collaborative learning. Based on our results, it would seem promising to closely monitor the kinds of problems groups encounter during collaboration and to then prompt students to apply strategies that our study identified as immediate. It is likely that the growing field of Learning Analytics (e.g., Ferguson, 2012) might, in the future, develop algorithms to diagnose current problems and to fade appropriate support in and out as needed.

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