

## How to promote optimal individual and collaborative learning in remote and hybrid environments? A focus on motivational and emotional factors

Gaëlle Molinari (co-organizer), University of Geneva & UniDistance, [gaelle.molinari@unige.ch](mailto:gaelle.molinari@unige.ch)  
 Annelies Raes (co-organizer), KU Leuven & University of Lille, [annelies.raes@kuleuven.be](mailto:annelies.raes@kuleuven.be)  
 Lily Zeng, University of Hong Kong, [zengll@hku.hk](mailto:zengll@hku.hk)  
 Susan Bridges, University of Hong Kong, [sbridges@hku.hk](mailto:sbridges@hku.hk)  
 Nathan Mentzer, Purdue University, [nmentzer@purdue.edu](mailto:nmentzer@purdue.edu)  
 Shawn W Farrington, Purdue University, [sfarring@purdue.edu](mailto:sfarring@purdue.edu)  
 Adrie Koehler, Purdue University, [akoehler@purdue.edu](mailto:akoehler@purdue.edu)  
 Lakshmy Mohandas, Purdue University, [lmohanda@purdue.edu](mailto:lmohanda@purdue.edu)  
 Ali Aamir, Purdue University, [aaamir@purdue.edu](mailto:aaamir@purdue.edu)  
 Mallory Claypool, Purdue University, [mclaypoo@purdue.edu](mailto:mclaypoo@purdue.edu)  
 Matthieu Petit, Université de Sherbrooke, [matthieu.petit@usherbrooke.ca](mailto:matthieu.petit@usherbrooke.ca)  
 Julie Babin, Université de Sherbrooke, [julie.babin@usherbrooke.ca](mailto:julie.babin@usherbrooke.ca)  
 Marie-Ève Desrochers, Université de Sherbrooke, [marie-eve.desrochers@usherbrooke.ca](mailto:marie-eve.desrochers@usherbrooke.ca)  
 Hanna Järvenoja, University of Oulu, [hanna.jarvenoja@oulu.fi](mailto:hanna.jarvenoja@oulu.fi)  
 Tiina Törmänen, University of Oulu, [tiina.tormanen@oulu.fi](mailto:tiina.tormanen@oulu.fi)  
 Sari Pramila-Savukoski, University of Oulu, [sari.pramila-savukoski@oulu.fi](mailto:sari.pramila-savukoski@oulu.fi)  
 Heli Kuivila, University of Oulu, [heli-maria.kuivila@oulu.fi](mailto:heli-maria.kuivila@oulu.fi)  
 Sanna Järvelä, University of Oulu, [sanna.jarvela@oulu.fi](mailto:sanna.jarvela@oulu.fi)  
 Kristina Mikkonen, University of Oulu, [kristina.mikkonen@oulu.fi](mailto:kristina.mikkonen@oulu.fi)  
 Lisa Ollesch, University of Duisburg-Essen, [lisa.ollesch@uni-due.de](mailto:lisa.ollesch@uni-due.de)  
 Daniel Bodemer, University of Duisburg-Essen, [daniel.bodemer@uni-due.de](mailto:daniel.bodemer@uni-due.de)  
 Armin Weinberger (discussant), Saarland University, [a.weinberger@edutech.uni-saarland.de](mailto:a.weinberger@edutech.uni-saarland.de)

**Abstract:** Last year, the global pandemic forced us to rethink education by applying social distancing in education and workplace training. Fortunately, current technologies make it possible to organize teaching and learning online, synchronously as well as asynchronously. Literature indicates that online learning did not negatively impact cognitive learning outcomes (Gonzalez et al., 2020). Yet, several affective variables, including students' well-being, optimal experience and engagement for learning, have been shown to significantly affect the learning experience of remote participants (Raes et al., 2020). Furthermore, the pressure to self-regulate is higher in online learning than in traditional learning (Cosnefroy, 2010), and such a pressure may lead to fatigue, stress and negative emotions that can have detrimental effects on motivation and performance. In this symposium, researchers will focus on the emotional and motivational dimensions within different forms of remote teaching and learning, and also will discuss how CSCL should be reconceptualized in the changing context.

## Introduction

### Symposium focus and major issues addressed

While it is still premature to conclude on the impact of the COVID-19 pandemic on education and learning, it is possible through the many studies conducted in different countries to get a first glimpse of the students' experience of online learning during this particular period. Results show that the forced transition to online learning led to a significant increase in academic workload which caused more stress for students (Yang et al., 2021). Moreover, although students found advantages in studying alone at home (e.g., time saved by not having to travel), they reported greater difficulty staying task-focused (Dell'ambrogio et al., 2020). They also had less opportunities to interact with their peers and experienced higher difficulty to work on group projects. These results are consistent with previous findings of studies in the field of distance education which point out that such a format of learning requires students to demonstrate high self-regulated learning skills. Cosnefroy (2010) talks about a pressure for distance learners to self-regulate, yet many studies warned about the limited self-regulations skills within students which may induce mental fatigue and anxiety, and thus may also have a detrimental effect on learning achievement. Molinari and Schneider (2021) also found that distance learners struggle to use appropriate volitional strategies to maintain their motivation at an optimal level throughout the academic year. As mentioned by Deimann and

Bastiaens (2010), “insufficient affective and emotional support is related to decreased motivation and eventually to dropout” in distance education (p. 10). To sum up, one of the main aspects of student learning affected by the COVID-19 related transition to online learning relates to their motivation and their psychological well-being. Results also emphasize the importance of a supportive and stimulating social space (Kreijns et al., 2004, 2021).

One may expect that the expansion of online and hybrid forms of learning (combining on-site and remote learning synchronously) will further accelerate and that the use of such new formats will become an integral part of the higher education system in the post-pandemic situation. If true, it is crucial to better understand the students’ experience of online learning at the emotional and motivational levels. In particular, further research is needed to investigate the dynamics of emotional states (Avry et al., 2020) as well as the fluctuation in motivation (Navarro et al., 2013) in learning situations where they have to work remotely either in an independent way or in a team. Besides, the aim is to understand how to design hybrid environments that promote a positive, engaging and optimal learning experience for both on-site and remote students.

## Significance and complementary of the symposium contributions

The symposium includes 5 contributions from researchers from different countries and continents (Hong-Kong/Asia, Oulu/Sweden, Duisburg-Essen/Germany, Purdue/USA, Sherbrooke/Canada) as well as from different research communities. A first set of 3 contributions focuses on the motivational and emotional issues that students and teachers/supervisors may encounter in hybrid learning. A second set of 2 contributions focuses on the social-emotional aspects of collaborative learning in remote settings. The discussant will be Armin Weinberger, a leading CSCL researcher known for his research on collaboration scripts. Each contribution, including that of the discussant, will have 10 minutes for presentation plus 5 minutes for questions, making a total of 90 minutes.

During the COVID-19 pandemic, the online format was imposed on the students. It is therefore questionable to what extent they would have chosen this format if they had the choice. **Zeng and Bridges** focus on the *factors that influence students’ choice of course modality and learning environment during COVID-19 in an Asian context*. They show a positive relation between students’ self-efficacy for online learning and the number of courses chosen to take online. Interestingly, the willingness to study online is also related to the preference for stimulating learning such as that offered by collaborative learning environments.

Flexibility could be the future for higher education. This means that one may expect a more intensive use of hybrid flexible (HyFlex) course formats, an instructional approach that combines face-to-face (F2F) and online learning (hybrid) and that give students the flexibility to choose how to participate. Students could benefit from such a format because it was shown that the experience of free choice in learning is a crucial factor for well-being and persistence (Jézégou, 2002). **Mentzer and colleagues** use self-determination theory (SDT) as an analytical framework to examine the extent to which the *HyFlex* version of a design thinking course designed in response to the COVID-19 pandemic is able to meet students’ needs for *autonomy, competence and relatedness* in the same way as its face-to-face version. The main results show that students in the HyFlex environment felt less frustrated in their needs for autonomy and competence compared to those in the F2F environment. Moreover, there is a decrease in the feeling of being connected to peers for students who choose remote participation over F2F.

Social presence which refers to a sense of being in a mutual interaction with an entity (a person or a virtual reality character) is considered as an important concept for creating a positive and constructive social climate in online learning environments (Kreijns et al., 2004, 2021). **Petit and colleagues** use the Community of Inquiry model to analyze *social presence in remote supervision* based on three indicators - emotional expression, open communication and group cohesion. In particular, they investigate the way supervisors adjust their practices to enhance their presence within cohorts of teacher trainees who decided to do their internship remotely. They show that supervisors try to show empathy for their trainees and to reduce their feeling of isolation using several strategies such as the multiplication of communication channels and the creation of informal social spaces.

One may wonder to what extent and how groups deal with social-emotional tensions in remote learning environments where access to emotional information is rather limited. **Järvenoja and colleagues** focus on *social-emotional interaction in hybrid collaborative learning*. They show that social-emotional interaction emerges in such a context and that groups engage in emotion regulation. They also point out that the aim of emotion regulation differs between the three consecutive hybrid collaborative learning sessions. For example, groups regulate so as to create a positive emotional climate in the first session. **Ollesch and Bodemer** investigate the effects of *emotional group awareness tools* in fully online, *remote learning settings*. In this study, the particularity of the awareness tools is that they provide friendliness information. Results show a beneficial impact of such awareness information on different aspects of collaborative learning (e.g., group selection, engagement, mental well-being). They also suggest taking into account the need for affect as an important individual characteristic when investigating the effect of methods designed to increase emotional awareness within the group.

## Discussant

**Weinberger**, our discussant, will discuss the particular need to investigate the *role of emotions in CSCL*. First, the peer in peer learning could be assumed to be one central source for a large variety of emotions. The alignment or misalignment of learners towards shared goals may produce reciprocally enhancing emotions of solidarity in facing challenging tasks, mutual respect and helping behavior, and joint accomplishment and pride, or alternatively, mutual disappointment and demotivation through social loafing, free riding and sucker effects. In this regard, emotions may play a larger role in CSCL than they have been accounted so far. Second, the computer in peer learning may influence the emotional climate of any given CSCL scenario, which is equally under-investigated. One general assumption is that especially computer-mediated, remote scenarios of learning together, may lead learners to also be emotionally remote. There are some indications that online talk is more focused on the task at hand than on social dimensions of interacting with one another, for instance. There is a notion of lack of social presence in two-dimensional online scenarios of learning together. Respectively, there is an effort to innovate the interface towards three-dimensional and multi-modal interaction, building on embodied cognition ideas like bodily synchronization or joint attention. Hence, CSCL could not be a place of emotional deficit, but a sandbox for analyzing, designing for, and facilitating a shared emotional experience of learning.

## Factors that affect student choice of course modality and learning environment during COVID-19 in an Asian context

Lily Zeng and Susan Bridge

With the advancement of technologies, universities have been increasingly offering flexible modalities (online learning (OL), face-to-face classroom learning (F2FCL), or hybrid/dual) for course or programme delivery. In higher education, the COVID-19 pandemic created an initial rapid shift from F2F course delivery to “emergency remote teaching” (Hodges et al., 2020) with increased adoption of hybrid/dual modes with a return to campus. Previous research shows that new modes of delivery bring new factors to the learning environment and complicate students’ learning experience (Bridges, 2015; Bridges et al., 2020). Therefore, it is important to understand what affects undergraduate students’ choice of engagement with course modalities and learning environments. Critics of the current research on students’ choice of course modality have found this to be typically small scale, focusing on single disciplines, mainly looking at the impact of demographic variables, and not having considered psychological factors sufficiently (McPartlan et al., 2021; O’Neill et al., 2021). Among the small number of studies that have explored psychological factors, most did not conceptualize the variables properly as latent psychological constructs nor assess them with established psychological measurements (O’Neill et al., 2021). Indeed, many of the demographic variables reported were related to non-traditional students such as age, marital status, family or work commitment, etc. (e.g. Brown, 2012; Chen et al., 2010; Jaggars, 2015; Ladyshevsky & Taplin, 2013; McPartlan et al., 2021; Millson & Wilemon, 2008; Ortagus, 2017; Wladis et al., 2015). To address the research gaps in the field, this study is conducted among students from multiple disciplines and typically traditional backgrounds with whom the demographic factors that affect students’ choice reported in the previous studies do not apply. It investigates the impact of psychological constructs (self-efficacy for OL, students’ perceptions of their prior OL experience, and conceptions of learning) on students’ choice of course modality and learning environment for synchronous OL. It also provides a first attempt to investigate students’ choice of course modality and learning environment in synchronous hybrid/ dual mode courses in an Asian context.

## Method

Data were collected through surveys from 643 undergraduates in an Asian university on their choices of learning environment for learning (F2F vs. online and online on-campus vs. online at home) during the COVID-19 pandemic, their self-efficacy for OL (Liaw & Huang, 2013), conceptions of learning (Vermunt & Donche, 2017), and perceptions of their prior OL experience (Webster et al., 2009).

## Findings

Between the choices of modality (F2F vs. online), no significant differences were found in participants’ choice across groups of different genders, years of study, origins, and disciplines. The proportion of the courses students chose to take online among the total numbers of courses they took in the semester were significantly and positively correlated with students’ self-efficacy for online learning but negatively correlated with their rating on stimulating education. The hierarchical regression shows that students’ conceptions of learning (stimulating education), self-efficacy for online learning, perceptions of their prior online learning experience (ratings on active learning, clear goal, and assessment) might have contributed to students’ choice of course modality.

Regarding students' choice of learning environment for synchronous online learning, significant associations were identified between student choice and gender, year of study, origin, and discipline. Significant differences were also identified in participants' ratings on their self-efficacy for online learning, conceptions of learning, and perceptions of their prior online course experience across groups of different genders, origins, disciplines, and learning environment choices. The logistic regression indicated the odds of studying synchronously online on-campus were greater for those who preferred stimulating education or cooperative learning or perceived their previous online course experience as having clearer goals.

Participants' responses to the open-ended question confirmed the findings from the quantitative data and suggested possible correlations between students' learning preferences, personalities, and self-regulation and their choices of course modality as well as the learning environment for synchronous online learning.

## **Autonomy, competence and relatedness in a HyFlex learning environment**

Nathan Mentzer, Adrie Koehler, Shawn W Farrington, Lakshmy Mohandas, Ali Aamir and Mallory Claypool

The Purdue Polytechnic offers all students an introduction to design thinking which is a core freshman-level course and the first in a minor in Design and Innovation. Using Self-Determination Theory (Deci & Ryan, 2008) as a driver, we focus on active learning through small group project-based learning. Students form design teams, identify real world community problems and work through the design process to generate and test solutions. The COVID-19 pandemic changed the culture and nature of education in many ways. To continue to address students' needs for autonomy, competence, and relatedness, which are basic psychological needs in the context of learning, we transitioned to a HyFlex environment which is aligned with previous literature (Reis et al. 2000; Masland, 2021). In our approach, students were encouraged to be in the classroom physically when practical, but they were able to participate synchronously online as needed temporarily. While HyFlex and online learning environments are not novel, our pedagogical approach, heavily rooted in team-based activities with a student body who had deliberately chosen the face-to-face (F2F) learning environment is less well understood. With our reliance on team-based activities and members of each small group potentially included a combination of students using both F2F and online modalities, with modality composition changing daily, we sought to understand how this model compared to previous F2F only environments and how students in this HyFlex model choosing to participate remotely differed from those who choose to participate in person consistently.

## **Method and results**

The foundation of our study includes two research questions: (1) Do students in our HyFlex design thinking course experience similar levels of autonomy, competence, and satisfaction compared to students in the F2F only version of the course? (2) Are there different experiences for students in the HyFlex environment based on participation modes for those who are always F2F vs. those who are remote on one or more occasions? To answer these questions, we leveraged a dataset from the fall of 2019 (F2F only, n=686) and the fall of 2020 (HyFlex, n=658) that included student responses to the Basic Psychological Needs and Frustration Scale (Fedesco et al., 2019). Student SAT scores were used as a measure of similarity prior to conducting analysis, indicating both groups were not statistically different at the time of enrollment in our University.

Scores were measured on a scale of strongly disagree to strongly agree with instrument statements. Students in both the F2F only and HyFlex experiences did not differ significantly in autonomy or competence satisfaction. Scores for both groups were between neutral and "somewhat agree" that their autonomy needs were met and between "somewhat agree to agree" that their competence needs were met. Autonomy frustration (a feeling of being forced to engage in a learning experience) and competence frustration (feelings of doubt that success is obtainable) dropped significantly in the HyFlex model as compared to the F2F learning environment. Scores in the HyFlex group were "neutral" for autonomy frustration and between "somewhat disagree" and "disagree" about having feelings of frustration related to their sense of competence. We hypothesize that the choice of participation mode was well received by students as they could decide what was best for them on a daily basis. Further, we speculate that students had less doubt about their abilities to perform in class because they knew they would be able to participate regardless of their ability to attend classroom daily. Relatedness to instructors and peers was not different between the F2F only and HyFlex course offerings. Comparisons of students in the HyFlex environment who participated once or more remotely and those students who chose not to participate remotely highlight only one significant difference meeting their in Basic Psychological Needs. Students who were remote one or more times felt a significantly lower sense of relatedness to their peers, such that they were between "somewhat agree" and "neutral" that they "really liked their peers in this course". Our data do not help us understand if being remote caused a drop in peer relatedness or a lack of peer relatedness contributed to students' choosing remote participation over F2F.



## Remote supervision of teacher trainee internships: Using digital technology to increase social presence

Matthieu Petit, Julie Babin and Marie-Ève Desrochers

The development and ease of access of high-quality digital technologies have paved the way for a multidimensional approach to remote supervision (Pellerin, 2010). While the aims of remote trainee supervision remain the same as when the internship supervisors attend in person, the supervisors perform their job differently (Hamel, 2012): they adjust their practices to enhance their presence within their cohort in order to reduce the isolation felt by those who choose to do their internship in a remote location or abroad. This presentation addresses hands-on teacher training in the digital era in terms of the perception of social presence within cohorts of trainees who are supervised remotely. Social presence refers to “the ability of learners to project themselves socially and emotionally in a community of inquiry” (Rourke et al., 1999, p. 52). In the Community of Inquiry (CoI) model (Garrison et al., 2000), social presence is perceived in the form of three types of indicators: emotional expression, open communication and group cohesion. Emotional expression is perceived by members of a CoI when they, for example, offer emotional support, use various means to convey encouragement, tailor their interventions and show signs of empathy or understanding. Open communication is defined by the (real or felt) possibility of “risk-free communication” in a safe space with other CoI participants. Group cohesion can be observed in how CoI members intervene to instill mutual respect, perceive each other as real people, notwithstanding distance.

### Method and results

In this presentation, findings will be shared about the concept of social presence through a description of manifestations according to the 3 indicators. Based on a thematic analysis (Paillé & Mucchielli, 2010), the descriptive component comes from semi-structured one-on-one interviews conducted with 11 internship supervisors. This convenience sample is composed of supervisors from 6 universities in different regions of Quebec (Canada) that offer 1) one or more teacher training programs and 2) remote supervision when internships are completed in a remote location or abroad. Our results attest to the humanistic nature of the remote supervision the supervisors interviewed offer. Despite how difficult it is to show empathy in mediated communication (especially asynchronous and written communication), internship supervisors show they try by many means, including video and immediacy, to comfort trainees who may feel alone. They increase the number of communication channels used to show they are very (even overly) reachable despite the distance. They also foster the creation of informal communication spaces that provide trainees with the needed emotional support in such contexts (Mabunda, 2013). Moreover, within the CoI, groups of different geometries (subgroups, triads, dyads) are created by supervisors or proposed by trainees for whom self-regulated learning turns out to be so important.

## Socio-emotional interaction in a hybrid collaborative learning context – Does it include emotion regulation?

Hanna Järvenoja, Tiina Törmänen, Sari Pramila-Savukoski, Heli Kuivila, Sanna Järvelä and Kristina Mikkonen

Learning technologies are increasingly used to offer contexts for teaching and learning. However, research findings show that digital transformation often leads to low social interaction with negative effects, such as feelings of exhaustion (Salmela-Aro et al., 2021). The meaning of interaction for learning became evident at the latest in COVID-19 crisis, which moved teaching entirely to virtual settings and cut down the majority of non-verbal signs of in-person communication (Järvelä & Rosé, 2020; Seymoure-Walsh et al., 2020). This was especially challenging for socio-emotional aspects of collaborative learning.

Successful collaborative learning rests not only upon socio-emotional interaction but on the ability to recognize such instances in the interaction that invite emotion regulation (Järvenoja et al., 2019; Lobczowski, 2020). Emotion regulation provides groups means to mitigate harmful consequences of emotions and to strengthen emotions supportive for learning and interaction (Harley et al., 2019; Wolters & Benzon, 2013). However, emotion regulation that is shared between group members appears to be delicate and dependent on sensitive emotional cues embedded in socio-emotional interactions (Isohätälä et al., 2020).

In the era of digital transformation, the question of “how emotion regulation is managed by groups collaborating virtually” becomes essential. The present study investigates higher education students’ socio-emotional interaction and emotion regulation in hybrid collaboration. The research questions are: How does socio-emotional interaction emerge in hybrid collaborative learning? (RQ1); How do groups engage in emotion regulation in relation to socio-emotional interaction? (RQ2).

## Methods

Participants were first-year bachelor's degree health sciences students ( $n=18$ ,  $Mage=23$  years) participating on "Health Care Systems" course. The course consisted of an informational lecture, 3 hybrid learning sessions (a 1.5h), and independent online learning.

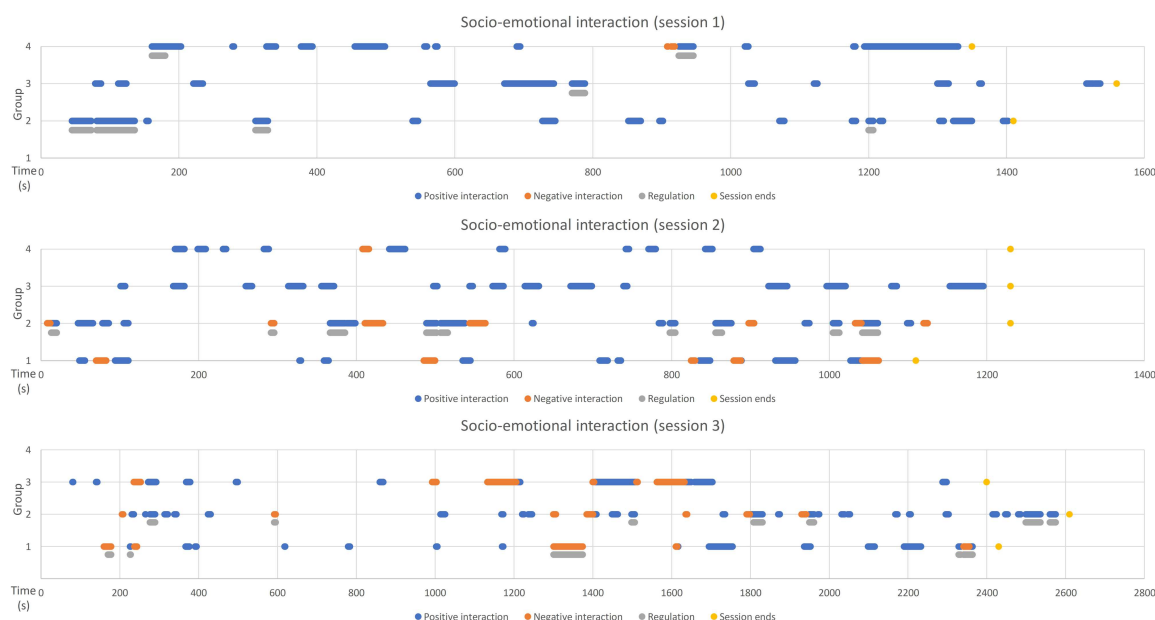
The data was collected during the 3 hybrid learning sessions including collaborative periods in Zoom breakout rooms, which were the focus of this study. The participants were divided into 4 groups of 4-5 members. One group member from each group attended the event from the F2F classroom, while other group members were present online. The participants were instructed to keep cameras on, and the data was collected by video recording groups' collaboration in the breakout rooms.

The collected video data from 10 sessions (2 sessions missing) were analyzed with Observer XT software. First, socio-emotional interaction episodes were located from the video when group members expressed emotions or engaged in emotionally charged interaction. Second, valence of each episode was coded according to a coding protocol as positive or negative (Törmänen et al., 2021) by one trained coder. Third, related emotion regulation was coded when regulation attempts were made visible with clear verbal statements. Fourth, timing of interactions and regulation were tracked. Each session was divided into 3 periods (beginning, middle, end) and Friedman test was performed to study the differences in the temporal occurrence of interaction. Finally, the occurrence of regulation was explored in relation to the interaction episodes.

## Results

### RQ1

All groups engaged in socio-emotional interaction. Altogether, 182 interaction episodes were found covering 16% of the collaborative work. Most typically, episodes included more than one but not all member's active participation (56%). The episodes involving everyone's participation covered 28% of the interactions. In 16% of the episodes, interaction was maintained by one group member. Figure 1 shows how socio-emotional interaction was mainly positive (73 %) and spread throughout the sessions. Friedman test confirmed that there were no significant differences in the temporal occurrence of interaction between beginning, middle, and end of collaborative learning ( $\chi^2=4.200$ ,  $df=4$ ,  $p=.122$ ).



**Figure 1.** Temporal manifestation of socio-emotional interactions and related emotion regulation in 3 hybrid sessions.

### RQ2

Only 31 socio-emotional interaction episodes included emotion regulation. In the first session, regulation was mainly carried out in relation to positive interaction. Accordingly, regulation was targeted to maintain or strengthen the positive emotions, socio-emotional atmosphere and motivated learning. Especially group 2 engaged in regulation from the very beginning of their collaboration. In the second and third sessions, more negative interactions took place, but only 2 of the groups were able to activate regulation in relation to these interactions. In the presentation, qualitative examples of the patterns emotion regulation in different socio-emotional interactions will be presented. The examples will illustrate how groups' working on-line realize emotion regulation to maintain positive interaction, control emotions in the face of socio-emotional challenges as well as how participation appears when regulation is not activated.

## Discussion

This study illustrates that socio-emotional interaction and emotion regulation are present in hybrid collaborative learning. Prior research has shown that emotion regulation manifests as a result of situational needs (Järvenoja, et al., 2020; Lajoie et al., 2015). These needs are present also in hybrid settings but engaging in emotion regulation seems challenging. This study shows that some groups were able to regulate their emotions together also in the hybrid context. More research is needed to unpack the particular characteristics fostering emotion regulation in hybrid learning, as we know how critical it is for learning engagement.

## Emotional (friendliness) group awareness tools in remote learning settings: Impact on group selection, contributions, learning outcomes, and well-being

Lisa Ollesch and Daniel Bodemer

Providing co-learners with emotional regulation support is essential for educational online collaboration (Järvelä et al., 2016). This has probably become even more important during the COVID-19 pandemic, as many institutions have been forced to switch to remote settings. Especially with online textual exchange, the co-regulation of emotional characteristics like friendly interaction patterns (e.g., appreciations, gratitude, and praise) is challenging due to the lack of social presence, including missing facial expressions and gestures (Kreijns et al., 2002). To support the shared regulation of affective states in a group, emotional group awareness (GA) tools showed to be promising by collecting and presenting such states (Avry et al., 2020; Phielix et al., 2011). In the present contribution, we focus on providing emotional group awareness information on learners' friendliness level in a collaborative writing context that is expected to be beneficial for affecting emotional but also cognitive and behavioral aspects in remote learning settings – during COVID-19 and beyond. This research aims to reveal whether feedback on emotional group attributes such as group members' friendliness are indeed perceived as relevant by learners when selecting online learning groups to collaborate with. Further, it is investigated whether friendliness awareness information has an influence on emotional, cognitive, and behavioral variables but also internal states, and to what extent this is affected by personal variables. Further, we investigate whether computer-based methods, such as sentiment analysis, are suitable for the automatic collection of friendliness awareness information at a textual level without additional user effort. To fulfill these research aims, a set of 4 experimental studies is presented that demonstrate the impact of friendliness awareness bars in an online collaborative setting.

## Method and results

In Study 1 (104 participants; Ollesch et al., 2020), Study 2 (19 interviews; Ollesch et al., 2020), and Study 3 (82 participants), it is investigated how relevant feedback on emotional GA information with varying friendliness of remote co-learners (provided at group level) is considered when deciding which group to work with. In Study 3, eye-tracking is applied (20 participants) to relate attentional processes to preferred selection decisions. After the first three studies focus on selection processes, in Study 4 (148 participants; Ollesch et al., 2021), effects on emotional, behavioral, and cognitive interaction patterns and outcomes are examined with friendliness awareness information (provided at individual and group level). To collect text-based expressions of friendliness, an on-the-fly sentiment algorithm is used. Across studies (Studies 1 and 4), we examine whether friendliness awareness tool effects on selection and interaction processes are influenced (moderated) by the individual need for affect, as this variable predicts how emotional information is processed (Appel et al., 2012).

By considering different group decision-making (selection) tasks from a student perspective, the quantitative results reveal that emotional (friendliness) GA information has the highest relevance in the selection of potential partners, compared to other types of group awareness information (cognitive and behavioral). The qualitative interviews underline these results: Emotional deficits regarding this variable are assumed to have the strongest impact not only on emotional problems (e.g., low tolerance) but also cognitive (e.g., impeding socio-

cognitive processes) and behavioral problems (e.g., unequal workload). First insights into underlying attentional processes reveal that increased visual attention on friendliness awareness bars has no influence on the selection of groups with high friendliness patterns. However, a higher subjectively assessed importance of friendliness awareness information, using a six-point Likert scale, goes along with a higher selection probability of topics presenting high friendliness of potential co-learners. Furthermore, decision-making (selection) tasks that are supported with single friendliness awareness enable the fastest selection decisions compared to all other tasks.

Regarding interaction patterns, friendliness awareness support shows positive effects on behavioral engagement and the emotional quality of discussions. Individuals supported by friendliness awareness information not only write more, but also friendlier discussion contributions, which were inter alia operationalized with appreciations of other contributions, friendly greetings, and the use of emoticons. Also, higher friendliness patterns serve as mediator for emotional GA tool effects on mental well-being. Friendliness awareness support does however not reveal direct positive effects on learning outcomes as well as produced content quality of contributions neither in an online discussion forum nor textual artifact to be modified. But there is a significant positive relation between the reported well-being and learning outcomes based on a knowledge test participation.

Regarding influencing personal characteristics, individuals with a high need for affect are more likely to select highly friendly groups and show friendlier interaction patterns.

To sum up, results imply facilitated selection, emotional, behavioral, and cognitive processes with emotional (friendliness) awareness tools. The impact on mental well-being illustrates the potential of feedback on friendliness awareness for internal emotional states. Also, the inclusion of personal influencing characteristics like need for affect is highly recommended to (further) investigate the effectiveness of such methods. Potential reactance effects of such automatic emotional feedback should be in the scope of future studies.

## Selected references

- Avry, S., Molinari, G., Bétrancourt, M., & Chanel, G. (2020). Sharing emotions contributes to regulating collaborative intentions in group problem-solving. *Frontiers in psychology*, 11, 1160.
- Bridges, S. M., Chan, L. K., Chen, J. Y., Tsang, J. P. Y., & Ganotice, F. A. (2020). Learning environments for interprofessional education: A micro-ethnography of sociomaterial assemblages in team-based learning. *Nurse Education Today*, 94, 104569.
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macro-theory of human motivation, development, and health. *Canadian Psychology/Psychologie Canadienne*, 49(3), 182–185.
- Fedesco, H. N., Bonem, E. M., Wang, C., & Henares, R. (2019). Connections in the classroom: Separating the effects of instructor and peer relatedness in the basic needs satisfaction scale. *Motivation and Emotion*, 43(5), 758–770.
- Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: computer conferencing in higher education. *Internet and Higher Education*, 2, 87–105.
- Järvelä, S., & Rosé, C. P. (2020). Advocating for group interaction in the age of COVID-19. *International Journal of Computer-Supported Collaborative Learning*, 15(2), 143–147.
- Lajoie, S. P., Lee, L., Poitras, E., Bassiri, M., Kazemitabar, M., Cruz-panesso, I., Hmelo-silver, C., Wiseman, J., Ki, L., & Lu, J. (2015). The role of regulation in medical student learning in small groups: Regulating oneself and others' learning and emotions. *Computers in Human Behavior*, 52, 601–616.
- Mabunda, P. L. (2013). Towards a theoretical framework for the use of ICT strategies for teaching practicum supervision. *Africa Education Review*, 10(Sup1), S7–S27.
- Ollesch, L., Heimbuch, S., Krajewski, H., Weisenberger, C., & Bodemer, D. (2020). How students weight different types of group awareness attributes in wiki articles: A mixed-methods approach. In M. Gresalfi & I. S. Horn (Eds.), *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020* (Vol. 2, pp. 1157–1164). International Society of the Learning Sciences. <https://repository.isls.org/handle/1/6309>
- O'Neill, K., Lopes, N., Nesbit, J., Reinhardt, S., & Jayasundera, K. (2021). Modeling undergraduates' selection of course modality: A large sample, multi-discipline study. *The Internet and Higher Education*, 48, 100776.
- Phielix, C., Prins, F. J., Kirschner, P. A., Erkens, G., & Jaspers, J. (2011). Group awareness of social and cognitive performance in a CSCL environment: Effects of a peer feedback and reflection tool. *Computers in Human Behavior*, 27(3), 1087–1102.
- Raes, A., Vanneste, P., Pieters, M., Windey, I., Van Den Noortgate, W., & Depaepe, F. (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Computers & Education*, 143, 103682.