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Student engagement in hybrid approaches to teaching in higher education

Participación del estudiantado en enfoques híbridos de la enseñanza en la educación superior

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Abstract

Prospective benefits of hybrid teaching arrangements have attracted attention of many educational administrators of higher education institutes (HEIs). Hybrid teaching is a teaching format in which some students and the teachers are physically present on campus, while at the same time other students are present online. The prospective benefits of this type of education are that students can choose to participate online or in class. This study examines student engagement and motivation in hybrid teaching in various disciplinary settings. Student engagement and motivation were measured through questionnaires and semi-structured interviews with students. Teachers shared their experience with hybrid teaching in semi-structured interviews. The analysis of the questionnaire data showed that both on-campus and online students who attend classes with autonomous motivation showed more classroom engagement and more classroom interaction than students with less autonomous motivation. The analysis of the interview transcripts provided in-depth insight into the engagement and interaction of students and teachers in hybrid teaching settings. The interviews revealed that interactions with online students were less frequent and less powerful than with their on-campus peers. As not all learning objectives can best be met with a hybrid arrangement, it is advisable to use hybrid teaching arrangement only for those courses that cannot be taught at the campus only.

Keywords: hybrid teaching; student engagement; higher education; evaluation.

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Resumen

Los beneficios potenciales de los arreglos de enseñanza híbridos han captado la atención de muchos administradores/as educativos/as de educación superior. La enseñanza híbrida es un formato de enseñanza en el algunos estudiantes y profesores/as están físicamente presentes en el campus, mientras que otros participan en línea al mismo tiempo. Este tipo de educación ofrece la posibilidad de que el alumnado elija entre participar en línea o en persona. Este estudio examina su compromiso y motivación en la enseñanza híbrida en varios entornos disciplinarios. Para ello, se utilizaron cuestionarios y se realizaron entrevistas semiestructuradas con el estudiantado. Los docentes también compartieron sus experiencias con la enseñanza híbrida a través de entrevistas semiestructuradas. El análisis de los datos del cuestionario mostró que tanto el estudiantado en el campus como en línea que asiste a clases con motivación autónoma mostró más participación en el aula y más interacción en el aula que el estudiantado con menos motivación autónoma. El análisis de las transcripciones de las entrevistas proporcionó una visión profunda del compromiso y la interacción de estudiantado y profesorado en entornos de enseñanza híbridos. Las entrevistas revelaron que las interacciones con el estudiantado en línea eran menos frecuentes y menos poderosas que con sus compañeros en el campus. Dado que no todos los objetivos de aprendizaje se pueden alcanzar de manera óptima mediante un enfoque híbrido, es recomendable utilizar este tipo de enseñanza solo para aquellos cursos que no puedan impartirse exclusivamente en el campus.

Palabras clave: enseñanza híbrida; participación del estudiantado; educación más alta; evaluación.

Introduction and objectives

Hybrid teaching approaches has attracted attention of many educational administrators of Higher Education institutes (HEIs) starting pilots in university teaching. Hybrid teaching is a form of teaching with at the same time students on-campus and students online. The prospective benefit of this type of education is that students can choose whether they participate online or at the campus. This means that students who would not be able or willing to participate in on-campus education can still attend course teaching. This makes hybrid teaching potentially more inclusive and better suitable for students abroad, compared to regular on-campus teaching. However, hybrid teaching approaches also might encompass challenges for both teachers and students. Hybrid teaching is highly challenging for teachers, as additional effort is necessary to design appropriate learning activities for both online and on-campus students, to organize valuable interactions between the student groups, and to manage the abundance of digital tools, such as cameras, microphones, screens, and the LMS. Hybrid teaching approaches are a rather new phenomenon in university education - accelerated by campus closures due to the COVID-19 pandemic - and the value of these approaches for student engagement and student learning is still unclear. Therefore, in this study we aim to expand our understanding of student engagement, student motivation, and interactions between students and teacher during hybrid teaching approaches in higher education.

Hybrid teaching

We distinguished three approaches to university teaching (cf., Raes et al., 2019); 1) on-*campus teaching* refers to education at the university where teachers and students are physically present in a teaching space at the same time, 2) *online teaching* refers to distance education via the Internet where teachers and students are present online at the same time, and 3) *hybrid teaching* is a form in which the above forms are combined and refers to teaching with some students present on-campus and others online at the same time. The above forms concern synchronous teaching, all participants are present in the educational environment at the same time. Asynchronous teaching is also used in all three forms of education, whereby students also participate in education outside these contact hours by, for example, reading literature, examining online sources, making assignments, and participating in a discussion forum with each other and the teachers. In all three teaching formats, the engagement of students is crucial for their performance. The hybrid teaching format introduces an additional challenge to stimulate and support interaction in two types of student groups, on-campus and online.

Student engagement

Students' sense of belonging has traditionally been a variable that determines their academic performance in higher education. Research on predictors of academic achievement has indicated that a sense of belonging to the education programs, teachers, and fellow students is the strongest predictor of student achievement (Astin, 1985; Pascarella & Terenzini, 1991; Tinto, 1993). Students with a strong sense of belonging, put more effort in their teaching-learning activities and are in other words engaged (cf,. Büchele, 2021). Student engagement is therefore a related concept with corelates with student performance in class. In short, student engagement can be understood as the efforts students make in their teaching-learning activities and is related to academic achievement and study progress in both on-campus education and online education (Bond et al., 2020). Five types of student engagement are distinguished (Deng et al., 2020; Reeve & Tseng, 2011; Skinner et al. 2008); 1) *behavioural engagement* – the extent to which students participate in teaching activities; 2) *cognitive engagement* – the extent to which students are mentally involved during the learning activities; 3) *emotional engagement* – the feelings students have about teaching and the teaching environment; 4) *social engagement* – the extent to which students interact with teachers and peers; and 5) *agentic engagement* – the extent to which students express themselves.

Previous studies have found that students in hybrid teaching environments were actively engaged in learning (Szeto & Cheng, 2016) with the enjoyment of using technologies (Butz et al., 2016). Those students also tended to have a sense of community and engagement with others (Bower et al., 2015). For example, during hybrid teaching students tried to look for affective support from group members when they did not understand the content knowledge (Szeto, 2014). After implementation of hybrid teaching students had a higher rate to pass the exam than before (Lightner & Lightner-Laws, 2016). However, it seems that online students in hybrid teaching are not as much active and engaged as their on-campus classmates (Butz et al., 2016). Szeto and

Cheng (2016) found that on-campus students had more intra-group interaction, namely the interaction with other on-campus students, compared to online students. Yet, online groups tended to reach out to the teacher more frequently than did the on-campus groups. Both groups can also have different levels of affective engagement. Butz and Stupnisky (2016) reported that online students usually had lower levels of relatedness compared to their on-campus classmates. However, the level of students' relatedness, no matter online or on-campus, was significantly higher if students attended the course with peers in the same learning environment.

Student motivation

Motivation is a necessary condition for engagement, and successful engagement will help students to feel motivated in the future. According to the Self-Determination Theory (SDT; Ryan & Deci, 2020), there are three distinctive drivers for motivation: feeling of competence, feeling of autonomy, and feeling of relatedness. Students need to feel competent that they can complete the task to become motivated to perform a task. Students also need to feel a certain autonomy in completing the task, perceiving a sense of control over their own actions (cf. Blankenstein et al., 2019). Finally, students also need to feel related to significant others, such as their peers, their teacher or future colleagues (Ryan & Deci 2020). The SDT describes that students' motivation can vary between amotivation (no motivation at all), various forms of extrinsic motivation (introjected regulation and external regulation) and intrinsic motivation. Intrinsic motivation, or autonomous motivation, means performing an activity because it is interesting or enjoyable. Students who are autonomously motivated experience a sense of volition and control. Students who are extrinsically motivated perform an activity to attain certain goals which are set outside of them, for example attaining a diploma, getting a high grade, or pleasing their parents. Students who are extrinsically motivated experience a sense of pressure of external reward or internal culpability (Ryan & Deci, 2020). Student motivation correlates positively with student engagement (Chiu, 2022) and a large body of research shows that intrinsic motivation correlates moderately positive with academic performance (Richardson et al., Guay et al., 2000). Students who are encouraged to participate in education through their own interests develop intrinsic motivation and show stronger academic achievement than students who are stimulated extrinsically (Vansteenkiste et al., 2005).

Previous evaluations of hybrid teaching

Several studies have reported teachers' and students' evaluations of teaching in hybrid environment. Based on a literature review Raes et al. (2020) described both the benefits and challenges of synchronous hybrid teaching formats. Regarding the organizational benefits, hybrid teaching can provide students with flexibility in course attendance. For instance, students can attend the course regardless of location, which provide opportunities for students with health issues or long travel distance to the university (Butz et al., 2016; Wang et al., 2017). Hybrid teaching might therefore also help to increase the number of international students (Butz & Askim-Lovseth, 2015;

Wang et al., 2017) and can increase retention rates (Lakhal et al., 2017). Hybrid teaching is also beneficial for educational inclusion and equality (Lakhal et al., 2017). Besides, hybrid teaching environment makes it easier to invite external experts to teach and share their experiences (Bell et al., 2014). As for the pedagogical benefits, students' learning outcomes in hybrid teaching seem to be similar to those in on-campus classes (Lightner & Lightner-Laws, 2016). Challenges in hybrid teaching related to both pedagogy and technology have also been reported. Teachers need to re-design the course and class activities (Weitze et al., 2013), and therefore change their teaching method (Bower et al., 2015). This requires teachers to be familiar with the technology used in the hybrid environment (Grant & Cheon, 2007). In class, teachers also need to frequently pay attention to both online and on-campus students to prevent that the online group feels neglected (Bower et al., 2015; Zydney et al., 2019). However, it is sometimes inevitable that teachers focus on one group and unintentionally ignore the other group, which would cause a sense of distance of some students (Bower et al., 2015; Szeto, 2014, 2015). Technical challenges are related to the quality of audio and video in the hybrid class (Bower et al., 2015; Cunningham, 2014). Also, some teachers can be disturbed by the issue that some online students disappear during the class (Weitze et al., 2013).

Objectives

In the academic year 2021-2022, Leiden University has carried out pilots with hybrid teaching. Newly furnished teaching rooms were used for this purpose. In these pilots, programs used different forms of hybrid education, which varied, for example, in the number of meetings that were given a hybrid form, the number of students who were present online and on-campus, and the alternation between online and on-campus presence of students. The present study aims to provide insights into student engagement in hybrid teaching based on teachers' and students' direct experience with hybrid teaching format in various domains. We specifically focus on students' engagement and interaction as these might be the greatest challenges for teachers in hybrid classes. The research questions that guided this study were:

1. How is students' engagement in hybrid teaching settings related to their motivation for learning?
2. How do teachers and students evaluate engagement and interaction in hybrid teaching?

Method

At three departments of Leiden University hybrid teaching rooms were established with cameras, microphones, and displays to support hybrid teaching experience for both lecturers and students. Lecturers can adapt their teaching-learning activities based on the possibilities the hybrid classrooms provide. During the first three teaching periods in academic year 2021-2022 all lecturers and a selection of students participating in the modules which were taught in the hybrid classrooms at department of Social Science, Law and Business Administration were invited to participate in this study. The data

collection consisted of a student questionnaire survey and follow-up interviews with students and lecturers. Ethical clearance was provided by the institutional educational research ethics review board (project number: IREC_ICLON 2021-10).

Participants

The student survey was administered in two rounds, at the beginning and at the end of each teaching period. In the first round, 327 students (Mage = 21.78; Female = 161; Non-binary = 2) and in the second round, 171 students (Mage = 21.83; Female = 86; Non-binary = 2) completed the survey. In Table 1, the number of participants who completed the survey is presented. In addition, during the first teaching period, 8 teachers (4 females) and 6 students (2 females), the second period, 13 teachers (9 females) and 7 students (3 females), and the third period, 5 teachers (3 females) and 9 students (6 females) participated in the interviews. All interviewees gave their active consent to be interviewed.

Table 1

Overview of valid survey responses in three pilots (BA= Bachelor's programme; MA= Master's programme).

Period	Department	Course level	First round		Second round	
			Motivation	Engagement	Motivation	Engagement
1	Business	BA	44	15	66	66
	Law	BA	27	27	22	22
2	Business	BA	56	1	20	21
		Postgraduate	42	26	16	18
		MA	5	1	2	2
	Law	MA			23	25
		MA			2	2
		BA	5	3		
	Social Science	MA		/	7	7
3	Business	BA	137	123	6	6
	Law	MA	11	6	2	2
Overall			327	202	166	171

Student survey: Student motivation for hybrid teaching

Student motivation for hybrid teaching was measured by 20 items from the Situational Motivation Scale of Guay et al. (2000) and one scale of the Academic Self-regulation Scale of Vansteenkiste et al. (2005). After Principal Component Anal-

ysis (PCA) with Oblimin rotation on these 20 items, item 12 was excluded due to low factor loading. Four factors of the remaining 19 items with a cumulative explained variance of 68.51% were extracted: autonomous motivation (items 1, 6, 11, 16, 2, 7, 17, Cronbach's α = 0.92), introjected regulation (items 4, 9, 14, 19, Cronbach's α = 0.77), external regulation (items 3, 8, 13, 18, Cronbach's α = 0.81), and amotivation (items 5, 10, 15, 20, Cronbach's α = 0.85). All measures adopted a 6-point Likert type rating scale from 1 = very much disagree to 6 = very much agree. The reliability and validity of each variable were examined in each measurement model in the Results section (see Table 4 and Table 5). A full overview of the variables and the corresponding items can be found in the Appendix.

Student survey: Students engagement in hybrid teaching

Student engagement in hybrid teaching was measured by five types of student engagement with in total 30 items based of the work of Deng et al. (2020), Reeve and Tseng (2011), and Skinner et al. (2008). These five types of engagement were 1) behavioural engagement – the extent to which students participate in teaching activities; 2) cognitive engagement – the extent to which students are mentally involved during the learning activities, 3) emotional engagement – the feelings students have about teaching and the teaching environment, 4) social engagement – the extent to which students interact with teachers and peers, and 5) agentic engagement – the extent to which students express themselves.

The first three types of engagement are related to students' individual engagement and the other two types of engagement are about students' engagement with others in the class. After a factor analysis (PCA with Oblimin rotation with two fixed number of factors on all 30 items) item 37 was excluded because its meaning was different from all other items in the same factor. Two factors of the rest 29 items with a cumulative explained variance of 55.71% were extracted: classroom engagement (Cronbach's α = 0.95) and classroom interaction (Cronbach's α = 0.92). Classroom engagement consists of items related to cognitive, behavioural, and emotional engagement. A sample item of general engagement was "I participated in class discussions". Classroom interaction consists of items related to social and agentic engagement. A sample item of general engagement was "I asked questions when I didn't understand the teacher" (see Appendix).

Follow-up interviews

The semi-structured interviews with teachers and students had an evaluative character and followed roughly an interview protocol with topics such as the role and performance of students and teachers in hybrid teaching, teacher-student and student-student interaction, the evaluation of room facilities, and preference between hybrid teaching and other forms of teaching. The interviews were conducted online and lasted approximately 45-60 minutes. The interviews were audio-recorded and transcribed verbatim for further analyses.

Analyses

To answer research question 1, partial least squares (PLS) analyses were performed with the four motivation variables as independent variables and two engagement variables as dependent variables. The second round of the survey data was analysed to answer the research question. To answer research question 2, two researchers read the transcripts and conducted various steps in the analysis, including, coding the data by marking segments, verifying the codes, developing themes by aggregating code, connecting themes, and analysing cross cases (cf., Creswell, 2012).

Results

Student motivation and engagement

To evaluate the reliability and validity of the measurement model using *PLS*, several indicators should be reported (Hair et al., 2011; Urbach & Ahlemann, 2010). Regarding the reliability, in exploratory research indicator loadings of each item can be accepted between 0.6 to 0.7. To meet the internal consistency reliability, Cronbach's alpha (*CA*) of each variable should not be lower than 0.60 and the composite reliability (*CR*) should be greater than 0.70. As for the validity, the average variance extracted (*AVE*) should be greater than 0.50 to meet the standard of convergent validity. To test the discriminant validity, the square root of each variable's *AVE* should be greater than the correlation of the variable to other variables.

Two items of introjected regulation (items 4 and 19) were further deleted due to low factor loadings. One item of classroom engagement (item 41) and one item of classroom interaction (item 49) were also deleted due to low factor loadings. Results showed adequate *CA*, *CR*, and *AVE* (see Table 2) of the measurement model. Hence, the reliability and validity of the measurement model are supported.

Table 2

Means, Standard Deviations, Reliabilities and Correlation of Variables (N = 166).

Variables	Number of items	Mean	SD	CA	CR	Correlation of Variables and AVE					
						1	2	3	4	5	6
1. Autonomous motivation	7	4.14	1.20	0.92	0.93	**0.82**					
2. Introjected regulation	2	2.09	1.26	0.72	0.88	-0.02	**0.88**				
3. External regulation	4	3.33	1.44	0.81	0.88	-0.13	0.41	**0.80**			
4. Amotivation	4	2.07	1.13	0.85	0.90	-0.36	0.47	0.41	**0.83**		
5. Classroom engagement	16	4.66	0.87	0.95	0.95	0.57	-0.31	-0.28	-0.38	**0.75**	
6. Classroom interaction	11	3.69	1.13	0.92	0.93	0.25	-0.09	-0.22	0.00	0.54	**0.75**

To test the structural model, bootstrapping with 5000 subsamples was conducted. The results showed that the R^2 for classroom engagement was 0.42, suggesting the model explained 42% of the variance of students' engagement for hybrid teaching. The R^2 for classroom interaction was 0.14, indicating the model explained 14% of the variance of students' interaction for hybrid teaching. In Table 3, the path coefficients for the model are presented.

Table 3

Results of path coefficients (N = 166).

Path	Relationship	*B (S.E)*
1.	Autonomous motivation →Classroom engagement	0.54*** (7.11)
2.	Autonomous motivation →Classroom interaction	0.31*** (3.69)
3.	Introjected regulation →Classroom engagement	-0.24 ** (2.69)
4.	Introjected regulation →Classroom interaction	-0.10 (1.07)
5.	External regulation →Classroom engagement	-0.09 (1.22)
6.	External regulation →Classroom interaction	-0.24 * (2.22)
7.	Amotivation →Classroom engagement	-0.04 (0.36)
8.	Amotivation →Classroom interaction	0.26 * (2.04)

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. T statistics are in parenthesis.

Autonomous motivation had a significant positive influence on both classroom engagement (Path 1: $\beta = 0.54$, $p < 0.001$) and classroom interaction (Path 2: $\beta = 0.31$, $p < 0.001$). This means the more students enjoyed hybrid teaching, the more they would put effort into learning and interact more with others.

Amotivation was also positively related to classroom interaction (Path 8: $\beta = 0.26$, $p < 0.05$). This indicates that the students who were not motivated to hybrid teaching tended to have more interaction with their peers. Besides, external regulation had a negative impact on classroom interaction (Path 6: $\beta = -0.24$, $p < 0.05$). This reveals that if students participated in hybrid teaching due to external pressure, they tended to have little interaction with others. Yet introjected regulation had a negative impact on classroom engagement (Path 3: $\beta = -0.24$, $p < 0.01$). This means that the more students desired external recognition, the less they would be engaged in hybrid teaching. Finally, no significant relationships were observed by introjected regulation and classroom interaction (Path 4), external regulation and classroom engagement (Path 5), and amotivation and classroom engagement (Path 7).

Student and teacher evaluation of engagement and interaction

The presentation of results is based on three themes from both students' and teachers' perspectives: student engagement in hybrid teaching, teacher-student interaction, and student-student interaction. The main findings are summarized in Table 4. In the interview fragments we present below we use numbers to refer to the number of pilots (first, second or third pilot round).

Table 4

Overview of interview results organised in positive and negative evaluation of hybrid teaching.

Category	Positive	Negative
Student engagement	Engaged in activities and class discussions; social supporting during university closures; extra effort on self-study; applied what they learned; searched for extra information; friendly class climate; balanced life and study	No well prepared for class; difficult to connect theory and practice; lectures not recorded; classmates not participating; Turned cameras off with excuses
Teacher-student interaction	Interaction with both F2F and online students; equal relationship; mainly content-based	Online students less interaction; students' extra effort to interact; online students felt distance; little chance to speak with teacher after class; less attention to online students; hard to interact with cameras off
Student-student interaction	F2F students interact frequently; tried to interact with online students; online students interact with instant messages and email	Superficial interaction between F2F and online students; low interaction initiated by online students; F2F students had to check what online students said; Little interaction between online students; online students disappeared during breaks

Student engagement during hybrid classes

Students were engaged in the hybrid teaching environment in various ways. Below we present illustrations of student engagement in hybrid teaching in three distinct engagement modes, behavioural, cognitive, and emotional engagement. Students' behavioural engagement was characterised during the hybrid classes through students' active participation in in-class and online activities, answering questions from teacher and peers, and sharing their thoughts and experiences as illustrated in this quotation from a student in the first pilot round.

> *In [the hybrid] class, I participated quite actively. […] For example, for the reading preparedness and we'd have discussions. I tried to also […] show initiative, like speaking or making assignments. [1]*

After class, students spent time on self-study, such as completing assignments and readings and preparing for the next class. Specifically, extra study hours were spent on working on a group project, collaboratively, or individually. In the quotation below, a student estimates here study time out-of-class.

> *Self-study, hmmm, I think around 15 hours per week, more or less. Last week I spent, I think, one day 10 hours at the university finishing the whole design, everything. So that was like only on one day. But I would say, yeah, and maybe even 20 hours [per week]. [3].*

Some students did not prepare well for the class. For example, they did not read all reading materials or procrastinated their effort on the group project, as illustrated in the following quotation.

> *Actually, […] I'm not a massive reader, especially not when it's difficult English. I really need to set myself on it. I really need to focus. [2]*

Occasional, students did not actively participate in the hybrid lecture, but only listened and took notes, and were anxious to ask questions in the hybrid class.

> *[I am] more of a passive listener during the lecture. Sometimes it's daunting to ask the question in front of a large group, you don't know enough about the subject to ask a really good question. [1]*

Students' cognitive engagement during hybrid teaching was characterised by applying the content knowledge, for example, applying theory to a practical case, or use new concepts and models, presented during the hybrid lecture, to analyse a case or restructure their own knowledge base. Students also actively looked for extra information online and from literature when they did not understand the concepts, models, or theories presented in the hybrid class. In the quotation below, the student describes how she handled the literature and other readings.

> *Later on, I scanned a bit more and looked for important parts. So, I adapted a bit to the literature to the course. So, in that way, I didn't do the same thing every week. You know what I mean? So, it really changed a bit; looking stuff up online if I didn't comprehend it or wanted some more information. [2]*

Naturally, students also found it was difficult to connect the presented theories, models and concepts to practice. They really needed to put in cognitive effort to apply the presented theories as becomes clear from the following quotations.

> *When I work or when I work alone, I find it difficult, maybe to apply the things I've learned and what I see from case Law. I find it sometimes hard to like, connect the two of them properly. [2]*
> *Most of the times, I […] like being sure that the examples or opinions that are being given by the teacher are not the same as mine. Or if they are I try to add something like else or contrasting ideas. [1]*

Students' emotional engagement was mainly characterised in their expression of interest for the topic, the theories, and the practical cases. But also, the need for relatedness with peers and interest in collaborating with fellow students in the hybrid classes was clearly expressed. The students not only learned from the teachers, but also form their on-campus end online classmates. This helped the student to feel connected to the group. The importance of having classmates in lectures becomes clear from the following quotation.

> *The great thing about our [hybrid] classroom […] is that we all ask and discuss with each other openly during the class itself. And so I think that is the main reason why we all came […] for the diversity, the different perspectives different students have. And I think that enriches the class discussion, the overall quality of the discussions. [3]*

Some students were disappointed because not all hybrid lectures were recorded, and therefore could not be re-visited by the students. Students needed to be present during those not recorded lectures and actively pay attention. And some students felt disappointed and annoyed of their classmates because they did not engage well in the class, such as turning on cameras and responding to teachers. This latter issue is described by a student as follows.

> *I enjoy participating, but I was also like, disappointed of all my other classmates, of all the other 120 plus students. And no one was even like looking at [the teacher] or raising their hand or even anonymously typing something in the chat. So for me, it was like to make him know that I was paying attention, I was enjoying the class and I was also willing to be like a student. Anything you expect from a student. [1]*

Teacher-student interactions

In hybrid classroom environments it is particularly relevant to involve all students and support interactions between teacher and students both on-campus and online. It was a challenge for teachers to balance the attention between both student groups. The teachers tried to give both online and on-campus students equal attention and one teacher reported the following.

> *When I just joined the course, I remember her once at the end of the lecture, looking at the online students and picking on names and asking us if we have anything to add or if we would like to share our views. I really like that in fact because it made*

> *me feel more included and part of the class of discussion. Even when we used to take the break, she would to, you know, tell us that we're taking a break now. But are you following the classes? Do you have any questions or. We did feel engaged and choose to interact with us so frequently. [3]*

Online students experienced less interaction with teachers and reported extra efforts to interact with the on-campus teacher. For example, they had to first unmute themselves, which meant that there was a delay in their questions. Some students also were anxious to disturb the class if they interacted too much as shown in the following quotation.

> *I tried to have interactions, but I didn't want to disturb the class a lot, so sometimes I type stuff in the chat. However, she did not have the chat open, so she would not always see. Only if someone told her that someone said something in the chat, she'd look and respond. But that would kind of defeat the purpose of putting it in the chat because it disturbed her. [2]*

Overall, online students felt a distance to the on-campus teacher. It was not easy for online students to reach teachers via, for example, emails, nor was it possible for online students to ask questions to the teacher after class. One reported this as follows.

> *We had a conference yesterday where we presented our results and we also interacted with the tutor there. I think it was very sad that the people online didn't have that experience because afterwards, you could talk on a like more personal level with the tutor. That's a bit sad for the online people that they cannot show up at that event. [3]*

Student-student interactions

On-campus students frequently interacted with each other during and between the class, but the interactions with their online peers were less frequent and more straightforward content-wise. Some online students felt overlooked during some activities. On-campus students tried to actively interact with online students to let them participate in classroom discussions or just to engage with them emphatically. One student reported that she tried to connect with the online students as follows.

> *Nobody wants to be with the online guys, but what if I'm one of those nine students? You know … that's why I was taking the initiative to actually deal, no that is the wrong word, but to actually be part of that online group, even though I wasn't really online. [1]*

The interactions between on-campus and online students were not only through in-class discussions, or through online chat but also through other online tools, such as instant messaging apps as the following quotation shows.

> *Through WhatsApp, though. I personally message like, hey, can you hear me or can you write an update or a summary? They answered during the breaks. But still, it was nice. [3]*

Student-student interactions were not only about the content, for example providing explanations to each other, but also emotional interaction, such as giving complements after a presentation or encouragements for completing an assignment. Yet the interaction between online students was limited as one student reported in the following quotation.

> *So we [the online students] kind of interact about either what the professor is saying or our impressions about the class and how it's going. But in this class, I have to admit there wasn't that much interaction in that sense. [2]*

The technology was not always helpful for on-campus and online student interactions. There is usually a delay when online students unmute themselves and try to interact. The sound not always was sufficient. On-campus students sometimes often had to check what online students said. And for online students the discussion in the class was not always clear especially when small groups interacted in class. This made online students reticent to interact in classroom discussion. This is expressed by one student in the following quotation.

> *Sometimes they wouldn't see that somebody had like, raise their hand or like their internet connection, wouldn't like it wasn't quick enough so that their question was addressed and things like that. And we might have moved on before the lecturer realized that there was a question that needs to be asked or somebody wanted to interject with something. And so that was a little bit of an issue, I think, because they didn't want to interrupt the lecturer if they were speaking. [2]*

It was these kinds of situations that online students felt overlooked or obsolete and became even more reluctant to interact with their on-campus peers, as expressed in the following quotation.

> *Sometimes you get the feeling that you are not being heard because if we had a group of six people, if four people are together, it's easier to discuss with the people offline than with the people online. [3]*

Discussion and conclusions

We explored student engagement in hybrid teaching based on teachers' and students' experiences with hybrid teaching format in various domains. To answer the first research question about the relationship between students' engagement in hybrid teaching and their motivation for learning, student surveys were completed by 327

(first round) and 171 (second round) students. To answer the second research question about teachers' and students' evaluation of engagement and interaction in hybrid teaching, semi-structured interviews with 26 teachers and 22 students were conducted and were thematically analysed.

The survey indicated the overall importance of students' autonomous motivation. Students should avoid controlled motivation and develop autonomous motivation that might support their engagement in the hybrid environment. The interviews revealed an overall strong engagement of students in hybrid teaching formats. Interactions between on-campus students were more frequent and profound, compared to the interactions of online students with their online peers and with their on-campus peers.

Student engagement and motivation

The survey results revealed the importance of students' autonomous motivation during hybrid teaching. Students tended to engage and interact more in hybrid classes when they enjoy class and could benefit from it. Thus, it is important to first design the course in such a way that is a good and interesting for the students, and to provide instructions that foster students' intrinsic autonomous motivation. This is similar to findings and suggestions for on-campus of blended forms of teaching. In general, in any form of teaching supporting students' intrinsic autonomous motivation will support students' engagement in class (Deci & Ryan, 2020; Niemiec & Ryan, 2009). In hybrid teaching situations, it seems even more essential for teachers to re-design the course to specific characteristics of the hybrid settings. For example, teachers needed to re-think and redesign debate activities to make student-student interactions workable for both online and on-campus students. In many situations in hybrid teaching, it is required to provide online students with additional assistance and guidance to interact and participate in class. Technical problems can easily undermine students' engagement, interactions, and motivation in hybrid teaching. This requires that technical support closely works together with teachers in hybrid teaching and provides essential and timely assistance.

In the hybrid teaching situation described in his study, teachers used various ways to activate online students during hybrid teaching. However, because teachers were used to teach in on-campus only teaching, they needed to constantly be aware to pay attention to, and interact with, online students during hybrid teaching activities. Besides, they also needed to provide additional online office hours to students after class. For example, some of the teachers opened an online meeting channel to stimulate after-class student-teacher interactions for online students. Overall, dealing with the hybrid technology is one of the additional tasks for teachers to make hybrid teaching a success. This might influence teachers' motivation, efficacy, efficiency, and quality of teaching. Thus, it is essential to support teachers in their digital literacy and their self-efficacy to use technology in classroom activities. Especially, in the transition from on-campus only teaching situations to hybrid and blended forms of teaching ample support, training and other forms of academic development will be a well-spent effort.

Teacher-student and student-student interaction

Although hybrid teaching affords flexibility in student attendance and therefore might support inclusiveness in university teaching, current hybrid teaching situations challenge an equal student attendance and interactions for both on-campus and online students (Kantcheva & Bickle, 2023). From the findings of the current study, it becomes clear that the student experience in the studied hybrid teaching situation is not the same for on-campus and online students. In general, teachers try to keep a high level of interaction with both online and on-campus students. The interactions during hybrid classroom activities were, however, less with online students because many attended classes without their cameras on. Teacher then tended to focus on the on-campus students and online students developed feelings of alienation and disconnection. Yet other students even stated it is unnecessary to interact with each other during class, especially during lectures. Another challenge was that online students could not see their on-campus peers clearly. This also adds to the feelings of online students feeling disconnected with others in class. In general, students in the studied hybrid teaching situations expressed satisfaction with their engagement and performance. However, some students reported that during a next hybrid teaching class they would work harder and interact more. Because for many students, and teachers, this was the first experience with hybrid teaching format, there likely will be an increase of their literacy with hybrid teaching at university.

Limitations and future research

In this study, hybrid teaching was studied directly after the university-closures due to the COVID-19 pandemic. After the emergency online teaching many teachers and students were inclined to quickly go back to on-campus teaching situations. Not for every student (e.g., international students who went back to their home country or students still suffering infectious diseases) it was possible to go back to on-campus education. Especially at that time, there was a strong call for universities to provided hybrid teaching affordances to provide education for all. This situation influenced the results described in this paper. Therefore, it is relevant to study hybrid teaching approaches in future contexts in which on-campus teaching becomes -again- the standard teaching situation at most of our universities.

Furthermore, the results of this study show that specifically online students' interactions with other online peers, with on-campus peers, and with the teachers need to be more supported in order to engage online students with teaching-learning activities. In future studies online students' sense of belonging to the student group and to study programme can be another focus, which might provide additional understanding of online students' engagement.

Moreover, this study focused on students' engagement, interactions and motivation and not on students' academic performance and achievement. Future study might focus on online and on-campus students' performance in hybrid teaching situation to get additional insight in the impact of learning activities in a hybrid context. This might also lead to an advancement of our knowledge base of domain specific aspects of hybrid

teaching. For example, to get a deeper understanding for which teaching-learning activities, and in which subjects and academic domains hybrid teaching is beneficial and for which activities it is less beneficial. Finally, another focus of future studies might be on collaborative learning activities in hybrid teaching might provide ample insight in the value of student-student interactions during hybrid collaborative work. Such studies might advance our knowledge base on technology enhanced collaborative learning in higher education (Guo, Saab, Wu, & Admiraal, 2021; Saab, van Joolingen, & van Hout-Wolters, 2007).

Practical implications

In general, teachers preferred hybrid teaching over online teaching, and fully on-campus teaching was most popular. Although many teachers are becoming used to hybrid teaching formats, the most important question for teachers to teach hybrid classes remains: "what actually is the added value for my teaching". Currently, many teachers conceive hybrid teaching as introducing multiple new problems and challenges, such as the re-design of courses, extra workload, and extra strain during teaching, while it is questionable whether it brings any learning gains for students. Therefore, for any university it is essential to encourage teachers to engage in hybrid teaching by explicitly explaining the value of it for them as teachers and for the learning of their students. For students enrolled in hybrid teaching classes, to increase the sense of belonging and feeling of community among students becomes essential to engage students in this form of teaching. Two suggestions to improve this are, first, to make explicit the preferred classroom behaviour during hybrid courses in student course manual. For example, students in the class should respect their online peers and it is dissuaded to make jokes or judgments about online students' profiles, turning on cameras in hybrid teaching, or to decrease the sensitiveness of the classroom microphone to avoid privacy issues of both online and on-campus students. Furthermore, teachers are suggested to design teaching-learning activities to encourage students to interact with each other. A 'buddy' or 'tutor' system, in which online and on-campus students are connected, might help to increase student-student interactions and collaboration.

Concluding remarks

Overall, hybrid teaching is often advocated as a valuable teaching format because it provides a flexible way of teaching and provides students with a choice to participate even if they have no opportunity to come to campus. However, this study shows that here are quite some differences in student experience and student engagement between on-campus and online students, and that online students do not benefit in an optimal way. To a certain extent hybrid teaching formats introduces a new inequality which teachers at university need to take into account when designing learning activities and teaching.

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Appendix. The original questionnaire items.

Item number	Scale	Item
Student motivation for hybrid teaching		
1	Autonomous motivation	Because I think this hybrid course is interesting.
2	Autonomous motivation	Because I am doing this hybrid course for my own good.
3	External regulation	Because I am supposed to do this hybrid course.
4	Introjected regulation	Because I want others to think I'm smart.
5	Amotivation	There may be good reasons to do this hybrid course, but personally I don't see any.
6	Autonomous motivation	Because I think this hybrid course is pleasant.
7	Autonomous motivation	Because I think doing this hybrid course is good for me.
8	External regulation	Because it is something that I have to do.
9	Introjected regulation	Because I would feel guilty if I don't do it.
10	Amotivation	I do this hybrid course but I am not sure if it is worth it.
11	Autonomous motivation	Because this hybrid course is fun.
12	*Excluded*	*Because I do it by personal decision.*
13	External regulation	Because I don't have any choice.
14	Introjected regulation	Because I would feel ashamed if I don't do it.
15	Amotivation	I don't know; I don't see what this hybrid course brings me.
16	Autonomous motivation	Because I feel good when doing this hybrid course.
17	Autonomous motivation	Because I believe doing this hybrid course is important for me.
18	External regulation	Because I feel that I have to do it.
19	Introjected regulation	Because I want others to think I'm a good student.
20	Amotivation	I do this hybrid course, but I am not sure it is a good thing to pursue it.
Student engagement for hybrid teaching		
21	Classroom engagement	I tried hard to do well.
22	Classroom engagement	I tried to relate what I was learning to what I already knew.
23	Classroom engagement	When I was in class, I felt curious about what we were learning.
24	Classroom interaction	I participated in class discussions.

Item number	Scale	Item
25	Classroom interaction	I expressed my preferences and opinions.
26	Classroom engagement	I worked as hard as I can.
27	Classroom engagement	I tried to connect what I was learning with my own experiences.
28	Classroom engagement	When we worked on something in class, I felt interested.
29	Classroom interaction	I often responded to other students' questions.
30	Classroom interaction	I asked questions.
31	Classroom engagement	I paid attention in class.
32	Classroom engagement	I tried to make all the different ideas fit together and make sense.
33	Classroom engagement	I enjoyed learning new things in class.
34	Classroom interaction	I contributed regularly to course discussions.
35	Classroom interaction	I told the teacher what I like and what I don't like.
36	Classroom engagement	I listened very carefully in class.
37	*Excluded*	*I made up my own examples to help me understand the important concepts.*
38	Classroom engagement	I felt the class was fun.
39	Classroom interaction	I shared learning materials.
40	Classroom interaction	I let my teacher know what I was interested in.
41	Classroom engagement	I took notes in class.
42	Classroom engagement	I often searched for further information when I encountered something that puzzled me.
43	Classroom engagement	I really desired to learn the materials.
44	Classroom interaction	I helped fellow students.
45	Classroom interaction	I offered suggestions about how to make the class better.
46	Classroom engagement	I put forth effort in this course.
47	Classroom engagement	When I had trouble understanding a concept or an example, I went over it again until I understood it.
48	Classroom engagement	I was inspired to expand my knowledge in class.
49	Classroom interaction	I participated in small-group discussions.
50	Classroom interaction	I asked questions when I didn't understand the teacher.