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Challenges and motivation for teachers transitioning to active learning spaces

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ABSTRACT

Research indicates that active learning and Active Learning Spaces (ALSs) may improve student learning. Four teachers in mathematics and statistics at a Norwegian university are examined as they transition to ALSs. The teachers' experiences were analyzed using grounded theory which resulted in the three categories presenting what the teachers perceived as significant challenges to overcome when transitioning to the ALSs. The three categories are *Engaging Students*, *Building Student Relations*, and *Developing Teaching Strategies*. These categories were examined for how the teachers addressed the challenges and their motivation for using ALSs. The teachers felt it was necessary to handle all three categories well to benefit from the ALSs, further motivating active learning and ALS use. However, poor handling of the challenges reduced the teachers' motivation. This study was guided by action research and is part of a more extensive study that looked at the student perspective.

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KEYWORDS
Active; learning spaces; active learning; teachers' perspectives; teachers' perceptions; higher education

1. Introduction

1.1. Research context

This paper focuses on the reflections and feelings of teachers striving to adopt new learning methods in a new learning environment. While there is an increasing amount of research that supports that active learning may increase student learning outcomes, it is also essential to remember that there is no guarantee that active learning will increase student learning outcomes (Freeman et al. 2014). Indeed, not all ways of doing active learning are equal, and changing the way and space to teach is inherently risky (Kvan and Fisher 2021). A better understanding of how to help teachers transition to active learning and Active Learning Spaces (ALSs) may mitigate teachers' perception of risk related to changing their practices and increase students' learning opportunities (Jones and Fevre 2021). Indeed, learning more about how teachers transition and struggle with such transitions would be beneficial for providing better support and professional development to teachers, which in turn may secure better learning outcomes from active learning. Thus, a continuation in researching and supporting the transition to ALSs is essential to improve student learning outcomes further and to confirm if teachers' perceptions of the transition process are similar in a mathematical context and the Nordic university culture as reported elsewhere in the literature.

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1.2. Active learning

Active learning takes on various forms, such as problem-based learning, flipped classroom, peer instruction, or simply asking students to solve problems individually or with peers during class (Barell 2006; Mazur 1997). Active learning is here defined as teaching methods that allow students to participate actively in the learning process beyond listening, thinking, and notetaking (Prince 2004). While active learning sometimes entails homework, here, the definition only includes classroom activities (Bonwell and Eison 1991). There is an increasing amount of evidence that active learning outperforms conventional lecturing as a teaching method (Crouch and Mazur 2001; Deslauriers, Schelew, and Wieman 2011; Deslauriers and Wieman 2011; Fraser et al. 2014; Freeman et al. 2014; Hake 1998; Michael 2006; Springer, Stanne, and Donovan 1999). Active learning can also change students' attitudes toward learning and increase motivation (Cohen et al. 2019). How to best implement active learning is a growing topic in the literature (Bernstein 2018; Johnson et al. 2021). Active learning is not always successful or unproblematic. There is evidence that teacher implementation (Andrews et al. 2020), students not appreciating or understanding the purpose of the active classes (Deslauriers et al. 2019), or poor collaboration between peers (Deslauriers et al. 2019) may negatively influence learning outcomes from active classes.

1.3. Active learning spaces

Increased awareness of active learning has led to reflection on the spaces where such teaching strategies are performed (Finkelstein et al. 2016). Indeed, many universities have invested in learning spaces that facilitate students to be active and engaged during the learning sessions to improve further the benefits of active learning (Oblinger 2006). These new learning spaces have many names, such as 'Active Learning Classroom,' 'Next Generation Learning Space,' 'TEAL,' and 'SCALE-UP,' here referred to as Active Learning Spaces (ALSs) (Baepler et al. 2016; Fraser et al. 2014). ALSs are here defined as spaces designed with the intent for students to learn actively (see Figure 1 for illustration and section 2.2.2 for description). They typically include tables large enough for small group discussions and technology to facilitate collaboration.

There is evidence that active learning in ALSs further increases students' learning outcomes (Baepler et al. 2016; Brooks 2011; Brooks and Solheim 2014; Fraser et al. 2014; Taylor 2009). The benefits of such spaces have been attributed to the design enabling enhanced interaction between students (Brooks 2011). The design of the space, and the expectations that the users of the ALSs get, have been argued to promote mindsets that support the use of active learning and work to create a social climate that improves student learning outcomes (Walker and Baepler 2018).

Evidence suggests that teachers with epistemic beliefs in favour of active learning succeed better in ALSs (Lasry, Charles, and Whittaker 2014). First-time users of ALSs frequently did not change their teaching practices, i.e. teachers that lectured continued to do so (Carr and Fraser 2014). Nonetheless, teachers who did use active learning in ALSs found incentives to allow for more flipped classroom teaching (Van Horne et al. 2014).

1.4. Challenges when adopting and adapting to ALSs

Many researchers want to see more evidence-based teaching practices (Handelsman et al. 2004; Henderson and Dancy 2007; Stains et al. 2018). However, some concerns hinder teachers from adopting and adapting to ALSs. These concerns include the preparation time required to implement, the use of classroom time, as well as concerns about covering the curriculum, student resistance, the efficacy of active learning, and even how their teaching will be evaluated (Andrews et al. 2020; Dancy and Henderson 2005; Felder 2007, 2010; Finelli, Richardson, and Daly 2013; Froyd et al. 2014; Vuorela and Nummenmaa 2004). In addition, teachers report challenges in adapting to ALSs, such as overcoming student distractions and managing a new teaching role (Petersen and

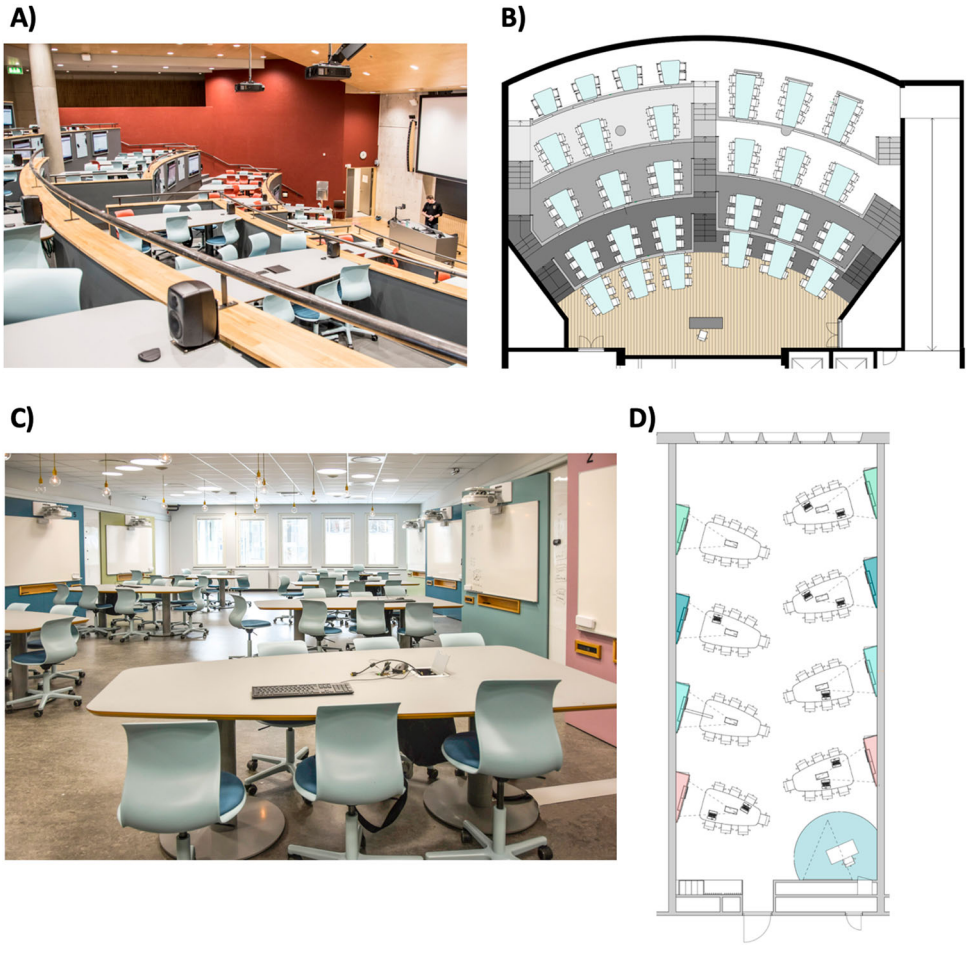

Figure 1. Illustrations of R2 (panels A and B) and SMIA (panels C and D), provided by Eggen Arkitekter AS.

Gorman 2014), lack of departmental support (Dancy and Henderson 2007; Fagen, Crouch, and Mazur 2002; Felder and Brent 1996; Silverthorn, Thorn, and Svinicki 2006; Turpen, Dancy, and Henderson 2010), students not appreciating or understanding the purpose of the active classes (Deslauriers et al. 2019), and poor collaboration between peers (Deslauriers et al. 2019).

Professional development can be an effective tool to support teachers in adopting and adapting to ALSs (Garet et al. 2001; Sorcinelli 2002). Teachers have reported that they would like professional development such as classroom observation, discussion with peers, or an experienced mentor to guide them through the implementation process when transitioning to the ALS (Finelli, Richardson, and Daly 2013).

1.5. Opportunities for adopting and adapting to ALSs

ALSs may provide new affordances, i.e. new opportunities for the teachers in how they structure their classes and how they interact with their students. In addition, ALSs can change teachers' expectations of what their classes should look like (Brooks 2011). Indeed, these affordances and expectations from the ALSs can make the active learning teachers are already doing even better (Brooks 2011) and make teachers interested in doing more active learning (Van Horne et al. 2014).

Furthermore, teachers can find joy and more fulfilling teaching experiences through active learning by helping students appreciate discovering something for themselves (Frank 2020). Teachers' enjoyment may lead to better student learning outcomes (Hernik and Jaworska 2018). Additionally, ALSs may change the social context of the classrooms towards fostering improved educational alliance and communication between teachers and students (Baepler and Walker 2014). Indeed, adopting active learning and ALSs could be a positive experience for teachers. Furthermore, there exist measures to encourage academics to focus on university teaching, for example, the focus on a national level on active learning and ALSs (Kunnskapsdepartementet 2017), and there also exist an effort to highlight excellent teaching practitioners at the Norwegian University of Science and Technology (NTNU) (Raaheim et al. 2020).

Nevertheless, there appear to be many opportunities left for institutions to encourage academics to focus more on their teaching. Graham (2022) reports that since 2019 there has been no significant change in academics' perceptions of their universities' underlying values and priorities with respect to rewarding university teaching, i.e. academics view university teaching as persistently undervalued (Graham, 2022). The use of the Expectancy Value Theory to evaluate teachers' motivation to adopt active learning practices found that teachers' adoption of such teaching strategies was often hindered by their perception of barriers such as fear of negative student response, a lack of time, a lack of support, and more (Finelli, Richardson, and Daly 2013). Indeed, it is still of interest to learn more about teachers' motivation to adopt and adapt ALSs, using theories such as the Expectancy-Value Theory (EVT) that acknowledges that teachers' motivation is influenced by both their perception of the difficulty of a task and their perception of the value of the task (Atkinson 1957; Wigfield and Eccles 2002; cf Section 2.1.2). Such research could be used to inform improved faculty professional development and administrative change plans.

1.6. Research questions

According to the Interaction Equivalency Theorem (Anderson 2003; Miyazoe and Anderson 2010; see Section 2.1.2), some form of interaction is necessary to obtain deep and meaningful learning. Active learning and ALSs can, but do not have to, support high-level interactions. Ample evidence suggests that active learning and ALSs may improve student learning outcomes, however, here, the focus is on how the teachers perceived challenges in transitioning to an ALS. Such an examination could clarify potential pitfalls in improving educational practices and highlight motivational obstacles to teachers wishing to use ALSs.

The research questions are:

(1) What do the teachers perceive to be significant challenges to overcome when transitioning to ALSs?
(2) What did the teachers do to overcome the challenges?
(3) How do the teachers perceive that their motivation and their challenges mutually affect each other?

Research question (1) aims to identify what the teachers perceive as significant challenges when transitioning to ALSs. Research question (2) explores what the teachers did to overcome the challenges, specifically what tools they used to overcome them.

Finally, research question (3) is concerned with understanding how the challenges and the teachers' motivation mutually affect each other to learn how teachers' motivation impacts their success with transitioning and how their perception of the challenges impacts their motivation to transition.

Interactive Action Research (IAR) (section 2.1.1) was used to make the teachers committed to transitioning to the ALSs by supporting them in overcoming minor challenges and looking at what they felt were significant challenges as they transitioned to the ALSs. The data material consisted of

individual semi-structured interviews, group reflection conversations, and post-observation conversations (see Table 2). Classroom observations were also indirectly used to provide further talking points with the teacher. Using grounded theory (cf Section 2.3.2), categories describing significant challenges for the teachers to overcome when transitioning to the ALSs were identified. These categories answered research question (1), and their structure is illustrated in Figures 2–4. Once identified, the categories were examined for answers to research question (2), what teachers did to overcome the challenges, and research question (3), how the teachers perceived the mutual relationship between the challenges and their motivation to use ALSs. For research question (3), the EVT was used to analyze the teachers' motivation (Atkinson 1957; Wigfield and Eccles 2000; cf Section 2.1.3).

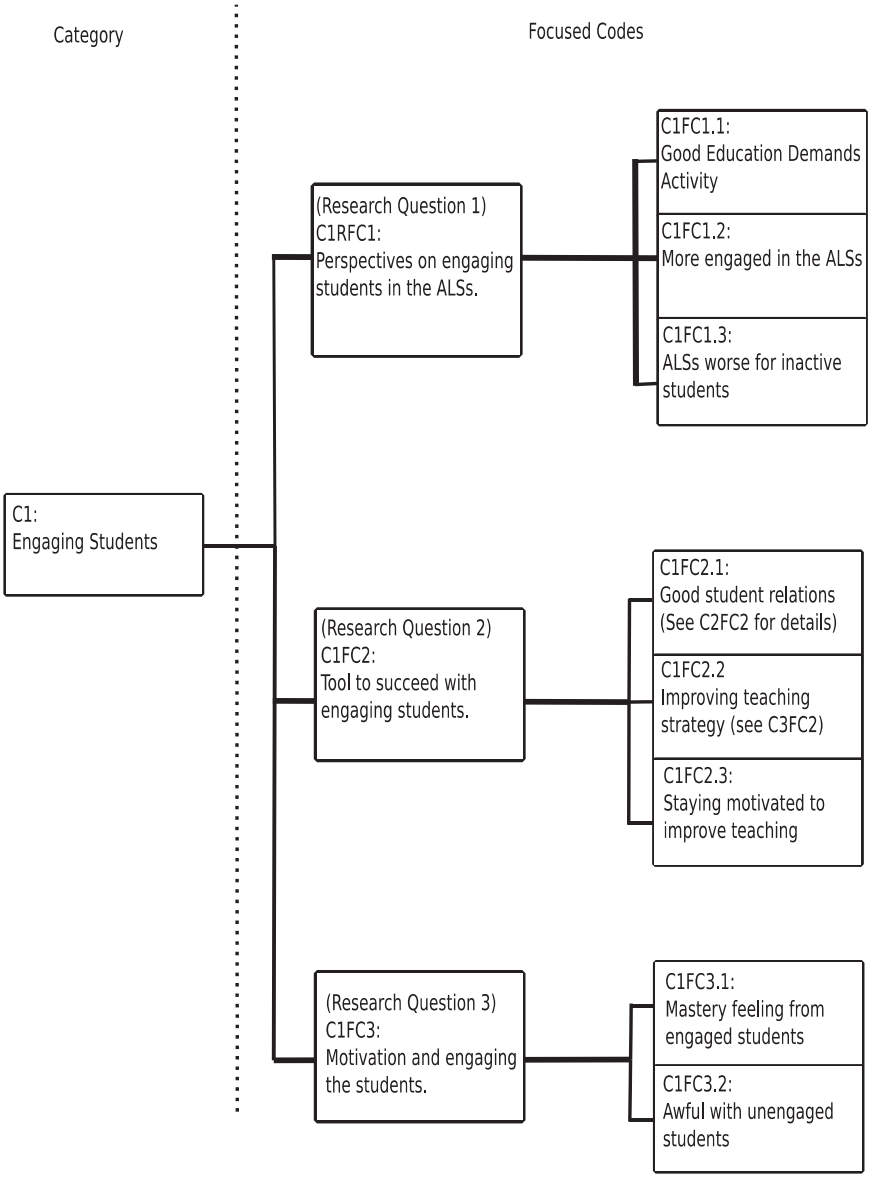

Figure 2. The focused codes show how the teachers perceive the challenge of engaging students. Research questions 1, 2, and 3 are respectively addressed by focused codes (FC) 1, 2, and 3.

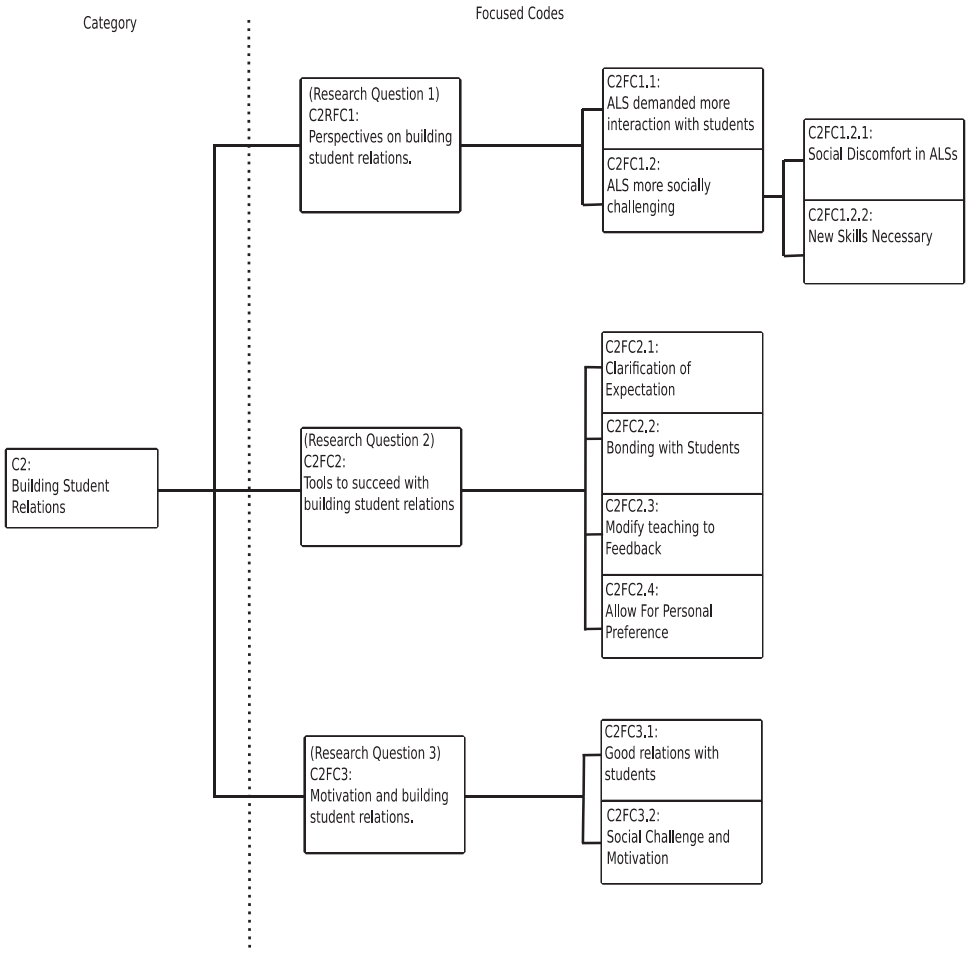

Figure 3. The focused codes show how the teachers perceive the challenge of building student relations. Research questions 1, 2, and 3 are respectively addressed by focused codes (FC) 1, 2, and 3.

The findings here may also be unique to the research context, i.e. mathematical and statistical subject matter and higher education in Norway. Of note is that Norwegian culture may be described as similar to other western cultures but with higher pressure on conformity (Avant & Knutsen, 1993).

2. Materials and methods

2.1. Theory

2.1.1. Interactive action research

Action research is a methodology often used in educational research that seeks to improve practice and explain it (Elliot 1991). It seeks to change and transform practitioners' practices, their understanding of their practice, and the conditions in which they practice (Kemmis 2009). There are many subcategories and ways to categorise action research, e.g. technical action research, practical action research, and IAR (Postholm 2007). By Postholm's definition (2007), IAR denotes a form of action research that focuses on researchers and practitioners meeting in an equal relationship, where the researcher has experience from the research field and works to develop the field of practice as well as to research this practice. Furthermore, IAR allows the researcher to offer thoughts on

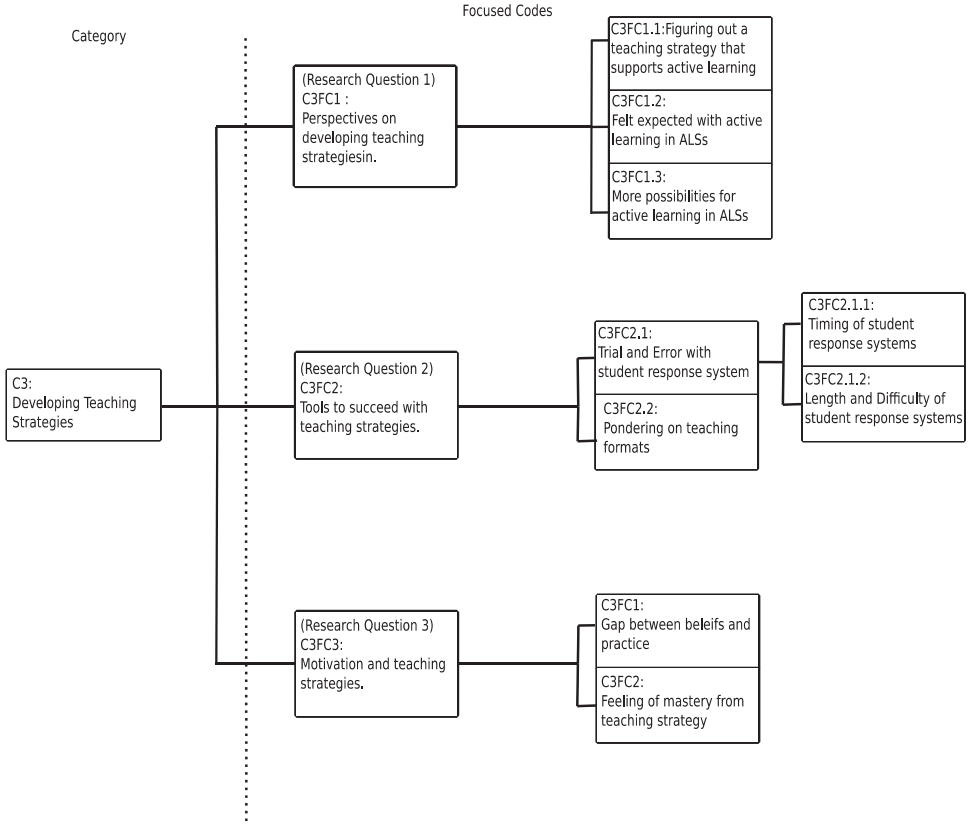

Figure 4. The focused codes show how the teachers perceive the challenge of developing teaching strategies. Research questions 1, 2, and 3 are respectively addressed by focused codes (FC) 1, 2, and 3.

teaching strategies and to probe for the practitioners' opinions on the challenges they encountered during the change in practice that is being researched.

2.1.2. Expectancy-value theory

Looking at the teachers' perceptions of transitioning to the ALSs can inform how one can motivate teachers to change their teaching practices towards using active learning and ALSs. Thus, the identified challenges will be used to examine teachers' motivation as they adopt active learning and adapt to ALSs. The Expectancy-Value Theory (EVT, Atkinson 1957; Eccles, Wigfield, and Schiefele 1998; Wigfield and Eccles 2002), is used as a framework for categorising achievement motivation. According to EVT, an individual's motivation for a task depends on their expectancy of accomplishing the task and the value they attribute to achieving it. The expectancy category consists of the ability self-concept, in this case, the teacher's belief in mastering the task, and the task difficulty, which is *their* perception of its difficulty. The value category consists of the attainment value (the subjective view on the importance of doing well), the intrinsic value (the anticipated enjoyment), the utility value (the usefulness for future plans), and the cost (e.g. effort, loss of opportunity, or emotional cost). Factoring teachers' motivation into the elements suggested by EVT offers a deeper understanding of the teachers' challenges.

2.2. Research design

This study is a part of a more extensive study that also looks at the students' perspectives of the teaching environment that the teachers in this study facilitated. The students' experiences were

investigated through focus-group interviews, surveys, and classroom observations and will be further explored in a later paper. The whole study was conducted during the fall semester of 2019 at NTNU.

A recently completed educational development project at the Norwegian University of Science and Technology (NTNU), Technology Education of the Future (Norwegian acronym FTS), established a set of principles for the future development of science and engineering education at NTNU and these principles have been adopted by NTNU's Rector as a platform for future educational development (Øien and Bodsberg 2021; Øien, Bodsberg, and Lyng 2022). The three principles concerning the pedagogical learning environment are of interest in this context: contextual learning, student-active learning, and pedagogical competence development for the teaching staff. If we aim to transform science and engineering education, we need to do more than merely add or update subject content. We need to rethink how education is designed. Central to this ambition is developing the teaching staff's pedagogical competencies and understanding their challenges to design appropriate support for them and the students (Øien, Bodsberg, and Lyng 2022).

2.2.1. The participants

The participating teachers were interested in but had no prior experience using ALSs. Four teachers participated in the study (see Table 1). It was considered that between 3–6 teachers for a research project of this size struck a balance between data and depth, where more teachers allowed for more data, but fewer teachers allowed for more depth in the teachers' reflections. It turned out that four was the number of teachers available in relevant courses that were interested and possible to fit into ALSs in this period. The courses taught were two statistics courses, one for second-year engineering students and one for second-and third-year science students, one calculus course for

Table 1. A summary of the different teachers learning spaces, teaching activities, experiences and preferences.

	Andy	Bob	Christoffer	Daniel
Active Learning Space	R2	R2	SMIA	R2
Norwegian Native Speaker	Yes	Yes	No	No
Experience teaching at NTNU	30+	30+	0–10	0–10
Age	50–70	50–70	30–50	30–50
Course	Statistics	Calculus	Statistics	Numerical Mathematics
Students	Engineering	Engineering	Science	Science & Engineering
The preconception of AL and ALSs	Positive	Positive	Positive	Positive
SRS as active learning	Yes	Yes	Yes	Yes
Mini Exercises as active learning	No	No	No	Yes
Exercise Session as active learning	No	No	Yes	No
Previous experience with active learning	Yes	Yes	No	No
Wants to continue with active learning	Yes	Yes	Yes	Yes
Previous experience using ALSs	No	No	No	No
Wants to continue using ALSs	Yes	Weak Yes	Yes	No
Wants to design teaching to allow for more student activity	Yes	Unclear	Yes	Unclear
Initial change to their teaching	Committed more to AL	Moving more around the space	Changed to active learning-focused class (see 3.3)	Started doing more AL
Main challenges of using the ALSs	Engaging the students	Balancing covering the curriculum and active learning	Developing and using a new teaching strategy	Building student relations due to social discomfort

first-year engineering students, and one numerical mathematics course for mostly master of technology students. All the teachers in this study were given pseudonyms. The teachers, Andy and Bob, were experienced users of a Student Response System (SRS) (Nicol and Boyle 2003; Draper and Brown 2004; Dufresne et al. 1996; Trees and Jackson 2007). The teachers Christoffer and Daniel had some experience trying to engage and activate students from their lectures through questions and discussions, but no prior experience with SRS, flipped classroom, problem-based learning, or other developed active learning strategies.

In the study, all the teachers used SRS-questions; one used mini-exercises, and another used exercise sessions (see Table 1). The SRS-questions were typically used for 2–3 questions every 45 min. Each SRS-question session lasted around 2–6 min. The teacher asked a question and gave the students time to talk, problem-solve and answer, after which the teacher presented the solution. The mini-exercises consisted of 3–4 questions that the students got roughly 15 min to answer before the teacher presented a solution. The exercise session lasted 2×45 min. The students worked on a lengthy task divided into smaller subtasks. The teacher delivered an introduction to the class, an explanation of the subtasks during the session, and a summary of the task at the end while being available for questions during the remainder of the session.

2.2.2. The active learning spaces

The ALSs used in this study were developed between 2016–2018 at an institutional level for all teachers at the university to use. They have been developed as a pilot project that corresponds with NTNU's and the government's ambition to have more active learning and spaces that accommodate such learning (Kunnskapsdepartementet 2017). There are still relatively few ALSs at the university compared to conventional lecturing spaces; however, these ALSs have become very popular among teachers and are hard to book.

The participating teachers used two ALSs named R2 and SMIA (see Figure 1 for illustration). The bigger space, R2, was used by three teachers and could fit up to 160 students. The smaller space, SMIA, was used by one of the teachers in this study and could fit up to 50 students. Both spaces retain some division between students and teachers through a designated teacher area. The spaces also feature tables designed for small group interactions while keeping enough space for teachers to walk around the room among the students. While SMIA is a flat room, R2 is levelled (see Figure 1). Furthermore, both spaces feature educational technology such as Wi-Fi, a whiteboard for each student group, microphones, and a control panel for managing technology at the teachers' desk. Additionally, R2 has a shared digital screen for each student group, while SMIA has an Interactive Whiteboard for each group.

2.2.3. Preparing the teachers

In order to enter into an equal partnership with the four participating teachers and explore their perceptions surrounding the challenges of transitioning to teaching in the ALSs, the research project was guided by the IAR methodology. Following advice from IAR (Postholm 2007), an essential aspect of my role was establishing a comfortable environment where the teachers felt safe sharing their experiences and reflections. Typically, when the teachers had nothing more to share on a topic, I shared findings and ideas from the relevant literature and theory to contrast or highlight a point and get a deeper understanding of the teachers' perspective. Additionally, the teachers were influenced actively to participate in the research project in the following ways:

(1) Before the teachers chose to transition to the ALSs and participate in the research project, I made the case to the teachers that active learning and ALSs could benefit the quality of their teaching. I clarified that the research project was built around data collection while supporting a change to improve practice and that I would be available to assist them as a 'research expert' as they transitioned to the ALSs. This was emphasised to make the transition seem more manageable and motivate the teachers to enter the research project.

(2) After the teachers committed to the research project, I influenced the room selection process to guarantee that the teachers were admitted to the ALSs.
(3) I further offered input to the teachers throughout the research period on ideas as they transitioned and encouraged the teachers to discuss active learning and ALSs with each other. This input was offered to improve the chance that the change would benefit the teachers and the students and reveal the more significant challenges they encountered.

Overall the discussions aimed to make the teachers share their emotions and thoughts on how it was to adapt to the ALSs. However, particularly for the early discussions, the teachers requested more information on possible ways to do active learning and how to teach in the ALSs. Hence, the researcher provided information on teaching strategies, such as problem-based learning, flipped classroom, and peer instruction. Different tools to make the students active such as grouping them in varying ways, diverse tasks, and SRSs, were also discussed. When explicitly asked by the teachers to do so, the researcher also offered opinions on matters related to the ALSs. It was made clear that such opinions were subjective and that there were other outlooks on the matter.

One such opinion was that for first-time users of active learning and ALSs who might be worried about the workload that came with transitioning to the ALSs, an SRS might offer a softer transition to the ALSs than, e.g. problem-based learning or flipped classroom. Such input may have impacted teachers' reflections on teaching strategies. However, it was also stated that it was possible to opt for a teaching strategy more similar to flipped classroom or problem-based learning, and that the teachers would be supported and put in contact with other more experienced users and practitioners of their chosen strategy to help them through their transition.

The sense of a shared community, possible support, and opportunity to talk to the other teachers seemed to positively impact the teachers' outlook on ALSs and active learning and may have impacted the results of this paper. Indeed, without the interference, the teachers would most likely not have transitioned to the ALS at this time.

2.3. Data collection and analysis

2.3.1. Data collection

To be able to answer the research questions, the following data was collected (see Table 2 for a summary):

- **Individual semi-structured interviews**; focused on the teachers' perception of challenges before and after teaching in the ALSs. For each teacher, one interview was conducted before the teaching started (pre-interview), and one was conducted after the first semester of teaching in the ALSs (post-interview). These interviews established a baseline for the teachers' perceptions of the challenges of transitioning to the ALSs, and how their perceptions changed before and after ALS use.

Table 2. A summary of all the data material used in this study.

Data-source	*Data-type*	*Group-size*	*Number of Times*
Individual semi-structured interviews	*Audio (Transcribed)*	*The researcher + One teacher*	*One Pre-Interview Per Teacher One Post-Interview Per Teacher*
Group Reflection Conversation	*Audio (Transcribed)*	*The researcher + 2–4 teachers*	*Five times – varying composition of teachers*
Classroom Observation (indirectly used)	*Notes*	*The researcher + Teacher and Class*	*4–6 times per teacher*
Post-observation Conversation	*Audio (Transcribed)*	*The researcher + One Teacher*	*1–2 times per teacher*

- **Group reflection conversations** were regular physical group conversations where the teachers shared their concerns about the difficulty of teaching in the ALSs with each other and the researcher. As encouraged by IAR (Postholm 2007), the researcher actively influenced the teachers by facilitating dialogue and making suggestions for reading materials and teaching strategies. The teachers were encouraged to share their successes and challenges.
- **Classroom observations**; the researcher observed some of the teachers' classes. These observations were not directly used in the analysis but provided talking points for later conversations. The conversations influenced what the teachers did in later classes.
- Finally, in **Post-observation conversations,** the teachers talked about their performance in class shortly after being observed. More specifically, while fresh in memory, the researcher discussed how the teachers perceived the challenges of the particular class. These post-observation conversations aided the researcher in comparing his experience from the observations with the teachers' first-hand experience from the classroom.

The different data sources were a part of an extensive iterative reflective process where the various data sources influenced one another. The researcher influenced the teachers' practices through interactions, giving rise to new discussion topics. Furthermore, the researcher took measures to ensure that all sessions were safe and comfortable places where the teachers could share their experiences and thoughts, both good and bad, related to teaching in the ALSs.

2.3.2. Data analysis

To address what the teachers perceived to be significant challenges to overcome in transitioning to ALSs (Research Question 1), the constant comparative method was used as a part of grounded theory (Strauss and Corbin 1998) to find any underlying structures in the transcribed data material from the individual interviews, the group reflections, and the post-observation conversations. The classroom observation notes were not analyzed but used as talking points in later conversations and interviews. The constant comparative method is used to structure the data material through an iterative process of rereading and analyzing the data material. In order to draw out the results from the data, each sentence was given a brief name that classified the topic. Non-pertinent elements of the text were removed. Text that was unclear whether it was relevant or not was temporarily given its own colour and name to be reevaluated at later stages. The analysis was gradually built up from bottom to top through rereading and re-analyzing the text to see how the text could be sorted and named differently. When all pertinent text was line-by-line coded and appropriately named, the analysis continued towards creating focused codes by grouping lines of similar topics together. In addition to being named, these focused codes were given colour codes. Creating focused codes consisted of further rereading and re-analyzing to test and modify the focused codes continuously. When the sorting of the focused codes was fixed, and there was no need for further changes, the focused codes were, in turn, grouped into categories. The focused codes and categories are presented in Figures 2–4. The analysis yielded three categories relating to research question (1): Engaging Students, Building Student Relations, and Developing Teaching Strategies (see Section 3.1–3.3). The underlying focused codes that resulted in each category are presented in Figures 2–4.

While coding for research question (1), wether the data material could highlight other themes was also considered. Indeed, there were discovered tendencies througouht the coding process of research question (1) that could highlight the themes of research questions (2) and (3). After the coding for research question (1) was finished, the codes were revisited and used to finish the formulations for research questions (2) and (3) as well as provide complete answers for these research questions.

For research question (2) it was investigated what sort of content in each of the categories discovered through research question (1) that gave answers to this research question. I.e. when the

Table 3. A summary of the teachers' perspective on their motivation for transitioning to the ALSs. The perspectives are structured using EVT and the three categories identified in research question 1.

	Engaging Students	Building Student Relations	Developing Teaching Strategy
Ability Self-concept & Task Difficulty	It was seen as more necessary to engage the students when in the ALSs. To positively influence students' engagement was seen as challenging and demanded time and effort.	Building good student relations were seen as particularly necessary in the ALSs. The teachers who considered themselves to have good social and soft skills saw creating student relations as an easier task.	The teachers felt that ALSs encouraged them to develop new teaching strategies, which demanded new pedagogical and didactical skills that differed from those used while lecturing.
Attainment Value	The ALSs were viewed to have a positive value if the students were engaged and a negative value if the students were unengaged.	Building student relations were seen as an essential tool to engage the students and made the classes seem more meaningful.	The teachers saw new teaching strategies as valuable to improve student learning outcomes. However, the teachers still felt they needed to cover the curriculum.
Intrinsic Value	Engaged students made teaching more fun. However, it was potentially heartbreaking to have unengaged students in the ALSs.	Good relations with the students made the classes more fun.	The teachers enjoyed aligning their practices with their teaching beliefs. However, struggling with the adaption was a source of dissatisfaction.
Utility Value	Transitioning to the ALS was perceived to have a negative utility value as teachers feared that poor perceptions from students or peers could have negative consequences.		
Cost	There was an emotional cost to transitioning to the ALSs and being uncertain if the students would engage.	There was an emotional cost to trying to connect to the students as the teachers feared being perceived poorly.	Transitioning to a new teaching strategy demanded time and effort. The teaching strategy is also needed to fit the ALSs.

teachers talked about the specific challenge of engaging the students, how did they talk about overcoming this challenge.

A similar process was used for research question (3), but this research question also introduces the concept of motivation. The teachers' motivational experiences and reflections were examined using EVT and structured into categories, as seen in Table 3.

3. Results

The grounded theory helped identify three categories of what the teachers perceived as significant challenges when transitioning to the ALSs. The three categories are *Engaging Students*, *Building Student Relations,* and *Developing Teaching Strategies*. Each category contains (1) a description of the perceived challenge and why it was necessary to overcome it to benefit from the ALSs, (2) a presentation of how the teachers reflect they could overcome the challenges, (3) comments on how the teachers perceived that the challenges and their motivation to transition to the ALSs mutually affect each other, and, finally, (4) a figure presenting the structure of each of the focused codes for the category (see Figure 2–4). The teachers' reflections were then sorted with respect to the three categories and the motivational factors from the expectancy-value theory, see Table 3. For Table 3, the *ability self-concept* and *task difficulty* categories were merged into one, as the discrepancies between the teachers' views on task difficulty and their belief in mastering the challenges were still in development.

The teachers reflected more on active learning than ALSs; however, they perceived that using ALSs was the final push for them to do active learning. The transition to ALSs compelled the teachers to reflect more on their active learning practices. The change in physical environment compelled the teachers to act differently as the ALSs afforded new opportunities, such as more readily facilitating student group work and connecting with students through walking around the classroom. Furthermore, the ALSs facilitated more teacher reflection on active learning as they experienced that it was expected of them to go beyond conventional lecturing in these spaces, which in turn made them

reflect more on how they could engage and increase student learning. Indeed, this was quite different from their experiences in the standard lecture theatres, where they felt no inspiration from the space to go beyond lecturing.

The teachers felt that the ALSs were comparable to raked lecture theatres for traditional didactic instruction. However, there were concerns that the oblong shape of SMIA and the wideness of each level at R2 made it hard to see the students, feel a connection with the students, and a concern that the students did not see the teachers well enough. Furthermore, the teachers felt that as the spaces afforded the students to interact, longer lecturing segments were more prone to students distracting each other. However, many teachers considered this a remainder to space out the active learning segments and kept their lecturing segments reasonably brief.

3.1. Engaging students

Engaging Students is the first of the three categories determined by the constant comparative method. Figure 2 shows how the teachers view the challenge of engaging their students. The teachers understood student engagement to mean that the students were paying attention to the teacher and showing curiosity for the subject matter and the learning activities in the class. The teachers laboured to engage their students as they felt that good student engagement was necessary for good student learning outcomes and reported that being in the ALS made them particularly aware of the importance of engagement.

Three key elements influenced the significance the teachers attributed to the challenge of engaging their students. Firstly, the ALS context made the teachers reflect more on the importance of engagement and thus put more pressure on themselves to engage their students. Secondly, the ALSs were perceived to make it easier for students to engage in non-curricular activities, which made it especially important to engage the students otherwise. Finally, the teachers perceived the active classes in the ALS as worse for unengaged students than the conventional lectures. The unengaged students in a lecture were perceived to absorb some of the information presented to them, but the students who refused to engage in the active elements or gave up quickly were perceived to learn nothing. Indeed, the teachers reflected that there is a bigger threshold for students to learn from active segments than from more passive ones.

The teachers used mainly three approaches to overcome the challenge of engaging their students. Firstly, they worked to create a positive and comfortable relationship with the students and explained their teaching strategies' purpose to connect with and motivate the students (see Building Student Relations). Secondly, they chose an appropriate teaching strategy with well-designed tasks (see Developing Teaching Strategy). Finally, they spent time adapting and improving their teaching in the ALSs (see Figure 2 for focused codes).

The teachers reported higher intrinsic values in the ALSs as they perceived that the space increased their students' engagement, which they reflected was likely due to the environment of the ALSs being conducive to them establishing good student contact and interacting more with the students. Daniel reported that active learning and being in an ALS helped him engage his students: 'The biggest success is getting students to reply. I have struggled with that for eight years, but now I can get them to reply … I am happy now.'

The teachers' attainment values of the ALSs were highly related to how they felt their students did in the ALS classes. Indeed, if the students were not sufficiently motivated to work on the tasks, the teachers thought that the ALSs could reduce the student learning outcomes. The teachers reflected that unengaged students would still interact more in the ALSs, but about non-educational matters. Thus, the attainment value the teachers attributed to teaching in the ALSs depended on their expectancy of being able to engage the students. Only some of the teachers were confident enough in their ability to engage the students that they saw the potential benefit of transitioning to the ALSs as guaranteed. The teachers who felt they succeeded in engaging the students reported enjoyment and found the active classes meaningful. Reversely, failing to engage the students was

felt to reduce their enjoyment and add emotional stress (see Table 3). For instance, the teacher who reported the highest social discomfort in the ALS also reported the lowest intrinsic motivation to be in the ALS.

3.2. Building student relations

The second of the three categories is *Building Student Relations*. The structure of the focused codes in this category is presented in Figure 3. The teachers experienced student contact as an essential tool to keep the students engaged. Good student contact was described as being in touch with the students and having a friendly bond between the teacher and the students. Furthermore, good student contact was felt to increase dialogue between the teacher and the students, the quality of the feedback the teachers received from the students, the students' willingness to participate, and the student's ability to stay focused and interested in what is going on in class. However, a significant challenge the teachers perceived when transitioning to the ALSs was that these spaces demanded more interaction with the students, which demanded time and was socially challenging for some teachers. Indeed, for the teachers that found it challenging, it could trigger their social discomfort and demand more time to refine their skills in connecting with the students. Daniel reflected that it was socially challenging for teachers and students, but for some more than others: 'But I do sympathize with the poor introverts that have to go to do group work all the time. My heart goes out to them. I do feel for them. I am one of them.'

With some variations, the teachers used the following approaches to overcome the challenge of building student relations. They clarified what is expected of the students in the course as well as in the class. Secondly, they worked to create an atmosphere of trust by walking around the classroom, talking with the students, and encouraging them in their work. Finally, the teachers demonstrated interest in their students by listening to their experiences and adapting their teaching to the students' preferences when possible. The teachers felt that these approaches had to be used in a natural way, i.e. the approaches needed to match their intrinsic values and ability self-concept to connect with the students successfully. The teachers' strategies to overcome the challenges were similar to findings on reducing student resistance to active learning, such as in Finelli and Borrego (2020). Furthermore, the teachers also felt that the ALSs stimulated them to try more strategies to engage their students, similar to what was found in Johnson et al. (2021).

The teachers felt that the enhanced feedback from good student relations guided them in improving the quality of teaching. In turn, when the teaching quality was good, it was perceived to be easier to build good student relations, thus creating a positive cycle. Nonetheless, the teachers sometimes perceived the students' feedback as insincere or un-reflected and instead focused on the students' desire for comfort than their interest in learning. Thus, to detect quality feedback, the teachers chose to use several complementary feedback sources, such as responding to in-class questions (including the SRS questions), observing the students working, and talking with the students in and after class. Andy reflected this as a challenge: 'It is hard to say, with any certainty, how good the teaching actually has been … talking with the students helped get good feedback.'

The four teachers reported that the ALSs afforded more opportunities and increased expectations for interacting with their students, influencing their motivation. The socially comfortable teachers reported increased attainment and intrinsic value from the ALSs. Contrary, the self-reported socially uncomfortable teachers reported that the ALSs increased their stress levels. This stress impacted teachers' motivation by making them perceive teaching in ALS as having a greater task difficulty and a lower intrinsic value. Indeed, the more socially uncomfortable teachers reported being more preoccupied with how they were perceived by their students, which in turn inhibited their support of the students. Bob perceived student relations to influence students' motivation positively: 'I really think the contact with the students is important. With good student contact, I think it becomes a lot more motivating for the students.'

One teacher reflected that he underestimated the relationship between the ALSs and his motivation, partly because he found it socially uncomfortable and challenging to teach in this space. This teacher reported that the social discomfort made him perform suboptimally, leading to a drop in attainment value, intrinsic value, and perceiving the task difficulty of adapting to the ALS as higher. The teacher did not want to teach in ALSs after this experience (see Table 3). The teachers reflected that guidance from others and time to figure out how to adapt to the ALSs were appreciated and necessary to succeed.

3.3. Developing teaching strategies

The third and last category identified was Developing Teaching Strategies. The teachers' reflections on what was challenging with developing a good teaching strategy are illustrated in Figure 4. The teachers perceived that finding and adapting a teaching strategy suitable to them and their students was a significant challenge that needed to be overcome when transitioning to the ALSs. To succeed with their teaching strategy, they felt that it needed to fit with their personal preferences and skills, such as constructing good tasks and allowing for engaging their students in a way that was socially comfortable for them as teachers. The development of their teaching strategy was reported to be a personal journey of trial and error that was sped up by teaching in the ALSs, where it was felt to be expected to use active learning. The teachers felt that maintaining good intrinsic and attainment values towards adapting ALSs depended on their mastery of adapting to a new teaching strategy.

While pondering on how to overcome the challenge of developing teaching strategies, the teachers reflected that there were two main approaches to implement active learning into their classes. The first way, referred to as *active learning enhanced lecture,* was augmenting a regular lecture with more active learning. The second way, an *active learning-focused class,* embraced a pedagogy form centred around active learning such as flipped classroom or problem-based learning. While the teachers reasoned that active learning-focused classes had the highest potential for attainment value, they still often chose to teach using active learning-enhanced lectures. The teachers felt more comfortable with active learning-enhanced lectures than active learning-focused classes, as they could keep lecturing while gradually adapting to teaching with active learning. Furthermore, the teachers viewed it as their responsibility to personally cover the curriculum for the students. Covering the curriculum was perceived to be easier with lecturing than with active learning, and for some of the teachers, their high attainment value attached to covering the curriculum prevented them from fully committing to active learning. That is, while the teachers still believed in active learning, they did not practice it as much as they wanted to due to the perceived cost of not covering the curriculum.

For the active learning enhanced lectures, the teachers used SRS. Using the SRS was felt to be an effective way of providing breaks from lecturing, allowing students to help each other, and providing feedback to the teacher. The teachers new to active learning invested time into developing appropriate complex conceptual questions to fit with the SRS-format (Nielsen, Hansen, and Stav 2016). The teachers drew inspiration from peer instruction, creating tasks where students answered 30–70% correctly on the first try (Mazur 1997). Reading the students' moods to deliver the activities at the right time was also seen as essential.

The teachers perceived it more challenging, i.e. a higher task difficulty, to fit active teaching strategies and develop suitable tasks for mathematics than for other subjects. Some teachers reflected that subjects that were perceived as less abstract and more related to everyday experiences were easier to discuss and create group work exercises for, while mathematics being perceived as abstract made it less suitable for group work. Furthermore, they reflected that mathematics often required a significant fundamental understanding of the subject before the students could engage in beneficial interaction. Such perceptions reduced the teachers' motivation to transition to the ALSs. Mathematics was seen as more abstract, less related to students' life experiences, and challenging to engage with beyond working alone. Additionally, the teachers felt that it demanded more time to adapt to making suitable mathematical tasks that fit their teaching methods. They had to shift from mainly

designing procedurally focused tasks to conceptually based tasks. Christoffer summarised one of his main challenges with developing a teaching strategy: 'I have lots of ideas – it could be very cool to do it like this and that – but then I don't since I do not have the extra time I wished I had.'

3.4. Relationships between categories

The teachers felt they benefitted from the ALSs when their handling of the three categories was good. Christoffer, who had good relations with his students, said, 'I think it is a lot easier to interact with the students in SMIA as I can walk from table to table and ask how they are doing – I do not do this in a regular lecturing hall.' Furthermore, good handling of one category increased the teachers' motivation to work on the other challenges and was perceived to make it easier to handle the other categories well. When the teacher mastered a challenge, their intrinsic motivation for working with active learning in the ALSs increased, including their intrinsic motivation related to the other challenges. Furthermore, overcoming a challenge made them perceive active learning in the ALSs as more meaningful, increasing their attainment value for working on the other challenges. Overcoming one or more challenges made the teacher feel that it was more feasible to overcome the other challenges, i.e. success with some challenges reduced the perceived task difficulty for other challenges. Indeed, they reflected that it became easier to manage a challenge well when the other challenges were managed well. For example, good student relations and suitable teaching strategies were viewed as favourable for engaging the students. Engaging the students and having good student relations were perceived to make the chosen teaching strategy more successful, and well-designed activities and engaged students were felt to improve the teachers' relations with the students.

The teachers felt that they could create a positive cycle where good handling of one challenge in the ALSs made the success of the other challenges more likely, while simultaneously increasing their motivation to use ALSs. However, the opposite effect was also made clear: poor handling of any of the challenges was perceived to make the success of the other challenges harder and reduce the teachers' motivation, thus making the teachers less likely to pursue further use of ALSs. Indeed, when a task was poorly handled, the teachers' intrinsic and attainment motivation related to the other tasks were reduced, and the perceived task difficulty of the other challenges was increased.

4. Discussion

In order to enhance and implement active learning, ALSs have been increasingly used (Baepler et al. 2016). Teachers have reported concerns about adopting ALSs, and users of ALSs have reported difficulties in successfully using these spaces (Andrews et al. 2020). These concerns and difficulties inspired further research on teachers' challenges when adopting and adapting the ALSs.

Using expectancy-value theory as a theoretical framework, IAR as a research methodology, and grounded theory for the analysis, I have identified three challenges that teachers transitioning to ALSs perceive to be necessary to handle well if their students are to benefit from the ALSs: 1) Engaging Students, 2) Building Student Relations, and 3) Developing Teaching Strategies. The structure of these challenges is to the author's knowledge novel, but many of the elements and concerns that the teachers mention within these categories, such as difficulty engaging students and lack of departmental support, are mentioned elsewhere (Andrews et al. 2020; Dancy and Henderson 2007; Deslauriers et al. 2019; Jones and Fevre 2021; Turpen, Dancy, and Henderson 2010). When the teachers felt they handled the challenges well, they also felt that teaching with active learning and being in the ALSs had high attainment value and intrinsic value, motivating them to continue using active learning and ALSs. However, for some of the teachers adapting to using active learning and ALSs was perceived to be difficult, demanding much time, and having both a possible emotional cost and a small utility value, adversely affecting their motivation.

While the teachers were aware that the university, as instructed by the government, is interested in teachers using active learning and ALSs (Kunnskapsdepartementet 2017), they felt little to no pressure from their institution to fulfil these demands. However, the teachers were more worried that peers could criticise their effort to do something out of the ordinary if it was unsuccessful (see Table 3). Indeed, these were ordinary teachers that were curious about active learning but otherwise influenced by the research project to transition to the ALSs.

Lasry and co-workers (2014) found evidence that teachers' epistemic beliefs must match student-centred teaching methods for students to benefit from the ALSs. The four teachers in this study had similar reflections and believed that it was necessary with teaching strategies suitable for the teachers to engage the students. Thus, teachers' belief in student-centred teaching may improve the quality of active classes in the ALSs, possibly through increased student engagement. Additionally, Section 3.4 presents how having engaged students may increase teachers' attainment value in active classes in the ALSs, i.e. causing teachers' beliefs to match student-centred teaching. How students are engaged in the ALSs is most likely dependent on a complex interaction between teachers, students, and ALSs. There may also be a bias in who is using ALSs, as teachers that are already successfully using active learning may self-select into ALSs (Morrone et al. 2014), and teachers that succeed in overcoming the challenges may be more likely to continue using ALSs. Thus, it is of particular interest here that the teachers in this study were ordinary and by no means experts in active learning or ALSs. Regardless, it is essential to support teachers to engage their students, build student relations, and develop teaching strategies. Both to improve the quality of active learning in ALSs, and to persuade teachers to transition and continue teaching in ways that support improved student learning outcomes.

Walker and Baepler (2018) found that social context is an underlying factor in how ALSs can improve student learning outcomes. This finding substantiates the four teachers' reflections that building good student relations or creating a positive social context is necessary to benefit from the ALSs. Furthermore, the teachers' reflections on creating a safe and comfortable learning environment that supports interaction and engagement agree with the idea of a 'natural critical learning environment' (Bain 2004; Fain and Kennell 2016).

In a natural critical learning environment, learning activities are most effective when the learner decides to engage because they think it will help them satisfy a need to know or help them to solve a problem that they regard as important, intriguing, or beautiful (Bain 2004).

When working to build good student relations, some of the teachers experienced social discomfort, which was reported to negatively correlate with their self-perceived success in the ALSs. Indeed, putting pressure on teachers to implement ALSs hurriedly may lead to backlash, and one should emphasise that teachers should take the time they need to adapt to new teaching strategies, as has been reflected by Kugel (1993). Additionally, teachers benefit from support as they transition to new teaching practices (Fisher and Fraser 1991; Liu, Li, and Zou 2019; Loucks-Horsley et al. 2009; Patrick et al. 2010). The teachers in the present study felt that adapting to an active learning-focused class was a significant shift in teaching strategy that presented many time-consuming challenges, such as developing tasks and figuring out how to engage the students better consistently.

Another comment is that teachers who saw it as their responsibility to cover the curriculum in person found this more accessible by lecturing than by applying active learning formats. It is unclear whether the concerns about covering the curriculum and the time needed to do so are to be taken literally or whether this is to be understood as a need for support, as they have little or no training or background in active learning strategies. Regardless, guidance and support are likely highly desirable for the transition to the ALSs to take place.

The teachers employed several approaches to engage students, build positive relations with the students and develop good teaching strategies (see Section 3.1–3.3). Their strategy choices have already been identified and shown to be successful both in and outside of the ALSs for reducing student resistance to active learning and also categorised into either planning, explaining, or

facilitating for reducing student resistance toward active learning (Finelli and Borrego 2020; Johnson et al. 2021; Tharayil et al. 2018). All four teachers reported the need for time and support. However, none of the four were inclined to employ all the strategies and argued the importance of trial and error to explore and discover a teaching approach they felt suited them well. Failing to allow for this may increase teachers' social discomfort in transitioning to ALSs, and negatively influence their experiences with the ALSs. They all felt they had to both be good at and enjoy their chosen approach to be motivated to persist and build the desired student relations.

While the answers to research questions 1 and 2 are in accordance with existing literature findings, reaffirming these findings in a mathematical context and for Norwegian students has an independent value. Furthermore, it is essential to know the teachers' outlook on research questions 1 and 2 when evaluating the relationship between the challenges and their motivation, i.e. research question 3.

Self-reported social discomfort correlated with teachers' perception of ALSs as a more stressful environment, impeding the teachers' ability to build good student relations. Thus, for uncomfortable teachers, the ALSs may have the opposite effect of what was intended. The challenge of engaging students and building student relations was more difficult than expected for teachers with self-reported social discomfort. Where social discomfort is involved, teachers and others may underestimate the difficulty of transitioning to the ALSs. Indeed, if teachers that transition to ALSs underestimate the difficulty, they may experience a loss of motivation. Such a drop in motivation may, in turn, lead to reduced effort in transitioning to the ALS, as the task seems too challenging or less meaningful. Thus, while teachers must be motivated for the transition to occur, it is also vital that their motivations are based on realistic expectations. The results concerning research question 3 are novel and follow related reflections on professional development (Finelli, Richardson, and Daly 2013).

Furthermore, Cohen et al. (2019) found evidence that social anxiety in students was positively correlated with students' discomfort with the ALSs, which in turn negatively impacted students learning outcomes. It is plausible that teachers' comfort levels with the ALSs can influence students' comfort levels. If so, this adds an extra layer of importance in supporting teachers to be comfortable with active learning, ALSs, and the transition process.

The teachers reflected that good handling of one challenge positively influences success with the other challenges and vice versa. Thus, it becomes crucial to support teachers in overcoming all of the challenges they experience, as neglecting the challenge of one category can make the other categories appear needlessly challenging. It remains to be established how well teachers must overcome a particular challenge or set of challenges for their students to benefit from their ALSs classes. It is of interest to further study teachers that experience that they have overcome the significant challenges that come with the added affordances of teaching in the ALSs. Hopefully, such research will uncover more about best practices for active learning and the use of ALSs. In addition, while not the focus of this paper, it is still interesting to learn more about how subject matter and institutional strategy influence teachers. This topic warrants further studies and would be interesting to research across institutions with different strategies.

There are many alternatives to structuring significant challenges to overcome in the teaching and learning context, one example being the Community of Inquiry (Garrison et al., 1999). In line with Bernstein (2018), the research presented here is part of asking more profound questions related to the use of active learning and ALSs. Indeed, careful reflection on the context of active learning and ALSs is necessary to succeed.

Some of the teachers perceived the use of active learning and ALSs to be more difficult in mathematics than in other subjects. It has been established that active learning can improve student learning in mathematics (Freeman et al. 2014). While Rosenthal (1995) reflects that advanced mathematics does not easily lend itself to an energetic discussion, he proposes active learning strategies such as small group exercises to augment math classes. Indeed, Laursen and Rasmussen (2019) reflect that while inquiry learning in mathematics may seem distinct from inquiry learning in

science education, at the core, it is the same in mathematics. That active learning has been found to support good student outcomes in mathematics despite the high variety in instructor implementations speaks for the robustness of active learning in mathematics (Laursen et al. 2014). Furthermore, communication between students and teachers in constructive learning environments has been reported to foster better active learning in mathematics (McCartan, McNally, and Hermon 2011), and teachers commonly believe that traditional fixed-seat classrooms can hinder the use of active learning in STEM (Apkarian et al. 2021). Indeed, this supports the findings that active learning and ALSs work well, even in mathematics (Johnson et al. 2021). Finally, it becomes vital to reduce student resistance (Finelli et al. 2018) and offer professional development support to teachers, so they can challenge long-standing traditions on how to teach mathematics and transition to ALSs.

5. Conclusion

In this study, three categories of challenges for teachers attempting to adapt active learning approaches in an ALS have been identified and characterised by a combination of investigative and analytical approaches. The categories are 1) Engaging Students, 2) Building Student Relations, and 3) Developing Teaching Strategies.

The teachers felt it was necessary to handle all three categories well to benefit from the ALSs. If they struggled with one challenge, they also came to struggle with the others, negatively influencing their prospects of supporting the students' learning. However, the opposite was also true, succeeding in one aspect made it easier to overcome the other challenges. Mastering all three categories improved the teachers' motivation and created a positive cycle, beneficial to both teachers and students.

The teachers' success depended on their attitudes, motivation, and confidence. Belief in adapting active learning strategies or social discomfort being in the ALS was observed to have a crucial impact on the likelihood of adapting to student active learning.

To avoid potential downsides with the ALSs, the teachers should enter the ALSs with realistic expectations. Thus, informing teachers on challenges they may experience, and also supporting them in overcoming these challenges is central to the success of implementing student active learning in an ALS environment. For a widespread and efficient transition to active learning and ALSs, teachers must be afforded support according to their needs to change their practices and adopt new skills (Jones and Fevre 2021).

The author recommends that these findings are used to inform professional development towards supporting teachers who are new to ALSs. Such professional development may first inform about the challenges commonly encountered by teachers adapting to the ALS, secondly inform about tools that can be effectively used to overcome said challenges, and lastly inform the teachers on the dialectical relationship between how motivation and the challenges impact each other. Informing about the challenges can make teachers' expectations more realistic, make for a more fluid adaptation to ALSs, and prevent teachers from unexpectedly encountering these challenges so that they might abandon their transition to such spaces. Informing on the tools that can effectively be used may help teachers overcome the said challenges. Informing the teachers about the dialectical relationship between the challenges and their motivation may make the teachers more likely to maintain their motivation to use the ALSs and increase student learning outcomes by facilitating a good learning experience.

Beyond professional development, it is also of interest that the local institution changes towards a culture that motivates teachers to a higher degree to adopt and adapt effective teaching practices.

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