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Flipped Learning in Physical Education Teacher Education - The Student Perspective

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Abstract
During recent decades teacher education has experienced a digital revolution, where digital technology has become a ubiquitous part of the everyday life of both students and teacher educators. The purpose of this paper is to understand students' perceptions of the use of flipped learning (FL), with special focus on their motivation and learning in physical education teacher education (PETE). 22 Norwegian PETE students were recruited from one university in the academic year 2016/2017. The data were generated using semi-structured interviews, which were reduced, analysed, and interpreted by constructivist grounded theory traditions through learning theory lenses. The analysis resulted in five main empirical themes in terms of how students experience the use of FL in PETE. The themes were "expectations", "simple input", "deep learning", and "supportive learning environment". We also present some challenges that were reported. A clearly positive perception of FL in PETE was expressed by the students. FL seems to facilitate both better motivation and deep learning in PETE. In addition, students reported that experiencing FL in PETE lays a good foundation for them to use this approach in future service in school PE.

Key Words: Physical education (PE), flipped learning (FL), flipped classroom, digital technologies, physical education teacher education (PETE)

Introduction

During the last decade teacher education has experienced a major digital revolution with digital technology becoming a ubiquitous part of the everyday life of both students and teacher educators. The purpose of this paper is to understand students' perceptions of the use of digital technology related to the pedagogical approach of flipped learning (FL), keeping a special focus on their perception of motivation, and learning in physical education teacher education (PETE). Students' motivation to engage in the learning process seems to be crucial and has been extensively studied (Skaalvik & Skaalvik, 2015), and it may be difficult to discuss learning without including motivation for learning, and vice versa. Living in the 20th century, the use of digital technology is a part of students' daily life, and the use of digital tools may provide essential contributions to students' learning. One intended outcome of FL is that stu-

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dents will actively construct their own understanding of concepts and actively engage with and take ownership of the learning process. However, there is a lack of research on student motivation in the PETE context. Of the available findings, we can deduce that interest in sports and training, acculturated during youth and adolescence, may motivate students to enrol in a PETE program (González-Calvo, Gerdin, Philpot, and Hortigüela-Alcalá, 2020). However, little is known about how this motivation is further affected during their studies and enrolment in a PETE program. This lack of research is highlighted when examining how learning and motivation are affected by using digital technology in PETE (Armour, Goodyear, and Sandford, 2020).

Digital technology in school PE and PETE

Despite Norway being at the top of global statistics in terms of computer density, internet connections, and digital infrastructure, the use of digital technology, by both students and teachers, in Norwegian schools is limited to the basic use of information and communications technology (ICT) tools (Røkenes, 2018). 'Digital competence' is one of five basic competences that span across all school subjects, including PE. The national curriculum states that digital competence in PE includes preparing students to be able to use digital resources to explore, create, and solve practical challenges in the subject (The Norwegian Directorate for Education and Training, 2019). In other words, using digital technology in PE should help students reach the proposed aims of the subject. This requires teacher educators to be competent in using ICT pedagogically and becoming digitally literate (Almås & Krumsvik, 2007). This means that teachers should be able to go beyond the basics of ICT and scaffold student learning in conversant and research-based pedagogical frameworks. Despite the growing emphasis on technology in PE, many pre-service (and in-service) teachers still consider themselves unprepared to integrate technology in school environments without practice and mentoring (Krause, 2017). There is limited knowledge of the use and potential benefits of digital technology in PE (Calderón et al., 2020; van Hilvoorde & Koekoek, 2018). Despite these limitations, the available literature highlights how the use of digital technology in PE may promote student learning and motivation (Armour, Casey, & Goodyear, 2017; Koekoek & van Hilvoorde, 2018; Østerlie, 2020).

To understand how young people live, experience, and learn in the omnipresence of digital technology, teachers must be more aware of the real-world that young people grow up in. Armour et al. (2020) highlight this need, stating "Once we accept that digital technologies have come to represent a significant social space in the lives of young people in contemporary society, it becomes essential that we consider how this experience impacts upon them as learners in PE" (p. 93). Further, the whole PE community must "define a research agenda that focuses on new ways of learning collaboratively with young people and across PE/PETE professional boundaries" (p. 100) and that "doing nothing does not appear to be an option in the digital age challenge" (p. 100).

Teacher educators, internationally and in Norway, have limited competence to promote student learning beyond basic ICT skills (Røkenes & Krumsvik, 2016; Tondeur et al., 2020). In the future, PE students should experience a learning environment with extensive use of digital technology to scaffold learning. This process begins with teachers and teacher students enhancing their digital competence or digital literacy - often named technological, pedagogical, and content knowledge (TPACK). PE teachers' professional digital competence is an area that researchers have only recently begun to examine, and the findings indicate that digital competence training, set in appropriate and research-based frameworks, may help positively develop teachers' competencies (Baek et al., 2018; Gawrisch et al., 2019; Jones et al., 2017; Krause & Lynch, 2018). Ertmer and Ottenbreit-Leftwich (2010) argue that the more teacher students are exposed to the use of digital tools in their education, the more comfortable they will be in their own practice later. There are a few examples of the use of digital technology in PETE. The use of a mixture of contact teaching and online teaching was positively perceived by both teachers and students since there was a reduced focus on lecturing (Calderón et al., 2020). In Spanish PETE, Calderón et al. (2020) pointed to increased intrinsic motivation and improved learning outcomes when physical education teacher students became involved in producing digital learning resources in a more student-centred learning environment. The use of Twitter in teaching was shown by Hyndman and Harvey (2020) to be positive for students' motivation through influencing the factors of autonomy, belonging and competence. Despite these examples of the use of digital technology in PETE, researchers have called for more research on TPACK in PETE in order to adequately equip future teachers with the ability to use digital technology to promote student learning (Armour et al., 2020; Calderón et al., 2020; Krause et al., 2019). Overall, the integration of digital technology in PE and PETE contexts seem to have positive findings, which aligns with Roth's (2014) claim that PE is a well-suited field in teacher education for integrating digital technology.

Flipped learning in school PE and PETE

The Academy of Active Learning Arts and Sciences [AALAS] (2018) defined flipped learning as follows:

> "Flipped Learning is a framework that enables educators to reach every student. The flipped approach inverts the traditional classroom model by introducing course concepts before class, allowing educators to use class time to guide each student through active, practical, innovative applications of the course principles" [Academy of Active Learning Arts and Sciences (AALAS), 2018].

The FL approach used in this study requires students to watch a video of a topic prior to attending the teaching session, where the content is further discussed, and

knowledge and competence are acquired through student-centred activities. The aim of doing so is to replace a passive, receiving student with an active learner taking a more autonomous role in their learning process. FL is a learning framework that has increased in popularity in higher education, including teacher education (Han & Røkenes, 2020). The approach is argued to engage students, thereby increasing the learning outcome and the individual learning process. In a scoping review of 33 studies on FL in teacher education, Han and Røkenes (2020) found positive outcomes regarding six aspects: (1) attitude, motivation, and emotion, (2) content delivery, (3) learning environment, (4) learning experience, (5) instructor and student presence, and (6) engagement. In an economics unit in teacher education in South Africa, Van Wyk (2019) found the FL approach, in comparison with the direct instruction method, enhanced the performance and perceptions of students, encouraged an engaging atmosphere, and fostered a collaborative, interactive synergy among student teachers. Additionally, the findings revealed that the role of the teacher in the FL design was crucial for promoting optimal learning experiences for student teachers (Van Wyk, 2019). Further, Colomo-Magaña et al. (2020) found that an FL approach was perceived as useful among Spanish pedagogy students for the promotion of autonomous learning. Flipped approaches might improve student motivation and help manage cognitive load, but more specific research looking into the effectiveness of the flipped learning approach is necessary (Abeysekera & Dawson, 2015), specifically because FL is less recognized as an approach in the PE and PETE context.

Despite the scarce amount of research investigating FL in PE (Sargent & Casey, 2020), studies in education, more generally, suggest that FL may affect student motivation and learning both in primary and secondary school (Ferriz-Valero et al., 2017; Marqués-Molías et al., 2019; Østerlie, 2020; Villalon et al., 2020), higher education (Chiang et al., 2018; Hinojo et al., 2018), and, even, PETE (Killian & Woods, 2018). Bing (2017) suggests that student learning in PE is mediated by integrating the use of video in the learning process, which may produce a positive effect on students' self-studying abilities in PE after attending a FL-designed PE class. As the FL approach facilitates spending less time on instructions and more time dedicated to learning activities, FL can foster more learning in PE at all educational levels (Isidori et al., 2018; Killian, Trendowski, et al., 2016; Lina, 2017; Østerlie, 2016; Sargent & Casey, 2020). Among Spanish primary teacher education students taught using a combination of 'gamification' and FL, both of which are based on the use of digital technology, in a didactical unit resulted in a positive impact on student motivation and learning (Gómez-Carrasco et al., 2019). Further, applying FL in a North American PETE course resulted in expanded active-learning opportunities for the students (Killian & Woods, 2018).

The teaching methods in higher education have tried to keep up with changes in society both in content and pedagogical challenges. Although the tools for learning have changed (e.g., digital solutions), there is still agreement that the learner should be

active in the learning process, affectively, bodily, and cognitively (Biggs, 1999; Østern et al., 2019). The concepts of deep learning and surface learning coined by Marton and Säljö (1976) may help explain how students engage in the learning process. That is, they examined how students address a learning situation, whether the intention of learning comes from an interest in furthering their academic career or obtaining the necessary knowledge to enter the workforce. They found that the students' intentions for learning have a significant impact on their motivation towards the learning process. Østern et al. (2019) supported these findings and described deep learning as a process of creation, where body, relations, and creative, affective, and cognitive processes together give depth to the learning, as no part is unaffected by another. Further, Tochon (2010) argues that the deep learning process among students is mediated by the teacher. With that, he argues that deep teaching not only builds on intrinsic motivation, but is also learner-centered, and the approach is contextualized, situated, and based on meaningfulness for the learner, as "meanings are embodied in action" (p. 6). To support deep learning in PE, teacher educators rely on scaffolding. Scaffolding is described by Wood et al. (1976) as a process that enables students to solve a task or achieve a goal beyond their unassisted efforts. Jumaat and Tasir (2014) state that technology mediates how teachers and students interact, calling for a new understanding of how scaffolding happens in school. This aligns with the findings of Yelland and Masters (2007) that, in the information age, the traditional form of scaffolding, based on the 'expert's' view of how a problem should be solved, should further be conceptualized as cognitive, technical, and affective scaffolding. Selander (2021) provides some context and insight as to how this may work practically by placing the teacher and the student together in the same corner of the design-oriented didactical triangle. To achieve this, both the teacher and peer students must take part in this scaffold. Implementing FL in PETE promotes this to a large extent, as less time is used on instruction and lecturing, and more time spent on working together.

At the moment, few studies have investigated how the FL approach impacts PETE students, and to our knowledge there are none in Norwegian PETE. In responding to this, the aim of this study is to investigate the students' perceptions of an FL framework in PETE.

Methodology

Too few studies use a qualitative approach to detail the complexity of teaching, learning environments and technology (Bond et al., 2020). Further, there are calls for PETE faculties to adopt a culture of evidence-based practice (Hastie & Vassily, 2020), and to include the view of students to grasp and understand how technology affects their educational benefits (Armour et al., 2020). Hence, this study has taken a qualitative approach to best understand the emic perspectives of the participating students' perceptions of being part of the flipped learning framework. With roots in

a social constructivist worldview and traditions, the generated data were sorted, reduced, and analysed in steps and considerations entrenched in constructivist grounded theory (Charmaz, 2014). The turn toward constructivist in the broad field of grounded theory traditions led to practicing more inductive, emergent, and open-ended, and less positivistic and verification-seeking approaches found in earlier traditions posited by scholars such as (Corbin & Strauss, 1990; Glaser & Strauss, 1967; Strauss & Corbin, 1990).

Participants

The participants were 22 PETE students with an average age of 24.2 years (SD = 2.5) and an equal distribution of males and females. They were students attending the Norwegian integrated teacher education program lasting four years, and were enrolled in PE as subject at the time of data collection. Some chose to take PE as a subject during their second year of study while others took PE in their fourth, and final, year of study. Despite the year of enrollment, the subject was equally structured regarding aims and content, and similarly distributed in both year groups.

Intervention

In the present project the studied learning framework is recognized as an FL framework. The FL approach was applied in two units in Norwegian PETE over a period of two semesters in the 2016/2017 school year. One unit was more practically oriented and covered achieving theoretical and practical competence in dance related to PE, and one unit covered theoretical knowledge of motor learning. In total, the intervention covered 11 FL lectures where the students had to prepare before the class by watching a video (See Figure 1 and 2).

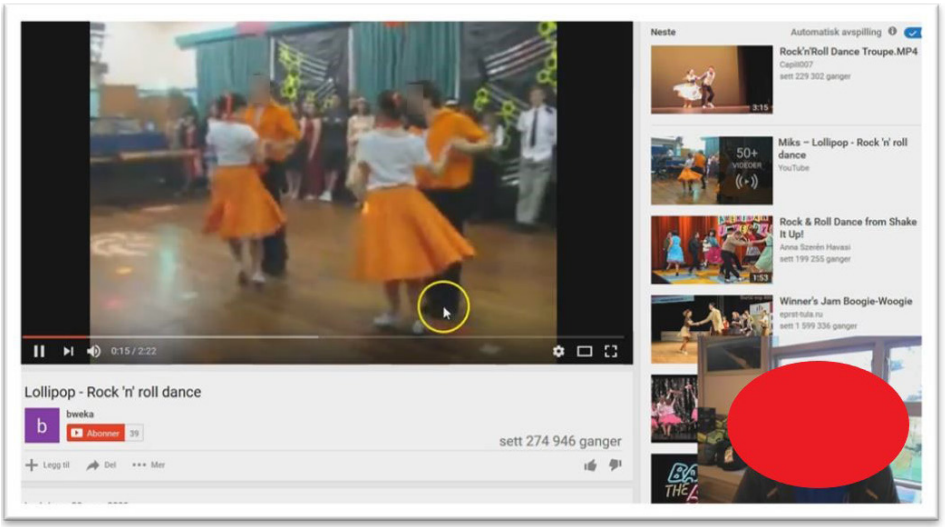

Figure 1. Screenshot of one video belonging to the dance unit where the teacher explains how to perform rock of a Rock'n Roll dance called Lollipop

Figure 1. Screenshot of one video belonging to the motor learning unit, where the teacher explains the concept of constraints in the dynamical systemstheory related to the motor learning.

As Figures 1 and 2 illustrate, the videos consisted of the teacher explaining key concepts and movements in relation to student tasks assigned in the upcoming class on campus. The videos lasted between ten and twenty minutes, which is within suggested lengths for videos of this purpose (Lagerstrom et al., 2015; Long et al., 2016). The teacher's image is displayed in the videos as studies suggest this practice has a possible positive impact on the students' engagement and learning outcomes (Carmichael et al., 2018). The in-class sessions on campus that students attended after each assigned video had a strong connection to the content in the video in an effort to ensure students perceived the videos to be worthwhile viewing in preparation for class. As much as possible, the in-class content was adjusted to be more student active with less time given to direct instruction, as instructions and explanations were included in the videos. Contrary to a more traditional approach, where the teacher might allocate literature to review before class, the medium of video is demonstrated to be better suited as more students prepare, and they report better outcomes due to (among other things) the format: accessible at any time and repeatable (Carmichael et al., 2018; Østerlie & Kjelaas, 2019). The actual PETE course consisted of 8 units, of which two were designed using an FL approach, which allowed students to compare their experiences in the FL units to the more traditional units, and hence, function as their own control group.

Data generation

Upon request in the final phase of the intervention, all students were asked to participate in an interview regarding their perception of attending the subject when the flipped learning framework was applied. Five groups with a total of 22 students were formed. Three groups were interviewed in the spring of 2016, while two groups were interviewed in the fall of 2017, applying the concept of 'theoretical sampling' (Charmaz, 2014), where the researcher iterates between data analysis and data collection. In this study, the researchers had no prior knowledge of, or presumption about, how the students would perceive the application of a FL learning framework in PETE as no prior studies had been completed. Pilot studies in secondary PE (Killian, Graber, et al., 2016; Østerlie, 2016) posited that learning and motivation could be positively affected. Following the concept and suggestions of semi-structured interviews proposed by Brinkmann (2013), certain key-topics (e.g., knowledge promotion and motivation) were included in an interview guide to ensure that the focused topics in the study were a part of the conversations. Further, following the concept of sensitizing (Charmaz, 2006) the interview guide was used as a starting point in which conversation could emerge rather than a question-asking tool. In this way the researchers were open to new topics arising that could possibly aid understanding of the phenomena. During the data generation process, the researchers stopped and wrote 'memos' as suggested in constructivist grounded theory tradition, as "it prompts you to analyse your data and codes early in the research process" (Charmaz, 2006, p. 72). The qualitative data was

recorded and further transcribed and reduced in NVivo 11.

Data reduction

The process of data reduction started during the interviews for the purpose of theoretical sampling. This was consistent with the aim of coding in grounded theory that centres discovering what the theoretical meaning of the data might be. Coding for theoretical meaning using grounded theory differs from the mere sorting of codes. Charmaz (2006) urges the researcher to question why the participants make particular statements in a specific context while always keeping an open mind. The notion of 'open mind' must not be equated with the notion of 'empty head' as all researchers must address their preconceptions when reducing and analysing data. Concerning preconceptions, Charmaz (2014) advises that the scholar should become acquainted with the phenomenon studied, including in-depth knowledge of the people that oppose the phenomenon. This study included participants regardless of their positive and/or negative perceptions toward the intervention. The initial coding process was followed by axial coding resulting in five empirical themes. The term 'empirical theme' in this study was preferred, as the goal was not working towards an explicit development of 'theoretical categories.' These distinctions are supported by the concept descriptions described by Charmaz (2014).

Trustworthiness

Trustworthiness in the present study was established through various considerations and actions. Often the researcher operates with concepts of reliability and validity, but these terms have roots in quantitative research traditions and often qualitative equalities are misunderstood and misinterpreted (LeCompte & Goetz, 1982). In order to not sort different considerations and actions into either the concept of validity or reliability, we choose only to describe the considerations and actions in order to strengthen the trustworthiness of the present study. This choice is supported in statements from Creswell and Poth (2018), suggesting that among the myriad of types of validation of studies, each researcher, or study, must find and describe the type best suited to their purpose and needs.

One action to strengthen the trustworthiness of the present study was having two researchers conduct separate initial coding followed by a comparison of codes and axial coding before conceptualizing the empirical themes. Wertz et al. (2011) propose the use of many different perspectives when researching personal experience, and argue that multiple knowledge claims may achieve greater truth. Allport (1942) provided similar thoughts almost 80 years ago, and more recent iterations of this idea have been referred to as the triangulation of researchers (Hartas, 2010; Lincoln & Guba, 1985). The trustworthiness of the present study was further strengthened by craftsmanship, communication, and pragmatic action, as suggested by Kvale and Brinkmann (2009).

Through transparency in the present paper, the quality of the researchers' craftsmanship can be assessed. Tjora (2018) states that "the purpose is that readers obtain such a good insight of the research that they can assess the quality of the research on their own" (p. 154). The purpose is not for the researchers in the present study to suggest conclusions, but through the ways the research is presented the reader can assess how and in what ways the results may be applicable to their own situations. This consideration is also named or linked to the concept of naturalistic generalization as a way of strengthening trustworthiness in research (Stake & Trumbull, 1982).

Regarding the transferability of the results in the present study, the statements of MacPhail and Lawson (2020) are interesting as they admit that "few innovations developed in one nation transfer easily and effectively to others because the national, regional, and local contexts differ, and each nation's somewhat unique social institutional design matters" (p. 4). However, they further state that "a particular nation's developing success story is noteworthy as leaders address one or more vexing problems that also challenge other nations" (p. 4), and that "new knowledge developed in one nation has practical import for other nations" (p. 4). How effective such a transfer might be to other nations and other contexts depends on the observed relevance by the reader and the craftmanship of the researchers of the present study and the perceived transparency of the present paper.

Ethical considerations

When evaluating research data, the scholar is accountable to a lot of people: the participants, funders, commissioners, supervisors, examiners, and so on, and this relates to whether primary or secondary data, or both, are being evaluated (Kara, 2015). Conducting interviews raises a considerable number of ethical issues that researchers must address. In the pursuit of new and interesting knowledge the respect and integrity of the participating interview subjects can be hurt as they might feel offended or feel that a line of intimacy might has been crossed.

The knowledge produced by such research depends on the social relationship of interviewer and interviewee, which rests on the interviewer's ability to create a stage where the subject is free and safe to talk of private events recorded for later public use (Kvale & Brinkmann, 2009)

The vital consideration lies in "calibrating social distance without making the subject feel like an insect under the microscope" (Sennett, 2004, p. 38). In accordance with the Norwegian Centre for Research Data (NSD) (https://nsd.no/nsd/english/) guidelines, oral consent from all participants was obtained, and anonymity was assured by not stating names, birthdays or identifying data during the interviews. After the recorded interviews were transcribed, and again screened for identifying data, the digital files were stored on a secure server at the researchers' institution according to NSD guidelines.

Findings

The analysis resulted in five main empirical themes on how students experience the use of FL in PETE. The themes were "Theme 1: expectations", "Theme 2: simple input", "Theme 3: deep learning", "Theme 4: supportive learning environment", and "Theme 5: challenges". The analysis and findings are further discussed below and will be followed by a more general discussion and a conclusion. The analysis did not reveal that gender or age seemed to be of importance in any theme, so the direct quotes used in the discussion to represent or exemplify theme content are not characterized by gender or age.

Theme 1: expectations

The findings revealed that the students experience that the teacher education program has expectations for them. These expectations come from both the teacher, who shares the videos and teaches them, and their peers in class. Expectations seem to appear in different forms. One form is the expectations of learning. The videos contain the content of the lesson, and hence the expectations are what to learn. The information ahead of the teaching, and the teaching itself, also contain how to learn the content. It was clear that the video contains all the information needed to discuss the topic, and that it was expected that the students should discuss together with their peers in the classroom. Regarding when to learn, there were no clear expectations except that the students knew when to discuss the topic. Nevertheless, some of the students reported that they watched the videos the day before, or when taking the bus to campus. However, the findings reveal that there was peer pressure to participate in the discussion and the conversations at school. As one student explains:

Yes, I noticed from my peer-student: 'have you watched the video today?', and I have never previously experienced that anyone has asked; 'have you read the chapter in the textbook today?' [ha-ha] – never! I think that is a good thing. It turned out to be 'haven't you watched the video?' - I became stressed and thought, 'Oh my God, I haven't watched the video'. And that I think became a good thing; it actually made the students watch the video.

The results also revealed that the expectations had implications for the students' motivation. The students felt peer pressure to participate in the discussions. If they did not watch the videos, they could not contribute to the discussions at school.

Theme 2: simple input

From the interviews the researchers interpreted that the students perceive FL to facilitate their learning, especially the preparation phase. In comparison to more traditional forms of class preparation centred around reading text, students perceived viewing videos as part of FL to be a more compact extraction of the most relevant information. Thus, creating the theme 'simple input.' Student responses were "I experienced

the learning to be kind of free of charge. Reading takes a lot of time, but this way I experience it to be very simple" and "Yes, because you point out the most important stuff, and not the kind of stuff between which is not that relevant to us". Students expressed a positive perception of the FL preparation phase, not only in facilitating their learning, but also as timesaving and motivating as viewing videos had a lower threshold than reading text when it came to actually preparing before class.

Theme 3: deep learning

A third theme that was revealed from the interview was that FL may contribute to the students' deep learning. That is, students develop a more thorough understanding of the key concepts and how they relate to the real world. The use of video introduces concepts in advance, and the students can use the concepts in their discussions with their peers. Several students emphasized that they were actively taking part in discussions in school. The teaching together with the videos contributed to a better understanding of the content. As one student expresses it:

I think the good way about this was that you watch the video first, then you attend the teaching in class, then we work with assignments or something, and then you can watch the video again. You understand the content better the second time. And you understand it better than some points on a PowerPoint, and you get so much more understanding using the video.

Several students emphasized the value of being able to watch videos over again, and that they can stop the video to look up words or concepts in order to understand the theories at their own pace. Hence, the interpretation in the analysis is that FL contributes to the students' deeper learning of concepts.

Theme 4: a supportive learning environment

The analysis also reveals that the students feel that the learning environment is supportive. This was both in terms of being more prepared for the lesson regarding theoretical knowledge, and also regarding information about practical learning activities. This became clear in one of the students' statements:

I think it was really good to feel prepared for the lesson, in a different way than I have experienced before. It is my fault, I know, but I think it was so good to be explained things, and then come to the lesson...and then I could make up my mind, and if I had questions, we have been discussing these as well. It's not that the video explains everything, nor that I know everything taught in the video when I arrive at the lesson. But I feel motivated to go to the lesson to find out what I am wondering about. And that I experience as a huge advantage.

The students expressed that they experience less uncertainty as they watch the videos in advance of the lesson, especially in advance of the practical ones. This became clear when the students had dance lessons as many students were unsure about

their own dancing skills. Additionally, some boys found it embarrassing to dance in front of their peers. The use of video had an impact on the students' experience of the lesson. As one student expresses himself: "It created a sort of security. You could try the steps back home and use it to gain an advantage." The video displays the dance moves, and some of the students became aware of what they should do, finding that the moves were not that difficult after all. Students could practice as much, or as little, as they felt necessary in advance of class.

Theme 5: challenges

Students reported on some challenges when FL was implemented in the course. Namely, they missed the opportunity to ask questions, and get a response during their preparation phase. As one student stated: "In any case, I'm more active when I'm in the classroom, because then I can ask straight away". Further, some students experienced technical problems when trying to access the assigned videos. In addition, some students reported FL being more time consuming.

Discussion

There is a broad agreement in motivational and educational literature on both the complexity and the inherent relationship between motivation and learning in school. One is not separable from the other, and they alternately affect one another (Skaalvik & Skaalvik, 2015). This leads us to discuss these two factors mutually rather than separating the concepts into different subchapters.

Our findings revealed an overall positive perception of the implementation of FL in PETE. How the students perceived being exposed to a FL approach in two different modules in a PETE course revealed a positive effect on both motivation and learning. The different nature of the investigated modules also supports a perception of FL as being an approach that is highly applicable to educational contexts that in broad terms are diverse in both content and outcomes. This also applies to the PETE context, where modules span from being highly theoretical to highly practical. The present project considered that, and both the practical dance unit and more theoretical motor learning unit were recognized as learning environments where FL could be especially useful. These findings are consistent with previous literature that suggest that FL is not just another teaching tactic, but can function as a meta-instructional strategy (Hwang et al., 2019; Shin, 2018).

Students had different expectations of their learning and motivational processes in the included units. One change in expectations was related to the preparation phase, where the students reportedly prepared more often when the format was a video rather than a written text. This perception is supported in other studies, such as Østerlie and Kjelaas (2019), who found that secondary school PE students tended to prepare before class more often when a FL approach was used compared to a more traditional one

expressing similar thoughts and preference for the video format. Regarding expectations of the class content, interview data showed that one group of students had a more positive expectation of the dance unit after preparing. Not only because the content was presented, and that seemed to increase their self-efficacy, but it also gave them a chance to prepare by training the movements involved in the upcoming class. This is an example of how FL positively affects both the motivation for participation and the learning outcome in PETE. Finding support from their peers during the learning process is also a stimulus to enhance learning and motivation. As students felt more or less obligated to prepare, their external motivation increased, resulting in more students preparing. They also perceived a richer learning environment where they both individually felt they contributed more, and that more of their peers contributed. Again, we can see that the dynamic between motivation and learning is positively affected by the implementation of FL in the units, as is also found in the studies of Gómez-Carrasco et al. (2019) and Killian and Woods (2018).

The interplay between learning and motivation, promoted by the integration of digital technology, is argued by researchers like Østerlie (2020) to possibly result in deeper learning in PE contexts. As our students expressed a somewhat different learning environment, and a better learning outcome, all being results of the implementation of FL, we can assume that FL prepares the ground for a deeper understanding and learning of the unit content and expected outcomes. Students expressed that both their own individual part in the learning process, and their experiences with peer-students and teachers, supported and deepened their learning. This observation is supported by Østern et al. (2019), who describe deep learning to be a process of creation, where body, relations, and creative, affective, and cognitive processes together give depth to the learning, as no part is unaffected by another. Further, the arguments by Tochon (2010) on how the deep learning process among students is mediated by the teacher is recognizable in the students' expressed perceptions. This observed improved (learning) interaction among students/teachers in this digital technology enriched learning environment is supported by the concept of scaffolding. Jumaat and Tasir (2014) state that technology mediates how teachers and students interact. The FL approach in PETE seems to advocate for a new understanding of how scaffolding happens in student learning processes. The video becomes the 'instructor', and the teacher becomes more of a mentor and support when peer students create knowledge together, breaking with the traditional knowledge injection from the teacher to the student. Our observation is in line with how Selander (2021) describes the relationship between the student and teacher, the content, the aims, and the distributed resources changing from a more traditional view on student learning and scaffolding in modern education.

The overall positive perception of the application of an FL learning framework in PETE is a positive finding on two levels. First, the use of the FL framework seems to have raised the overall study quality of the PETE courses through by having a positive

impact on students' learning and motivation. Digital age learning systems "present alternatives to the inherited model for teaching-instruction orchestrated and controlled by specialist teachers. No longer is it assumed that all learning is attributed to teachers. However, it is assumed that teachers have pivotal roles to play in preparing students to learn how to learn, nearly anytime and anywhere" (Lawson, 2020, p. 173). The students expressed this double advantage in learning experiences in teacher education as they saw FL promoting their own learning and, at the same time, saw FL as an approach they could use themselves when going into their professional career. Second, a positive experience of FL in PETE might result in the use of FL in school PE. This is in line with the argument of Ertmer and Ottenbreit-Leftwich (2010) that the more teacher students are exposed to the use of digital tools in their education, the more comfortable they will likely be in their own practice later. This assumption is also supported by the call from Gawrisch et al. (2019) to integrate TPACK in PETE with the aim of quality integration of digital technology in school PE. Further, our assumption finds support in the study of Krause (2017), arguing that PETE students' self-efficacy in integrating technology into physical education significantly improved when technology (i.e., mastery experience, vicarious experience, and social persuasion) were integrated in the PETE course.

Conclusion

The overall conclusion is that students experience FL as an interesting and useful approach that improves their understanding of PE teaching. The students reported that their engagement and motivation regarding participation in class and learning had increased. Hence, we suggest that FL contributes as a positive promoter of student learning and motivation in PETE. Further, the students found exposure to a digitally enriched learning environment to be useful, specifically viewing FL as a 'tool' they could make use of in their own practice and future work as PE teachers. There were some reported challenges like missing the possibility of communicating with the teacher, and finding FL to be time consuming, but nevertheless, the perceived advantages outnumbered the observed challenges.

There are some limitations in the present study. First, we may have overlooked some perceptions among the students as our initial approach focused on motivation and learning. Second, collecting data from different learning institutions might have increased the trustworthiness of the present study. Nevertheless, bringing forward the perceptions of 22 individuals across age, gender, and academic year is a strength of the present study. Future research should further investigate how digital technology can be implemented, adapted, and perceived in PETE, and how PE teachers' TPACK can affect student motivation and learning in school PE.

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