



# The Perception of Adolescents' Encounter With a Flipped Learning Intervention in Norwegian Physical Education

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**Objective:** The discrepancy between observed and suggested levels of physical activity among adolescents urges society to obtain more knowledge and insight into how physical education (PE) in school can be beneficial for all individuals. The purpose of the present study was to examine the perceptions of adolescents of a flipped learning (FL) framework, applied to enhance student motivation and learning in PE.

**Methods:** Ten students, from 13 to 17 years of age, were recruited from one secondary school and one upper secondary school from two different counties in Norway during the spring of 2016. The data were generated using semi-structured interviews, reduced, analyzed, and interpreted by constructivist grounded theory and stepwise-deductive induction traditions through constructivist and situated learning lenses.

**Results:** It was demonstrated that the video format is preferred as preparation material over text material, that instructions on class activities are preferably given in the preparation material and not in class, and that the students did not report any negative aspects of FL. The students showed a positive perception of preparing for PE classes if the preparation material is in the form of a video, and if it has a clear connection to the upcoming class content and outcome aim(s). FL has a positive effect on student understanding and learning in PE, and FL produces a positive change in how students value PE.

**Conclusion:** A clearly positive perception of FL in PE was demonstrated. FL seems to facilitate deep learning in PE, facilitated by motivation, knowledge, and the nature of the learning framework.

**Keywords:** physical education (PE), flipped learning (FL), flipped classroom, motivation, learning, digital technologies

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## INTRODUCTION

Globally, there is a well-documented discrepancy between observed and suggested levels of physical activity among adolescents [World Health Organization (WHO), 2010, 2016] including in Norway (Norwegian Institute of Public Health, 2019). Worldwide, the proportion of 13–15 year-olds doing <60 min of physical activity of moderate to vigorous intensity per day is 80.3%, with girls being less active than boys (Hallal et al., 2012).

However, the proportion of Norwegian adolescents shows somewhat more positive numbers: girls are significantly less active than boys and sedate awake-time among 15-year-olds is high and increasing (Norwegian Institute of Public Health, 2019). As schools can reach virtually all children, they are vital in shaping children's lives. Hence, the school subject physical education (PE) is a vital arena for motivating young people in their early stages of life to create and uphold a healthy and active lifestyle. As the physical activity levels amongst late teens is the strongest predictor of adult physical activity levels (Anderssen and Andersen, 2004), it is vital to perform high-quality studies that might cast light on this issue.

The ubiquity of digital technology in our society can in many ways obstruct the aims of PE. Nevertheless, digital technology can give new perspectives and opportunities as new developments are constantly emerging. But this is followed by a demand for new critical reflection and research into its potential benefits for PE (Koekoek and van Hilvoorde, 2018). It is crucial for PE teachers to understand how to select from all the digital information and technologies without losing sight of the main pedagogical and educational goals. In other words, "physical educators, scholars and policy-makers increasingly face the challenge and need to create a digital pedagogy for physical education" (van Hilvoorde and Koekoek, 2018, p. 3). New pedagogical frameworks and methods merging the use of digital technology with students' learning processes are being implemented in schools to optimize learning, although education has been one of the last sectors to embrace this phenomenon (Armour et al., 2017). One of these new learning frameworks is flipped learning (FL).

## Flipped Learning

A major part of the traditional model of classroom instruction includes the teacher as the central focus of a lesson and the primary disseminator of information. 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].

In rethinking the traditional way of conceiving and teaching, from both an epistemological and didactical point of view, the flipped approach shifts from mere teacher instruction to a learner-centered learning environment that can foster meaningful learning opportunities, where students and teachers together can explore topics in-depth. Educational technologies such as online videos are used to "deliver content" outside of the classroom. Recent literature reviews suggest that FL in general can improve students' academic success, satisfaction and engagement, promote self-paced learning, increase interactions between teachers and students (Chen, 2016; Akçayir and Akçayir, 2018; Cheng et al., 2018), and promote a more student-centered approach to education (Kim et al., 2014; Wang et al., 2019).

FL is also considered applicable as a meta-strategy in education (Shin, 2018). In order to learn and develop new skills in school settings children must be motivated and engaged in activities (Reeve et al., 2004; Reeve, 2012), and both student motivation and student learning can benefit from the use of digital technology in an appropriate pedagogical manner (Casey et al., 2017; Gilje, 2017). As FL originates from, and is almost uniquely applied in theoretical subjects, the lack of a framework on how this pedagogical framework can appear in a practical subject like PE is missing. Hence, a thorough description of the intervention is included in the methods section, and possible biases are highlighted to strengthen the trustworthiness of the present study.

## Flipped Learning in PE

Flipped learning in PE is a topic scarcely examined by scholars (Sargent and Casey, 2019). This reflects the general lack of research on how digital technologies are used and affect student motivation and learning in PE (Casey et al., 2017). Nevertheless, FL is suggested to have a positive influence on motivation to participate in PE among adolescents, as the attainment value and the expectation of success increase (Østerlie, 2018b), and the perceived costs of attending are reduced (Østerlie, 2018a), especially among girls. Furthermore, Hinojo-Lucena et al. (2018) suggest applying FL in university PE due to its positive influence on motivation and academic performance. Compared to a more traditional approach in PE, the flipped approach allows for more time to be dedicated to practical activities and individual feedback, resulting in improved student learning in PE (Killian et al., 2016; Østerlie, 2016; Lina, 2017; Isidori et al., 2018; Sargent and Casey, 2019). In universities, a significant improvement in the ability of students to engage in self-study of the PE curriculum is observed as FL enriches the teaching resources of sports courses and enhances the students' interest in learning (Bing, 2017). Moreover, in secondary school PE, FL has been applied to support students when learning the rules of new games (Bergmann and Sams, 2014), and García et al. (2015) demonstrated a positive effect on individualization when a flipped approach was used to guide students when improving orientation skills in PE. Reports of students not being satisfied with the extra work-load that FL might involve highlights one challenge for the FL approach; ensuring that all students prepare at home (Missildine et al., 2013; Akçayir and Akçayir, 2018). Nevertheless, the observed advantages outnumber the observed challenges (Akçayir and Akçayir, 2018).

Flipped learning interchanges the general organization of the lessons and may be used to rethink, from both an epistemological and didactical point of view, the traditional way of conceiving of and teaching PE as a subject in school. The idea of FL in PE is, among other things, that students prepare before class to obtain more time for practical activity, and promote more learning, both bodily and cognitively. The preparation content, preferably delivered as a video, must be tailored to the upcoming class content by including both theoretical knowledge underpinning the desired outcome of the activities, and practical information about the activities. Situated learning theories attempt to replace the image of the learner as an isolated individual to include an

emphasis on the social setting that constructs and constitutes the individual as a learner (Lave and Wenger, 1991). A major focus on learning and allocating more time to learning in a social setting makes FL a desirable learning framework seen through constructivist situated learning lenses.

In describing what knowledge, skills, attitudes, and values today's students will need to thrive and to shape their world, deep learning is a key concept [NOU 2014:7, 2014; NOU 2015:8, 2015; Meld. St. 28 (2015-2016), 2016; OECD, 2018]. As FL can facilitate students' higher-order thinking and skills, it can be used as a framework to advocate more reflection and deep learning (Bergmann and Sams, 2014; Lee and Lai, 2017; Wølner and Horgen, 2019). Parker et al. (2017) highlight three major constructivist tenets.

"First, learning is an active process where students are viewed as agents in their knowledge construction and understanding comes through decision-making, critical thinking and problem solving.... Second, students construct knowledge in relation to their prior knowledge and experiences (Rovegno and Dolly, 2006)...Third, knowledge is a social product, and knowledge creation a shared experience" (p. 42).

The present study uses the definition of deep learning by Pellegrino and Hilton (2012), which states that deep learning is the process "through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (i.e., transfer)" (p. 5). Frey et al. (2016) differentiate between the deep and transfer learning phases, where the deep learning phase is defined as "interaction with skills and concepts", with the driving question being "how do these facts and principles fit together?" recognized by the processes of "planning, organization, elaboration, and reflection". The transfer learning phase, on the other hand, is defined as "organizing, synthesizing and extending conceptual knowledge," with the driving question being "how and when do I use this for my own purposes?" recognized by processes of "making associations across knowledge bases and application to novel situations" (p. 570). Deep learning, which is conditional on surface knowledge (Frey et al., 2016), is, according to Wang et al. (2017), characterized by "a high level of engagement in learning, driven by intrinsic motivation and more importantly, supported by relevant learning approaches or strategies that allow learners to manage complexity and key challenges (most on cognitive aspects) to sustain engagement and achieve a high level of understanding and performance" (p. 162). Digital technology can be used appropriately to achieve just that.

How students employ learning strategies in PE, whether at a surface or deep level, hinges on the students' perceived value of the task to be learnt (Fu, 1999). Viewed thorough the lenses of Vygotsky (1978) and Wood et al. (1976), and their concepts of scaffolding and zone of proximal development (ZPD), schools form a controlled educational environment, and it is important to challenge, motivate and encourage successful deep learning from an early age, also in a subject like PE. To understand and learn, students need support from the teacher and their peers. Scaffolding is a concept, Wood et al. (1976) defined as a process

"that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts." (p. 90). As they note, scaffolding requires the adults "to control those elements of the task that are initially beyond the learner's capability, thus permitting him to concentrate upon and complete only those elements that are within his range of competence" (Wood et al., 1976, p. 90). Further, scholars argue that the future of PE also depends on whether and how teachers implement terms like self-paced learning, reflection, meta cognition, and deep learning in their practice (Ennis, 2015; Vinje, 2016). Teaching for transfer or teaching for deeper meaning hinge on enabling students to use knowledge in increasingly more complex ways, not only to remember and understand (Anderson and Krathwohl, 2001). The flipped learning framework seems to facilitate just that.

## Physical Education in the Norwegian Context

The main aim of PE is to motivate all students to engage in a lifelong, physically active and healthy lifestyle (Kirk, 2010; Norwegian Directorate for Education and Training, 2015; Gerdin et al., 2019). A recent report reveals that PE in Norwegian schools lacks variation both in content and teaching methods, and that this has resulted in a subject that is not beneficial for all students (Moen et al., 2018). A decline with age in student motivation to participate in PE has been observed, contrary to the intentions of the Norwegian PE curriculum (Säfvenbom et al., 2014). Motivation to participate in PE declines already from an early age (Mowling et al., 2004; Xiang et al., 2004), and continues to decline throughout secondary school and upper secondary school (Säfvenbom et al., 2014), reflecting a global trend (Gao et al., 2008). This decline is greater in adolescents than in young children (Fredricks and Eccles, 2002), and is greater among girls than boys (Thomas et al., 2008; Säfvenbom et al., 2014). The loss of motivation in Norway especially among girls, is partly the result of a "sportified" PE favoring boys and pupils who engage in sports outside school (Andrews and Johansen, 2005; Säfvenbom et al., 2014; Dowling, 2016), echoing an international challenge (Ennis, 1999; Scraton, 2013; Vlieghe, 2013; Oliver and Kirk, 2015; Lundvall, 2016). In Norway, a "narrow" PE curriculum is observed regarding the subject content, where ball and fitness activities conducted in an instruction-conduction teaching manner seems to predominate (Moen et al., 2018). The same trend is also observed internationally, where researchers argue that the PE curriculum only comprises sports-like activities and fitness workouts and fails to include the enhancing of students' cognitive and social skills, with no focus on encouraging a positive perception of the students' physical self-worth (Ennis, 2011; Dyson, 2014).

Green (2008) concludes that PE, internationally, remains gendered in terms of organization, content and delivery, and that: "The tendency for PE to reinforce more than challenge hierarchical relations between the sexes remains." (p. 152). Some studies, although not specific to PE, demonstrate that the use of digital technology might reduce gender differences observed in school (NOU 2019:3, 2019). Despite the non-intended direction of PE, it is one of the most popular subjects in primary and

secondary school both in Norway (Moen et al., 2018) and internationally (Goodlad, 2004). Nevertheless, Moen et al. (2018) reported a great decline in motivation from fifth grade to tenth grade in Norwegian students, who self-reported liking PE “very much,” and this decline was twice as great among girls than boys. Palakshappa et al. (2015) point to the fact that the manner in which PE classes are delivered may reduce the predicted positive connection between participation in PE and levels of physical activity in young adulthood. Recent research confirms a student view of PE as non-educational, being merely a “break” from other school subjects (Woods et al., 2012; Moen et al., 2018; Lyngstad et al., 2019).

As PE does not fully achieve its main intention, which is to motivate all students to engage in a lifelong, physically active and healthy lifestyle, change is needed. Digital technologies can be a facilitator for both enhanced motivation and learning in PE (Armour et al., 2017), although one should not assume that they are inherently positive or negative in a PE pedagogical context. The use of digital technology in PE provides opportunities and incentives to, in a constructivist view, build up rather than dispense knowledge (Parker et al., 2017). Innovative curricula and approaches in PE are in general welcomed by students (Dyson, 2006). Hence, new pedagogical approaches in PE should be adopted, as the subject remains dominated by a traditional teacher-centered teaching style (Green, 2008), despite emphasis being placed on pupil-centered approaches [Meld. St. 16 (2016-2017), 2017].

This study was part of a larger research project, the goal of which was to investigate how the learning framework of FL affected adolescents' motivation to participate in and learn from PE. To obtain insight into how FL affects student motivation and learning in PE, a quality research approach was chosen in the present study, as “listening to students can provide valuable perspectives and new insights into the complexities of teaching and learning that can then be applied to improving the quality of physical education” (Dyson, 2006, p. 343). Further, a synthesis by Karabulut-Ilgü et al. (2018) revealed that “there is a paucity of literature employing qualitative methodologies that would provide more in-depth understanding of learning in a flipped environment” (p. 407). The purpose of the present study was, by means of interviews, to examine the perceptions of adolescents' attendance in physical education when FL provided the learning framework.

## METHODS

The present study is grounded in the qualitative research tradition to best understand the emic perspective of the participants' perception of being part of a flipped learning educational environment (Richardson and St. Pierre, 2005). Based on an epistemological world-view rooted in social constructivist theory, the generated data were sorted, reduced and analyzed by steps and consideration entrenched in constructivist grounded theory (see: Charmaz, 2014) and stepwise-deductive induction (SDI; Tjora, 2018). Grounded theory has from the classic statements of Glaser and Strauss

(1967), and the further movement of the method by Strauss and Corbin (1990) and Corbin and Strauss (1990), been taken in various and divergent directions. Charmaz (2014) describes a development starting in the early 1990s, where scholars moved grounded theory away from the original positivistic version of Glaser's and Strauss and Corbin's theory in a constructivist turn, adapting the inductive, emergent, and open-ended approach, while not emphasizing the method as a method of verification. “The constructivist turn answers numerous criticisms raised about earlier versions of grounded theory. Constructivist grounded theory highlights the flexibility of the method and resists mechanical applications of it” (Charmaz, 2014, p. 13).

Social constructivist philosophies have been recognized as providing a potentially useful reconceptualization of existing approaches to teaching and learning in physical education (Dyson, 2006). Situated learning theory has been represented as one example of a social constructivist approach to learning (Kirk and Macdonald, 1998), and “situated learning provides an authentic framework in which to position the study of students' perspectives in physical education” (Dyson, 2006, p. 330). In the following is a presentation of the participants and the intervention they participated in, followed by how the data was generated, sorted and reduced, including some ethical considerations.

## Participants

The participants comprised 10 adolescents from 13 to 17 years of age: seven girls and three boys. They were students from two schools, purposely chosen from the six schools that participated in the intervention, forming two groups of five participants. The whole class was asked to voluntarily participate in the interview by their own PE teacher. Among group A, only girls responded positively to participation. The teachers were instructed to choose from among those who gave their consent five students to represent major diversity based on gender, grades and involvement in PE. Group A consisted of five girls ranging from 16 to 17 years of age from an upper secondary school, level VG1<sup>1</sup>. Group B consisted of two girls and three boys ranging from 13 to 14 years of age from a secondary school, year 8. By selecting participants from both the youngest and oldest parts of the cohort, the diversity of perceptions could be generated following the principles of maximum variation among the participants (Creswell and Poth, 2018).

## Intervention

The intervention was based on constructivist approaches, emphasizing that:

“learning is an active process in which the individual seeks out information in relation to the task at hand and the environmental conditions prevailing at any given time, and tests out her or his own capabilities within the context formed by the task and the environment. Learning is situated in social

<sup>1</sup>VG1 is abbreviation for “Videregående 1,” meaning the first year in upper secondary school.

and cultural contexts and is influenced by these contexts” (Kirk and Macdonald, 1998, p. 376).

The intervention took place over a period of 3 weeks during the spring of 2016. Three learning resources with regard to endurance, strength and coordination were used. Each consisted of a video that was assigned for viewing as a homework task before class, an in-class lesson plan that the PE teacher followed, and a teacher's guide. The videos lasted about 12 min, which was well within the length suggested for such videos (Lagerstrom et al., 2015; Long et al., 2016), and were published on a digital learning platform which the students and teachers had access to. Each video gave a thorough but easy to understand introduction to the in-class topic. For example, when endurance was the weekly topic, the video explained endurance in away appropriate to the age-group by discussing why endurance improves health, what happens in the body when endurance is enhanced, and how to increase endurance. At the end of the video, a summary of the forthcoming class content was given. Short quizzes embedded in the videos were used to increase the students' motivation to continue watching and to develop a deeper understanding of the content, as suggested by Frydenberg (2012), Long et al. (2016), and Geri et al. (2017). The in-class lesson was strongly linked to the video content and consisted of play-based activities focusing on one of the three topics in the intervention. One possible bias was how to control for performance of the homework. The interviews revealed that some students watched the videos together, resulting in a situation where the statistics from the learning platform on logins and on-time could not be used. From a pragmatic viewpoint, not all students completing all of the homework is reality in school, and statistical analysis cannot alone give an absolute representation of reality (Olsen and Morgan, 2005).

## Data Generation

The week after the intervention, the adolescents participated in a semi-structured interview with focus on motivation for, and learning in, physical education. An interview guide was used to ensure certain key topics were included in the conversations. Following the concept of sensitizing (Rennstam and Wästerfors, 2015, p. 34), the researcher was open to new topics in basing the interview more on discovering rather than merely asking questions (Charmaz, 2006). The mentioned key topics were motivation and learning in PE, as these were the two main focuses in the main study. The interviews were conducted by one of the researchers in the students' own school and lasted 23 and 16 min. The data were later transcribed to a written document and imported to NVivo 12 for further analysis.

## Data Reduction

Grounded theory (GT) is a widely used framework in qualitative studies (Charmaz, 2014). This extended use has raised questions about inflation in references to GT and whether concepts are too broadly understood within this tradition (Tjora, 2018). Stepwise-deductive induction is argued by Tjora (2018) to provide a more linear process in respect to GT, with iterations generally limited to backward coupling between two adjacent stages in the model.

In GT this iterative process is termed “theoretical sampling” (Charmaz, 2014, p. 192), shifting between data analysis and data collection, and this may be difficult to apply practically in the research process. Hence, this study relies on, and finds inspiration from, both GT and SDI in analyzing the generated data.

The initial coding stage in SDI differs from GT in that induction is more present (Tjora, 2018). What is named initial coding in GT, which is a sorting based coding, is in SDI actually two different stages: empirically close coding (EC coding) and coding (Tjora, 2018). An example from the present study is how the student response “*It's a bit more motivating to see a video than to sit and read ten pages of text without content*” was coded. The EC code generated was “more motivating to see video than to read text,” while a more traditional sorting-initial-coding could be “motivation.” As the analytic process started already during the interviews, the researcher was open to other topics occurring, and one specific topic did occur: the view and value of PE. This is named an “empirical-analytical reference point” (EAR-point) in SDI (Tjora, 2018, p. 35), or “memo” in grounded theory (Charmaz, 2014, p. 162). The response leading to this topic emerged from the conversation about the videos assigned for preparation for the practical classes: “*It's somehow like homework, so then it [PE] becomes more like a [school] subject.*”

Initial EC-codes were counted as 113, then reduced to 10 focus codes and further to six empirical themes. This study uses the term *themes* and not categories, as we were looking to describe empirical themes rather than working toward an explicit development of *theoretical* categories (Charmaz, 2014, p. 199).

## Trustworthiness

*Reliability* relates to the consistency and trustworthiness of research findings, often treated in relation to the issue of whether a finding is reproducible by other researchers and at other times. Tjora (2018) states that one of the most important requirements for all research, or the presentation of research, is linked to transparency. How the present study was carried out, what choices were made at what times, how the participants were recruited, what theories were applied, and how these contributed analytically, were just a few questions put forward in the present article to assure transparency. Tjora (2018) further 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). Transparency is linked to naturalistic generalization. The goal of naturalistic generalization is not for researchers to suggest conclusions, but by the ways the research is presented so the reader can assess how and in what ways the results may be applicable to their own situations (Stake and Trumbull, 1982). To further assure reliability in the present study, two researchers first produced a separate EC-coding followed by a comparison of EC-codes and the second step of focused coding before conceptualizing the empirical themes. Other types of generalization are also used in qualitative research in sport and exercise science to display quality, but Smith (2018) emphasizes that a lack of displayed generalization is not a sign of less quality. There is often a concern about leading questions regarding interview reliability. It might be that the interview subjects can change their answers during the interview

or give different answers to different interviewers. We rely on a view, and this view is an alternative to a view rooted in an empiricist and positivist conception of knowledge. Our view is based on Kvale and Brinkmann (2009) describing the interviewer as a traveler, “which follows from a postmodern perspective on knowledge construction; the interview is a conversation in which the knowledge is constructed in and through an interpersonal relationship, co-authored and co-produced by interviewer and interviewee” (p. 173). The key question is not if the interview questions are leading questions, but where the interview questions lead. They should preferably lead to new, dependable, and useful knowledge.

*Validity* refers in ordinary language to the reality, the accuracy, and the strength of a statement. In a methodological positivistic approach to social science, validity has been operationalized in the question “Are you measuring what you think you are measuring?” (Kerlinger, 1979, p. 138). However, “in a postmodern era, truth is constituted through a dialogue; valid knowledge claims emerge as conflicting interpretations and action possibilities are discussed and negotiated among the members of a community” (Kvale and Brinkmann, 2009, p. 247). The validity in the present study was constituted by craftsmanship, as communication and as pragmatic action, as suggested by Kvale and Brinkmann (2009). Through the transparency of the present research report, the quality of the researchers' craftsmanship can be assessed. A communicative validity was constituted through the two researchers' conflicting knowledge claims argued in a conversation. With an emphasis on instigating change, based on the researcher's observations and interpretations, the pragmatic validity and the trustworthiness of the present study were strengthened. The number of interviewees in the present study might be considered low, but through the coding constant comparison of incidents (indicators) in the data a “theoretical saturation” were achieved. “This constant comparing of incidents continues until the process yields the interchangeability of indicators, meaning that no new properties or dimensions emerging from continued coding and comparison” (Holton, 2007, p. 265).

In a school context, the researcher must also be aware of local culture and its role in constructing knowledge through studies like the present one. As the participants were from two different schools, the concept of “analytic bracketing” (Rennstam and Wästerfors, 2015, p. 53) was applied. Analytic bracketing is about accepting duality in social reality, and hence, trying to account for the influence local culture could have on the participants' responses by the researchers constantly shifting between analyzing what the participants are talking about and how they talk about it. As a final step to obtain satisfactory quality and trustworthiness in the present study, the researchers responded to the calls from Smith and McGannon (2018) to “subscribe to the notion of universal criteria and a criteriological approach as a way of ensuring rigor” (p. 118).

## Ethical Considerations

Interview research is permeated with ethical issues, as the pursuit of interesting knowledge must be mediated by respect for the integrity of the interview subject:

“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 and Brinkmann, 2009, p. 16).

The interviewer might find himself or herself offending the subject, transgressing a line that only friends or intimates can cross. The key lies in “calibrating social distance without making the subject feel like an insect under the microscope” (Sennett, 2004, p. 38). This project was reported to, and approved by, the Norwegian Centre for Research Data (NSD) (<https://nsd.no/nsd/english/>) Project #47604. Written informed consent was obtained from all participants above the age of 15 and from the parents of all participants below the age of 15, in accordance with the NSD guidelines and recommendations.

## ANALYSIS

The initial coding and grouping of codes resulted in six empirical themes, of which three were further discussed. The three main themes emerging from the analyses were: “motivation for preparing for and attending PE,” “understanding and learning in PE,” and “the view of and value of PE.” Three themes that emerged from the analysis were found interesting but not suitable for further discussion. These themes were: “the format of the videos,” “FL and the consequences for the practical lessons,” and “the disadvantages of FL.” A description of these three last mentioned themes is followed by a deeper analysis of the three main themes.

*The format of the videos matters.* The students reported on interactive momentum being important for endurance. Hence, embedded quizzes make them watch more of the video or the whole video, as opposed to a video without such interactions. This is in line with the research mentioned in the method section, stating that quizzes embedded in the videos enhance the students' motivation to continue watching (Frydenberg, 2012; Long et al., 2016; Geri et al., 2017). The students also reported on the importance of video length. These reports fall into line with the findings of Lagerstrom et al. (2015) and Long et al. (2016), suggesting that video length limited to 20 min is appropriate, though length alone is not the sole factor in determining how students interact with online videos. The instructor in the video being visible and not just represented by voice seems to be an advantage according to the students, saying that it was easier to pay attention and that body language matters. A visible and enthusiastic instructor helps in terms of concentration and motivates the students to keep on watching (Stull et al., 2018).

*FL and its consequences for practical lessons.* As suggested by, e.g., Killian et al. (2016) and Sargent and Casey (2019), the students in the present study stated that more time could be dedicated to practical activity, as explanations of the activities were made in the videos. The students also mentioned that the gym is not a place where they want to sit still and listen to explanations, as one student stated: “I think it was best when we saw the videos, because if [the teacher] explained, it would not be

so informative and fun. You want to be in an activity when you're on the court [they had outdoor classes in this period], not sitting and listening, you know".

The *disadvantages of FL* seem to be absent in the students' statements in the present study. All the students seem to have only a positive perception of FL as a teaching framework, suggesting an extensive use both in PE and in other subjects. This finding contradicts the synthesized findings of, e.g., Akçayir and Akçayir (2018) in describing a student perspective of FL being a model requiring more work and time. However, the above-mentioned literature review, which included 71 research articles, was mainly sourced in higher education and non-PE courses.

## Motivation for Preparing for and Attending PE

The students in the present study connect preparation for PE with improved outcome of the practical classes, and the feeling of being prepared has an impact on the motivation to attend. Preparation for PE is a scarcely examined topic in PE due to a tradition of PE being a non-homework subject (Hill, 2018). Our findings show that the students do not mind preparing for PE classes; in fact, they like it, for several reasons. This contradicts the findings of scholars like Kohn (2006), who suggest that homework does not promote higher-order cognitive skills, but rather leads to a loss of interest. The motivation for preparing is dependent on the form of material designated as homework. The students proposed a clear distinction between text material and video when it comes to motivation for preparing prior to class, where video was described as both "more motivating" "more interesting," and "more systematized," whereas text was described as "boring," "difficult to understand," and "easy to forget." Hence, the students displayed a positive perception of preparing for PE classes if the preparation material is in the form of a video and has a clear connection to the upcoming class content and outcome aim(s). The video interventions all had a short explanation of the upcoming class content, and this was mentioned as important by several students. It seems that this has contributed to the reported higher motivation for attending PE when a FL framework was applied. The present intervention and the FL model in general emphasize the important of homework being a preparation activity rather than a post-class activity. The focus on a understandable connection between the homework and the practical lesson might have contributed to the positive perception of the preparation, and this is supported by the recommendations of Hill (2018), who states that "if students are able to make the connection between homework and important learning objectives, they may be less likely to believe that the homework is just busy work" (p. 62).

As motivation for preparation in PE is increased, one can assume that this is also reflected in increased motivation to participate in PE. Even if this connection might not apply for all students, the responses included "I felt I got more motivated after seeing the videos, because then I knew what I was training and that it helped you," and "To me, it's about motivation. I like to know things; I like to know what I shall do." The importance of knowing something about the content in the upcoming class

was emphasized by several students as making a significant contribution to motivation for participation. It seems that a better understanding and knowledge about a PE class topic (e.g., endurance training) acquired prior to the class contributes to increased motivation for participation. This falls in line with earlier findings of FL changing motivation for participating in PE in a positive direction based on higher expectancy beliefs in PE (Østerlie, 2018b), and lower perceived costs of attending PE (Østerlie, 2018a), although these changes were only observed among girls. With observations and statements from national and international scholars like Ennis (2011), Dyson (2014), and Moen et al. (2018), arguing that the PE agenda is too narrow, merely focusing on conducting activities, we can suggest that one reason for the decline of motivation for participating in PE is connected to the lack of knowledge and understanding of PE (cognitive) content.

## Understanding and Learning in PE

The present intervention had a focus on cognitive knowledge in the preparation videos, closely connected to the practical activities conducted in class: how would the students react to this shift in focus, when for decades scholars have argued that PE is "sportified" (e.g. Säfvenbom et al., 2014) and when recent research confirms a student view of PE as non-educational, merely a "break" from other school subjects (e.g., Lyngstad et al., 2019). Surprisingly, all the interviewed students displayed a positive attitude toward being exposed to this shift in focus, including (cognitive) preparation before class in statements like:

"The thinking process one has before a class allows one to spend more time, and one can go into what one wants, if something is unclear. And I believe it is not stupid to be able to think a little about one topic before coming to class,"

and "I felt it was interesting and I learned a lot from them [the videos]," which give an impression of a positive perception of FL in PE. The students seemed to prefer FL over a more traditional approach, characterized by a teacher-centered instruct-conduct approach, as they appreciated learning about a topic both in cognitive and physical ways. In general, the students reported a better learning outcome when compared to their "normal" classes in PE. Knowledge about a topic is perceived by the students to last longer when video preparation is applied, as students responded with: "when another person reads it or explains it for you, then it sticks better in your brain automatically. Especially when you see the face and movements, and so on, and examples, than just reading", and:

"It is much easier to learn theory that way, to get a little bit all the time through what you are working on. Instead of, when you know you have a [knowledge] test, then you may not have read anything throughout the year, and then it will be a last-minute-effort and it [the knowledge] will be forgotten right after the test. So, it is very good to have some theory before every class, so you get it repeated all the time."

In analyzing the interviews, we saw a pattern of the students connecting prior knowledge to the content of the videos and the learning in the activities in class, with student statements such as:

“Some of the video content was known, but parts were very clarifying and made it [the knowledge] more holistic. It's not just about training endurance to get in better shape. It was explained better. When you have a vague explanation followed by a deeper one, it sticks better.”

Students in this study reported both enhanced understanding and learning in PE. Frey et al. (2016), p. 570 defined the deep learning phase as “Interaction with skills and concepts,” with the driving question “How do these facts and principles fit together?” and the transfer learning phase being defined as “Organizing, synthesizing, and extending conceptual knowledge” with the driving question “How and when do I use this for my own purposes?” Students in the present study insinuated that by being exposed to FL, they acquired and constructed knowledge about how physical activity and training affected their health, and they included responses like: “after seeing the videos I knew more what I was training, and that it helped me,” and:

“I think it should be a subject where one should both learn and be in an activity. If you were to have PE without knowing what is being trained and knowing what is happening in your body, then you would not know what happens when you are over-trained and if you stopped exercising and such.”

The analysis of the interviews in the present study suggests that FL can promote both deep learning and transfer learning in PE.

## The View and Value of PE

The analysis revealed a clear pattern of changes in student perceptions of PE when FL was applied as the learning framework. The students said they started thinking of PE as a subject:

“Because PE is a subject we only have one class a week, then it goes for a week and then something new without getting anything in between. Then it is in a way easier to look at physical education as a subject as well”

As PE in Norway is delivered once or twice a week, the students reported feeling more included and connected to the subject and the teaching when having to do homework between classes, and this made it easier to look upon PE as a school subject. This falls in line with the findings of FL affecting students' attainment value in PE, although this change was only observed among girls (Østerlie, 2018b). One can assume that the students' feeling of being more included in a learning process is a way of putting into words the perception of a more student-centered learning environment. Responses like “the PE classes made more sense because I understood more of what we were doing”; “maybe one takes it [PE] more seriously,” and “normally, when we have PE, we just do things” underpins the view of PE being a mere “break” from other subjects in school emphasized by scholars like Lyngstad et al. (2019) and Woods et al. (2012), who

describe a student-view of “traditional” PE found both in Norway and internationally. The students also stated that their normal classes, in what we can call traditionally conducted classes, seemed more “unstructured,” “spontaneous,” “non-connected,” and that the norm was an instruct-conduct delivery of PE. Nevertheless, the students underlined the importance of PE being a mandatory subject.

## DISCUSSION

The discussion of the findings was done through social constructivist and situated learning lenses in comparing with existing research presented in the theoretical framework. In general, the students had a positive perception of the learning framework FL. The present study further demonstrates that the video format is preferred as preparation material over text material, but video length, inclusion of interactive momentum in the video, and the instructor talking on the video and being visible are important. The students report that instructions about class activities are preferable when given in the preparation material and not in class and did not report any negative aspects of FL. The students presented a positive perception of preparing for PE classes if the preparation material is in the form of a video and has a clear connection to the upcoming class content and outcome aim(s). Furthermore, FL seems to have a positive effect on student understanding and learning in PE, and FL promotes a change in how the students value and look upon the subject.

General satisfaction with the FL model is reflected in international findings synthesized in larger reviews (Akçayır and Akçayır, 2018; Cheng et al., 2018). Decelerating the observed decline in student motivation in PE (Mowling et al., 2004; Xiang et al., 2004; Gao et al., 2008; Säfvenbom et al., 2014) is a global challenge that must be put forward as a matter of high importance, and the findings in the present study suggest that FL contributes in a positive direction in this matter, supported by the suggestion of Mowling et al. (2004), that designing lessons that students will find meaningful fosters higher intrinsic motivation among them. As students can prepare before class, their motivation to participate is increased and their learning outcome is better. During the preparation their knowledge helps learning, while information about the class content raises motivation for participation. Hence, both are important parts of the preparation video.

To understand and learn, students need support from the teacher and their peers. Central to the concept of scaffolding is the concept of aiding with tasks that students are unable to master for themselves. With this in mind, the way in which teachers pitch their expectations of students is a key issue. This paper argues that (cognitive) knowledge is important for students' learning and outcomes in PE. It is important for both motivational reasons and cognitive and physical learning. This is supported by scholars like Ennis (2015), who states that:

“Knowledge, too, is at the heart of physical literacy and provides the foundation for knowing what to do and how and when to perform. In fact, physical literacy cannot occur without



knowledge. Knowledge of facts, procedures, principles, and concepts and their cognitive and physical applications permit physically literate individuals to transfer knowledge to new contexts, solving previously unencountered problems in novel situations" (p. 90).

Further, this paper suggests that FL can function as a scaffold for deep learning in PE, supported by a view of FL as meta-strategy (Shin, 2018). However, deep learning does not just happen: "students first need time to become familiar with the factual or surface knowledge and principles of the discipline before they can consolidate and expand their knowledge" (Frey et al., 2016, p. 568). The connecting of cognitive knowledge and physical literacy through practical activity is fruitful in enhancing motivation, understanding and learning, and this is supported by the findings of Sargent and Casey (2019), who advocate the use of FL in PE, as more time can be devoted to more engaging, student-centered activities, more student learning and increased physical activity. Rooted in social constructivist theory, FL can promote learning in PE, as both teacher and peers support each individual learning process. As more time is allocated to more student-centered and learning-centered activities, the potential for more learning arises. With peer students being more prepared for class by having more knowledge both of the topic and the activities, the peers can be included in the scaffolding. Vygotsky (1978) stated that we cannot just look at what students can do on their own; we have to look also at what they are capable of doing in a social setting, defining the zone of proximal development (ZPD) as: "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (p. 86).

How students value and look upon PE is important. Fu (1999) concluded that "the selection of learning strategy (surface or deep) hinges on the students' perceived value of the task to be learnt and that teachers should structure activities which can foster value clarification processes among students" (p. 191). The findings in the present study indicate a positive direction regarding this matter. Students seem to value PE more with FL, and this promotes both motivation and learning. The feeling of being prepared for PE increases the motivation for participation as the attainment value changes in a positive direction, especially among girls (Østerlie, 2018b). Attainment value is a person's perceived importance of doing well in a task, and students will naturally feel more capable of doing well if they are better prepared. The change in focus of PE being a subject of learning, and a perceived better competence in PE affect the value allocated to the subject. Both Kim et al. (2014) and Wang et al. (2019) argue that FL environments are more student-centered than more traditional learning frameworks. A student-centered approach, among other factors, seems to impact on how students value PE and how they look upon it in terms of being a subject of learning, or in their words, a school subject. Kirk and Macdonald (1998) state: "our view is

that constructivist influence, sometimes associated with student-centered learning, has the potential to contribute to new theoretical perspectives on learning in the physical domain that can regenerate school physical education" (p. 377). Following Kirk and other scholars like Locke (1992), we can observe that such regeneration is unfortunately still missing, but yet a matter of the utmost priority, as it has been for a (too) long period.

## CONCLUSIONS

This paper investigated the perception of adolescents' encounter with a flipped learning intervention in Norwegian physical education. A clear positive perception was discovered. It was demonstrated that: (1) The video format is preferred as preparation material over text material, but the video length, inclusion of interactive momentum in the video, and the instructor talking on the video being visible are also important. (2) Instructions about the class activities are preferably given in the preparation material and not in class. (3) The students did not report any negative aspects of FL. (4) The students presented a positive perception of preparing for PE classes if the preparation material is in the form of a video and has a clear connection to the upcoming class content and outcome aim(s). (5) FL has a positive effect on student understanding and learning in PE. (6) FL promotes a positive change in how students value PE.

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

This project was approved by the Norwegian Centre for Research Data (NSD) (<https://nsd.no/nsd/english/>, Project #47604). Written informed consent was obtained from all participants above the age of 15 and from the parents of all participants below the age of 15, in accordance with the NSD guidelines and recommendations.

## AUTHOR CONTRIBUTIONS

OØ contributed to the design and implementation of the intervention, collection of the data, and outlining of the methodological considerations. OØ and IK contributed to the analysis of the results and the discussion, and to the writing of the manuscript.

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**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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