



**Review Article**

# **Flipped Classroom Learning Approach in Physiotherapy Education - A Journey Towards Digital Era.**

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## **Abstract:**

The objective of this study was to assess the effectiveness of the Flipped Classroom Approach which is a blended learning approach in which students receive digital lectures as homework, while active learning activities are used in the classroom. To start with students are provided information about this model and its implications on learning. Classroom learning resources consists of about 12 hours pre-recorded video lectures, YouTube videos, e-learning course video lectures, watching of pre-recorded lectures video prepared by experts and experienced teachers, seven full day seminars for 8 weeks period, assignments (ranging in difficulties from lower order thinking skills to higher order) and films. The role of the educator is to council the group and is to organize the seminars. The course examination took place about 8 weeks after the last seminar. The students' performance was assessed with grades.

Meta-analysis yielded statistically improvement in learner's performance in higher order thinking skills, self-regulatory learning and clinical competences as compared to conventional teaching. It also encourages collaborative work environment.

## **Introduction**

With the access to the Internet and the rapid development of communication and mobile technologies mean, academics are now able to design curricula that have the potential to dramatically alter the way physiotherapy education is provided. A number of learning innovations make this a distinct possibility.

The flipped classroom is a blended learning approach in which students receive digital lectures as homework, while active learning activities are used in the classroom [1-3]. The rationale is that the students' preparation prior to class enhances the efficacy of the learning activities,

The use of educational and mobile technologies is also an important feature of, what has been termed the 'flipped classroom' [4]. The flipped classroom is an inversion of traditional teaching where students attend didactic lectures or practical sessions and then are required to complete assignments tasks following the lectures. In the flipped classroom, students gain exposure to material outside the class, usually by reading prepared material or watching short pre-recorded lecture videos, with class time used to assimilate knowledge through strategies such as problem solving, discussion or debate [5-6]. Anecdotally, the flipped class room is being used increasingly for the teaching of practical physiotherapeutic skills. For example, high resolution videos of practical skills with instructions can be made available to students prior to a practical class. This allows practical class time to be reserved for feedback on the skill rather than a proportion of the class being taken up by demonstration. Thus, in the flipped practical class, physiotherapy educators spend less time demonstrating, more time interacting with students, and more time supporting rather than driving learning [6].

Physiotherapists are increasingly working in settings where they take autonomous decisions that may place increased demands on team-working abilities. In addition, there is a global trend of a rising numbers of individuals with a range of disorders that largely cause disability but not mortality [7]. Physiotherapy education has a curriculum consisting mainly of theory and practice. The entry requirements of Physiotherapy programmes are usually relatively high, suggesting that the students who are admitted have already developed successful learning strategies. In order to graduate physiotherapy students who are able to thrive in increasingly complex health systems, it has been argued that educators must move away from teaching and learning strategies that disempower students and teachers [8]. Until now, educational

interventions that combine digital technology and active learning, have been little investigated within physiotherapy education.

### **Designing a flipped classroom approach**

In designing flipped classroom approaches there are a number of factors to consider. It has been suggested that the principles for designing a flipped classroom approach include engaging students in self-learning at home, designing learning activities based on authentic problems, designing learning activities to engage students in higher-order thinking, encouraging peer-to-peer and peer-to-teacher interactions [9]. Due to the typical collaborative design of learning activities in the flipped classroom, designers should consider the affective dimensions of learning, including commitment to peers, being recognized, feeling safe, and the relationship with the educator were conducive for students' learning [10].

Three months before the course began, students are provided with information about the flipped classroom model and the associated implications on their learning, and then again a week before the course started. In order to clarify their expectations about work intensity outside the classroom, about 80 hours on the students' timetable are allocated for pre-classroom studying and after-class work.

### **Development of the flipped classroom approach**

The development, implementation and evaluation of flipped classroom approach can be easily understood with the help of study conducted by **Roe et al** (II) on the topic "musculoskeletal disorders" taken from Physiotherapy field.

The design of the flipped classroom approach was inspired by social constructivism, which emphasizes the importance of the learner being actively involved in the learning process and by literature on constructive course alignment [12-14]. The course-leader and the other

educators involved in the course only had the minimum pedagogical requirements for teaching in higher education.

The pre-class learning resources consisted of about 12 h of pre-recorded video lectures, YouTube-videos, pod casts and an e-learning course. In addition, several key scientific papers, were included. The video lectures were produced by five educators, who had several years of experience with teaching. The lectures were recorded using the Microsoft Office Mix platform, which allows an image and audio track, parallel with PowerPoint slides. Typically, the digital lectures would include audio on all slides and a video of the educator on the first and last slides. The video lectures were accessible on all types of devices, including mobile phones. The digital learning resources were organized in seven themes (Table 1) and made available for the students a week in advance of the course.

The in- class learning activities consisted of seven full day seminars held during a eight week period. In the seminars, the students worked on assignments in groups of about seven. In order to facilitate accountability and regulation of working groups were constant throughout seminars. The central themes, sub-themes and learning resources for each seminars, are shown in Table-1. The assignments ranged in difficulty, from lower order thinking skills to higher order [15]. Effort was made, to develop assignments which reflected authentic problems in physiotherapy practice [9]. For example, in one of the seminars (Evidence-based physiotherapy II),

an assignment provided the students with a link to an animation film on healthcare professional use of metaphors in communication with patients at a hospital. After seeing the film the students were encouraged to identify similar types of metaphors in physiotherapy practice and discuss the consequences. In addition to the film, the learning resources included a link to a physiotherapy podcast where the use of metaphors was discussed. While some assignments were typically fact-based, others would require that the students critically debated a topic, using different perspectives.

All seminars had a similar structure, starting with a plenary session of about 45 min, where the students had the possibility to ask questions related to the pre classroom digital learning resources. The plenary session was followed by five hours (including lunch and breaks), where the students were working in groups, solving assignments. The end of the seminars was devoted to student presentations where two groups exchanged and discussed answers of the assignments.

The groups were encouraged to work on a shared document, for example in Google Drive or Microsoft One Drive. This was supported by a study in a physiotherapy department, which found that using technology to engage in shared learning, experiences facilitated the development of critical attitudes towards knowledge [16]. The use of fixed groups was inspired by a theory of team-based learning, groups were strategically formed featuring permanent teams with about seven members.

**Table 1: Overview of the in-class learning activities of the 8 weeks flipped classroom approach.**

Name of seminar and central themes	Learning resources
Standardized measures for musculoskeletal disorders: √ Different types of measures √ Quality criteria √ The International Classification of Functioning Disability and health (ICF)	-95 min pre-recorded video lectures - Web-pages and blog-posts - YouTube videos -Book chapters and three scientific papers
<b>Evidence-based practice (I and II)</b> √ Modal for evidence based practice √ The hierarchy of evidence √ Planning of treatment √ How to structure the patient journal √ Self-management interventions	-75 min pre-recorded video lectures - An online course - You Tube Video - Web-pages - Podcast episodes - Three scientific papers
<b>Pain as an unpleasant sensory and emotional experience</b> √ Nociception and pain processing √ Hypersensitivity √ Patient experiences with persistent pain √ Pain monitoring models √ Pharmacology and pain	- <b>174 min pre-recorded video lectures</b> - An online course in patient education - You Tube videos - Web-pages - Podcast episode - Seven scientific papers
<b>Physiotherapy for upper-extremity disorders</b> √ Epidemiology √ Diagnostic classification √ Prognostic factors √ Treatment	- <b>167 min pre-recorded video lectures</b> - You Tube Videos - Web-pages and blog-posts - Book chapters and one scientific paper
<b>Physiotherapy for lower-extremity disorders</b> √ Epidemiology √ Diagnostic classification √ Prognostic factors √ Treatment	- <b>83 min pre-recorded video lectures</b> - You Tube Videos - Book chapters and one scientific paper
<b>Physiotherapy for low back pain</b> √ Epidemiology √ Diagnostic classification √ Prognostic factors √ Treatment Generic learning resources	- <b>128 min of pre-recorded video lectures</b> - You Tube Videos - Podcast episodes - Book chapters and one scientific paper - Book chapters and live web-pages

**The role of the educators** was to council the groups and to organise the seminars. For each seminar at least two educators who were experts on the central themes, participated.

These educators were usually the same ones who had recorded the video lectures that were watched by students at home. The participating educators had no previous experience with the

flipped classroom model. Due to practical reasons, the educators did not go through any training with respect to the teaching role, before the course.

The course-exam took place about eight weeks after the last seminar. In the period between the last seminar and the course exam, the students were in clinical education. The examination was based on the assignments the students had worked on during the seminars, of which some were fact-based while other reflected higher order thinking. The topics of the assignments were consistent with those covered in the classroom activities. In order to increase reliability, the pairs of assessors should be rotated during the day of examination. The decision with respect to grades is based on agreement between assessors, using the

qualitative criteria decided by the Norwegian Association of Higher Education Institutions (UHR) (Table 2). In a preparatory meeting held for assessors, the criteria were discussed in detail. In addition, the importance of implementing both fact-based and reasoning-based assignments in the examination, emphasized. Student performance was assessed with the grades from the course-exam in 2017 and then compared with historical controls of conventional teaching practices in the same course from 2016, 2015, 2014 and 2013. The historical cohorts were similar prior to taking the course. The course grades were collapsed into three categories: Excellent, Very good and Good (A, B, and C), Satisfactory and Sufficient (D and E) and fail (F).

**Table 2: General qualitative descriptions of grades in Norwegian**

Letter grades	Criteria used in the assessment of examinations.
A – Excellent	An excellent performance, clearly outstanding. The candidate demonstrates excellent judgment and a high degree of independent thinking
B- Very Good	A very good performance. The candidate demonstrates sound judgement and a very good degree of independent thinking.
C- Good	A good performance in most areas. The candidate demonstrates a reasonable degree of judgement and independent thinking in the most important areas.
D- Satisfactory	A satisfactory performance, but with significant shortcomings. The candidate demonstrates a limited degree of judgement and independent thinking
E- Sufficient	A performance that meets the minimum criteria, but no more. The candidate demonstrates a very limited degree of judgement and independent thinking.
F- Fail	A performance that does not meet the minimum academic criteria. The candidate demonstrates an absence of both judgement and independent thinking.

Roe et. al [II] conducted the above study and found that flipped classroom approach in

Physiotherapy education resulted in improved students' performances in this professional

programme when compared with conventional teaching. Students responded positively to the collaborative learning environment especially with respect to the associated autonomy and flexibility.

The share of students with Excellent, Very good and Good (A, B and C) performances showed a higher rate by more than 10% relative to any previous year. In addition, Satisfactory, Sufficient and Fail performance (D, E and F) showed a lower rate by more than 10%.

Altogether 46 students (87%) responded to the survey. Of these, 29 students reported that they preferred the flipped classroom approach in comparison to conventional teaching 8 preferred conventional teaching and reported that they were "not sure".

With respect to the flexibility inherent the in-class activities, 20 students reported that they preferred a more structured classroom, 17 said that they were "not sure" and 9 students said that they preferred "as much autonomy as possible". Furthermore, 35 students supported the decision to use fixed groups in the collaborative classroom activities, 8 preferred rotating group members, and 3 reported that they were "not sure".

The most frequently reported factors that represent students' view from the seminars were interaction with peers and educators, and the flexibility associated with digital learning resources.

### **Strength of flipped classroom approach**

Learning in the flipped classroom has a number of potential benefits, including the implication that more responsibility for learning is transferred to the student [7]. The optimal level of autonomy and flexibility in the flipped classroom, has been little studied [24] it has been suggested that certain designs of the flipped classroom may promote self-regulated learning and higher order thinking skills such as applying, analyzing, evaluating and creating knowledge [15,18]. Another benefit to

the flipped classroom model that educators can be given more flexibility to cover a wider range and depth of material, as well as offer timely feedback and supervision to the students [18].

Another strength of this teaching approach is that it offers students a well-planned, flexible and coherent working process.

It has been shown that flipped classroom teaching has the potential to enhance higher-order thinking skills and self-regulated learning, among students [17,18,19,20] Although we did no systematic investigation of this, the assessors at the course exam think that the students are able to discuss and debate at a higher level than in previous course.

An important success factor for this approach to learning is the preparation made by students before attending the classroom model [2]. The collaborative working environment at the seminars is imperative for the learning.

There is evidence that blended learning has the potential to improve clinical competencies among health students [29]. Students preference for working in the smaller-class format in teams and also achieved significantly better course grades [19].

Findings of a systematic review on the use of flipped classroom in higher education, indicate improved student satisfaction and increased academic performance as measured by improved examination results, pre-test to post-test scores and course grades, compared with conventional teaching (22)

With respect to health education, a recent meta analyses on the effectiveness of the flipped classroom concluded that the approach yielded a statistically significant improvement in learner performance when compared with conventional teaching (23). A similar systematic review in higher education nursing programmes yielded academic outcomes that were either neutral or positive (6)

There may be a tendency to believe that if material is provided on line then, much like a didactic lecture, students have gained ‘‘ Knowledge’’. This raises the possibility that physiotherapy entry-level teaching material could be shared across state and national borders.

The value of a flipped class is in the repurposing of class time where students can inquire about lecture content, test their skills in applying the knowledge or clinical skills, and interact with one another in hands- on activities (30). This will require that physiotherapy educators reconceptualise their teaching approaches to function more as a coach or facilitator, encouraging students in individual inquiry and collaborative efforts [25].

These new approaches and the available technology create numerous opportunities for sharing of educational resources. This is evidenced by one of the early proponents of the flipped classroom. Salman Khan, a hedge funds manager with degrees in Maths and Science, created a free stock of over 4000 videos covering everything from basic algebra to chemistry.’’ These videos, originally posted on You Tube for his cousins, grew in popularity with school students such that he created the Kahn Academy. (<http://www.khanacademy.org> [25].

### **Limitations of flipped classroom approach**

This study has some limitations with respect to the interpretation of the improved learning outcomes. The study design did not control for external factors that may have affected student’s performance relative to previous cohorts. It is also conventional learning environment, may also lead to the kinds of improvements in learning outcomes that were observed during this study, However an important success-factor lies in the combined effect of the preparatory work and the well – organized, collaborative learning activates.

No doubt both students at the higher and lower levels of performance profited from the approach. However, there are at least two factors that should be considered in the interpretation of the results. Firstly, due to the lack of a control group it is not possible to decide whether the observed effects were caused by others factors. For example, this may have been an exceptional student cohort. In addition, there may be other changes made to the programme that may also have contributed to the improved outcomes, such as the authentic, group-based classroom activities that were not necessarily part of the flipped classroom approach. Furthermore, it cannot be completely ruled-out that the students modified their learning-behaviour in response to their awareness of being observed (Hawthorne-effect). Finally, the reliability and validity of course- grades as a measure for learning outcomes, is arguable.[19]

“Long and exhausting seminars” is the most common complaint from respondents.

There are indicators that all groups did not work optimally and that accountability to other group members did not always ensure pre-classroom preparations.

**To conclude** Nevertheless, considered these objections, we still think the result are important for educators who plan to alter their teaching methods in an attempt to develop higher order thinking skills in physiotherapy students. The improved grades observed in the present study are similar to findings in other students: The flipping classroom approach Engineering course resulted in improved perform (quiz, exam questions and open-ended design problems) and also allowed the educator to cover more trial the first of these studies.

Further research is warranted to investigate whether health professions students are able to profit from this type of learning in a clinical setting, as well as to determine the optimal level of autonomy and flexibility in a flipped

classroom approach. It is suggested training of the educators before the teaching approach would help the educators to find an optimal level of activity. However, at the time the design of the intervention took place, much effort should be devoted to the technical issue concerning the production of video lectures.

While research into blended learning, which is the combination of on line (synchronous and asynchronous) and face to face engagement to support and enhance learning through the interaction between students, teachers and resources [28] and the flipped classroom in physiotherapy and other health professional is in its infancy, yet there are implications of these pedagogical approaches [29].

Physiotherapy education should reflect present and future demands of the health care. Due to the global rising numbers of individuals with a range of disorders that largely cause disability rather than mortality, patient education strategies are increasingly emphasized, within, the context of rehabilitations [7, 26, 27]. While physiotherapy education has traditionally focused on physical activity, exercises and manual skills, future education will need to expand learning with respect to communication, critical thinking and collaboration, within a clinical setting. The flipped classroom model represents an opportunity to implement higher-order learning skills in the teaching.

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