

The flipped-classroom approach

An assessment of the flipped classroom and near-peer involvement in teaching anatomy and physiology to radiography students

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The flipped classroom places the emphasis on student-active learning rather than a traditional, passive classroom approach. This allows students to assimilate knowledge in preparation for classroom activities that focus upon the construction of meaning rather than the transfer of information. The aim is the development of a workable tool in the performance of professional practice.

Busebala and John¹ highlight the benefits of the flipped-classroom approach in Learning, Teaching and Assessment (LTA), primarily in learning course content. They suggest further research in adapting the model for use in other course areas and this study presents the experience of teaching anatomy and physiology (AP) to first-year radiography students. The flipped classroom presents an opportunity to structure LTA in areas where basic knowledge develops into a workable tool in the performance of professional practice. It allows for the particular requirements of radiography undergraduates in the appreciation of AP in clinical practice.

Traditionally AP is, as a general subject in health sciences, without professional distinction. The flipped classroom allows a profession-specific experience for the student at an early stage in their training².

The use of the flipped classroom provides the student with the ability to work at a pace that suits them as well as avoiding missed lectures. It also provides the opportunity to return to the content as required for the student. In addition, there is a closer teacher-student relationship with more time for interaction during the classroom activities^{3,4,5,6}.

In this study, this relationship is supplemented by using near-peer assistants in seminars. The suggestion is that this opens for a more rational approach to learning⁷, where first-year students benefit from the experience of a more advanced student who, in turn, experiences

leadership building and mentoring⁸. Merati et al⁹ reinforce this in their study into near-peer involvement, reporting an improvement in care and collaboration in the clinical setting. We expected this involvement to contribute to a transformative learning experience for the students, based on their own experience of clinical practice¹⁰.

Other reported benefits include better-quality teaching through active learning. The model frees classroom time to focus on the profession-relevant application of the discipline¹¹. Through active and social learning activities¹², which promote cooperation, collaboration, motivation and ownership, students should experience increased autonomy and relevant skill development. Providing a student-centred environment, the ability to assume responsibility for learning and involvement in an active learning process should improve motivation for the subject over time¹³.

Norwegian experience

There is a focus in Norway on the role of students in the construction of society and their importance in the development of health services, among other areas. As healthcare professionals, they represent and influence the government's social mandate. Universities must offer updated and relevant education that will motivate learning and completion (Parliamentary Notification no. 16 (2016-2017)). This, in turn, influences the teaching of subjects that will produce modern, reflective and future-orientated radiographers. We expected a

profession-related AP course would provide students with a grounding in the relationship between a core subject and clinical practice, while meeting the demands of a modern radiological department.

The offer of 'updated and relevant education' demands LTA approaches that stimulate active learning, and teachers that have competence in the profession they represent. Encouraging profession-specific work in AP should encourage the student to be actively responsible for the preparation for the professional component of the approach – that of reflection, evaluation and creation^{14,15,16,17}.

Educational establishments work closely with clinical practice, which is crucial in determining learning outcomes and producing candidates prepared for the clinical challenge. To meet this demand, schools should focus on the application of



Figure 1. The model of the organisation of the approach used in the anatomy and physiology flipped classroom

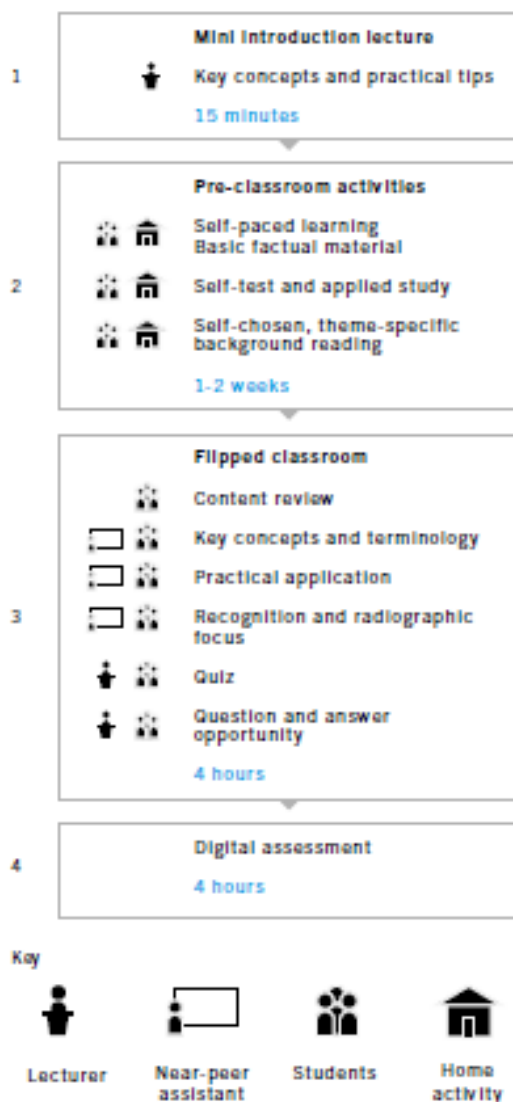


Figure 2. Responses to question 1. Evaluation of video usefulness. A Likert scale is used where 5 is the most positive

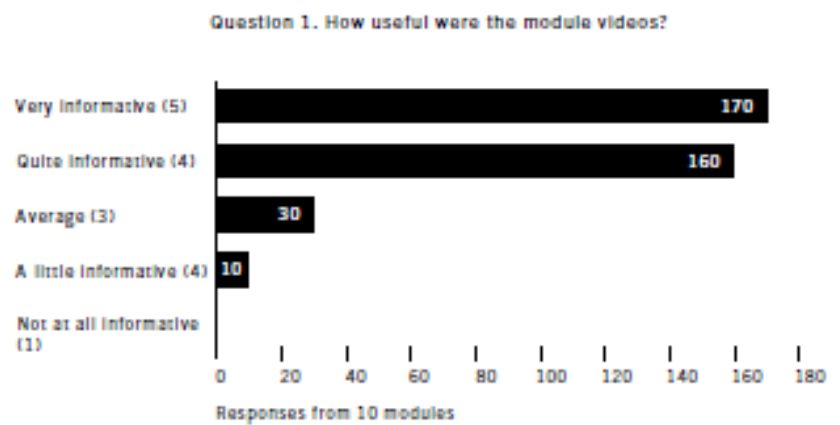
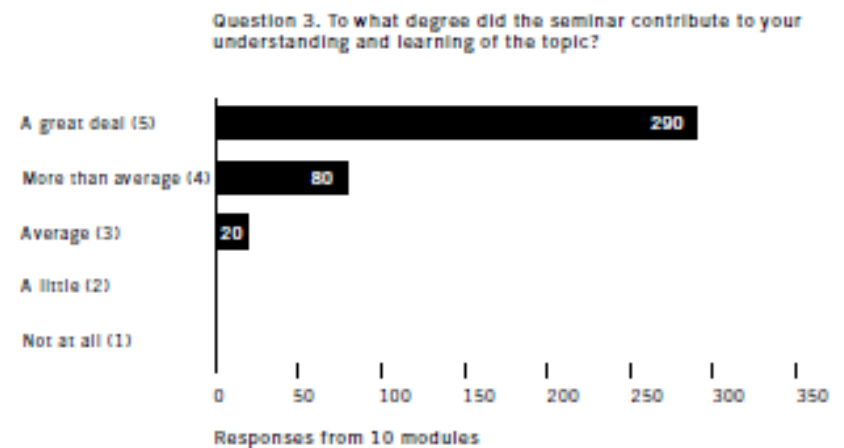


Figure 3. Responses to question 3. Evaluation of seminars. A Likert scale is used where 5 is the most positive



the course in practice. The flipped classroom goes a long way towards helping realise this focus⁹ and creating a professionally relevant core subject. The involvement of near-peer assistants allows a bridge between the theoretical focus of the university and the practical requirements of the clinical environment from a student perspective¹⁸.

In using general competence in areas that do not require specific professional focus, such as an assimilation of the basics of AP, the development of critical and analytical competence as well as an understanding of the clinical relevance of the subject assumes a larger role and allows for the more effective use of resources and work allocation^{14,15,16}.

Research suggests that learning approaches have little to offer without a grounded structure in evaluation^{18,19}.

Assessment that presents a combination of the basic understanding of the subject and an element of radiographic application should offer an evaluation method that reflects the course content and delivery method. McDermott et al²⁰ report that multiple-choice and short-answer assessments increase future use of information – an important consideration in how well a student radiographer understands and is able to use AP in their work and further study. This directed the decision to offer constructed-response questions as a final assessment.

Course construction/method

This study took place at the University of South East Norway (USN), Institute for Optometry, Radiography and Light Design. The subjects were first-year bachelor students in radiography. The flipped-

classroom course replaced 10 weekly, classroom-based lectures and a written assessment. Although conducted during the first year of the Covid-19 pandemic, this course was unaffected by restrictions.

Drawing upon experience of a trial year in 2019 using a hybrid (flipped and lecture-based) course construction as well as the available literature, four focus areas formed the basis of the course design:

- **Focus area 1.** Student support – the inclusion of near-peer assistants in seminar work.
- **Focus area 2.** Specificity of course content – the relationship of anatomy and physiology to clinical practice.
- **Focus area 3.** An assessment that reflects the pedagogic approach.
- **Focus area 4.** Ease of use of course material.

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Figure 4. Responses to question 5. How students prepared for the seminars

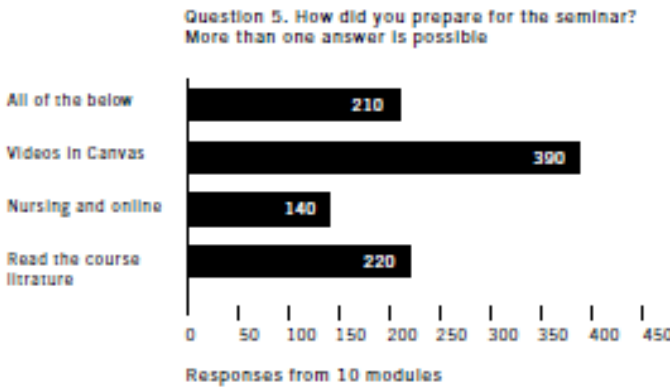


Figure 6. Final assessment results: 38 of 39 sat the assessment with an overall pass rate of 92.1%

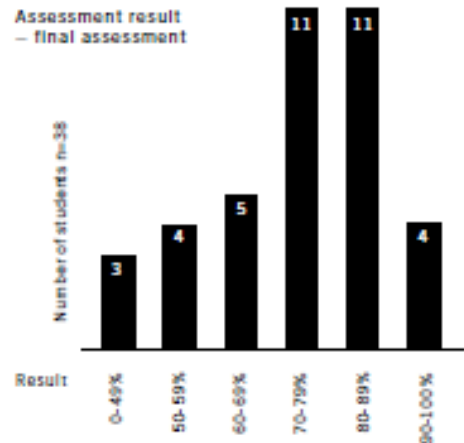
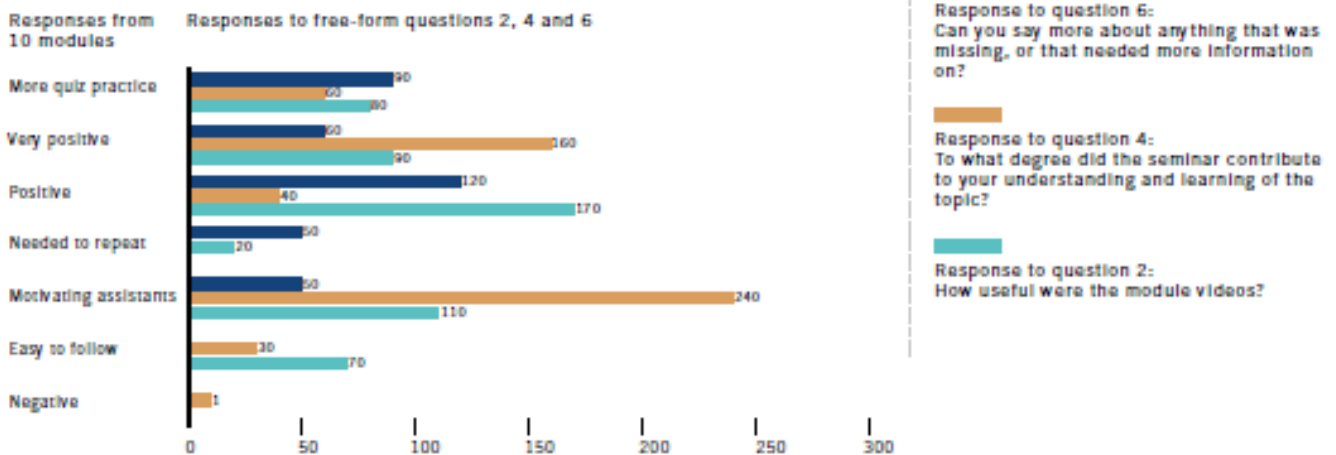


Figure 5. A summary of the main responses to the free-form questions 2, 4 and 6



Addressing these four focus areas allowed for a well-structured design and a degree of innovation in the inclusion of near-peer assistants.

Modules and set-up: focus areas 1 and 4
During the autumn semester of 2020, 39 first-year radiography students followed a digital, modular course in AP, supplemented by a weekly classroom seminar and a short introductory lecture for each module.

Students had access to the course from the first day of the semester with a recommendation of course literature. It ran over one semester from August to December and included a total of 10 modules and seminars and a final assessment. See Figure 1 for a summary of the organisation of the course. Canvas was the chosen learning platform.

Seminars: focus areas 1, 2 and 4

The focus of the seminars was the application of AP to clinical practice and the cementing of the knowledge the student had gained in self-study.

To increase student/teacher contact, three student assistants were engaged to help in the planning and design of the seminar work and to provide support. Chosen from second-year students, all had a top grade in AP from the previous year. They offered current students near-peer²⁸ support with an understanding of the demands of the subject.

The engagement of near-peers also addressed a point in a state-run student opinion poll concerning a degree of discontent in the practice of teaching and mentoring at university level. The poll concluded that universities should ensure that students take an active role in

the planning and execution of learning activities.

Examination: focus area 3

Changing the assessment format from a written evaluation to a constructed-response assessment was based both on the literature concerning the subject²⁹ and the university's assessment platform (WiseFlow). The chosen format for this study was an arrangement that allowed for an array of multiple-choice and constructed-response options. The range of choice makes it possible to create an assessment at the appropriate level and that actively involves the student in answering²⁹.

Evaluation

After each seminar, an evaluation questionnaire was available for students, and also a short discussion between the AP

students, the near-peers and the teachers. The students answered six questions. The responses to these questions are shown in Figures 2 to 5.

Ethical approval

Ethical approval was not sought for the present study because it is a part of an approved quality-control and development programme at USN.

Evaluation and discussion

In evaluating the experience of feedback and support, AP students reported a positive – but not overwhelmingly so – attitude to the module content and used several added sources. In future, it may be useful to include other student-active activities in the pre-classroom phase rather than just video and background information. The challenge here is to increase the assimilation of core content without pre-empting the classroom element.

Students were positive to the seminars and reacted positively to the use of near-peers. Using near-peer assistants is not new but was innovative in the context of the course. A departure from the norm was the use of second-year students rather than third years. We benefitted from their experience in designing the seminars and the first-year students agreed that the use of students made it easier to relate to them and to discuss academic work at an understandable level. Students commented that having assistants with high grades from the year before had motivated them to work towards achieving that without feeling overwhelmed. The scope of this study did not include an in-depth study of the near-peer contribution to the success of a flipped classroom. This indicates further study with a deeper understanding of this contribution.

The use of near-peers is an arena that opens for a more rational approach to learning by using a little-used resource⁷. Radiography students must act as mentors

and educators after qualification. This approach has demonstrated that they can be a valuable resource even before qualification. In a purely observational regard, we experienced a growth in confidence and management ability in the near-peers. Although intended as assistants, the positive influence on transformative learning of AP and its use in practice for both students and teachers was a positive experience and should be explored further^{23,26}.

On the specificity of the course content, students reported that focusing on clinical applications gave them a sense of identity as well as contributing to practice preparation and a link between a core subject and radiography. This would appear to concur with others' findings². The student assistants regarded the flipped classroom as a feature that contributed to the ability to make sense of the different topics in the first semester, and teachers found it satisfying to use clinical expertise in a core subject.

Once again, a less positive point here is the amount of time it takes to prepare the course, although this would decrease in subsequent years and the benefits would appear to outweigh the extra time spent.

An assessment reflecting the philosophy of the learning approach was favoured to test understanding and creativity rather than memory. The response to the assessment was positive. This surprised us, notwithstanding the findings of Simkin and Kuechler²⁴, among others^{25,26}. We had expected some resistance to a digital assessment among those students who prefer a written assessment. Conversely, we had expected that those students who viewed the assessment as easier to prepare for would be less positive to the constructed-response questions. The responses to the final assessment included enjoyment, fairness, challenge and an opportunity to learn.

The pass rate represents a clear improvement from previous years, with pass rates between 56% and 83%. It is difficult to say whether this is due to the flipped classroom, the students' ability and their preparation or the focus and time used in running the course. The extremely positive assessment results suggest a regulation of the assessment standard, despite independent quality control of these questions and their difficulty. It is not safe to suppose that the assessment results in this case were due to the flipped classroom.

Students were positive about the presentation of the course. They experienced cohesion between the modules

and supporting activities. They enjoyed a degree of personalisation and cooperation with other students and the built-in communication system. They appreciated the personal feedback they received from teachers and near-peers, and the fact that the course navigation was easy to use and logical. The evaluation of assignments and an ability to monitor activity via the learning platform was a significant factor in quality assurance and identification of problem areas.

Few studies have explored the effects of the learning platform on the achievements and learning that students demonstrate, rather than their reflection of the technological solutions the teacher has used. Broadbent and Poon²⁷ have reported a positive correlation between a student's academic success and opportunity for time-management with a negative correlation with critical thinking and synthesis. This supports the use of a flipped classroom with a well-presented pre-classroom element, supported by classroom activities that motivate analysis, synthesis and creativity.

On a negative level, the presentation of the course is dependent upon the technological expertise of the teacher, while many of the technical finesses that a learning platform offers are under- or non-utilised²⁸. This was also our experience. The students preferred other media sites and an online area devoted purely to students. It is debatable whether it is worth spending time trying to 'correct' this. There was no weakening of the impact of the course as a result – in fact, there appears to be an increased interest as students use favoured social media sources to further their own goals.

A learning platform offers many non-utilised functions, but our experience is that a more 'stripped' presentation contributes to 'ease of use' for the student and a more controllable tool for the teacher. This would not negate using other functions in the future but would be dependent upon both the technical expertise of the user and the requirement of its use²⁸.

An unexpected find during discussion reinforced observations during the seminars. Several students displayed the ability to use elements of the course to create clinical solutions in practical work, for example, identification of structures and anomalies in radiographs and procedures for medical conditions, without demonstrating an understanding of the information in the course material. This lack of understanding provided motivation to learn more and they returned to the course to build a more informed picture.

Considering Bloom's revised



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taxonomy^{30,31}, it would appear that the flipped-classroom approach allows for a more random assimilation of knowledge rather than strictly following a hierarchy. It does not indicate any long-term retention of this knowledge and requires further research to investigate the phenomenon.

Conclusion

Our experience of the flipped classroom has demonstrated a learning approach that functions well in the relation of a core subject to specific clinical practice. It can enhance teaching and maximise the use of time and resources. The use of near-peers gave an added dimension to the course and proved to be an asset in its planning and delivery. It also provided the assistant with the opportunity to develop competencies required in radiographic practice.

This study found two areas worthy of further research. The first is a more in-depth look at near-peer involvement and the other is the assimilation of knowledge and understanding using the flipped classroom. ■

About the author

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