

MULTI-MEDIA FOR FLIPPED CLASSROOMS: ENGAGED NUTRITION LEARNING IN A MULTI-MEDIA ENHANCED FLIPPED CLASSROOM

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ABSTRACT

This article focuses on the experiences of Health Science students changing from a traditional lecturer-centred, face-to-face teaching scenario to a multi-modal learning experience in a flipped classroom. Getting students engaged with course content is sometimes a challenge for lecturers, especially in a basic introductory compulsory course, where a student may not be interested or motivated. Furthermore, traditional teaching methods are increasingly being criticised for not 'speaking' to the younger generation who demand more active visual methods of teaching to keep their attention. A lack of student engagement and motivation in a nutrition course prompted the lecturer to redesign the traditional teaching approach previously used in this introductory course. In addition, the unavailability of multi-media content for the specific South African context formed part of the research problem. The nutrition introduction course for second-year students was re-designed according to Picciano's model for multi-modal learning, applying multi-modal learning by incorporating self-designed multi-media study material within

a flipped classroom approach. Design-based research with a mixed methods approach was followed, including a pre-course test, polls, narratives and focus group interviews. The results showed that students were initially negative and unsure about this process, but that their experience improved during the semester, and that the use of multi-media within a multi-modal learning approach enhanced their learning experience. The study also showed that close collaboration between the lecturer and the instructional designer is necessary to ensure quality effective multi-media resources, and that technical support for students is critical.

Keywords: flipped classroom, multi-modal learning, technology, teaching, learning

1. INTRODUCTION AND BACKGROUND

‘They are not living in my times, I am living in theirs.’ This is a thought that hit me between the eyes when I realised one day that I have to change not only the way in which I teach, but also the tools I use to teach. In order to do so I had to gain a deeper understanding of what this generation that I teach look like. I am sure what I found is nothing new. The generation sitting in our classrooms are digital natives; technology is nothing new to them, they are not scared of it; in fact they own it. They are seen as a generation that is always ‘connected’ – taking their tablet or mobile devices everywhere (Worley 2011, 35–37). Furthermore, the traditional lecturer-centred teaching is often not an effective approach to teaching for this generation (Herrington and Kervin 2007). This was also my experience of teaching an introductory nutrition course in a Health Sciences curriculum. Initially a statement made by Carpenter and Pease (2012, 36–39): ‘To improve results, teachers must require that students assume more responsibility for their own learning’ inspired me to start using a flipped classroom approach incorporating various types of technology ranging from videos to social media. The flipped classroom is broadly described as the swapping of homework for class work (Millard 2012). In flipped teaching, the students first study the topic by themselves. During contact sessions (in-class) students apply the knowledge by solving problems and doing practical work. The lecturer tutors the students when they get stuck, rather than imparting the initial lesson in person (Tucker 2012). Students typically are expected to study the study material through reading or video-watching for homework, freeing up class time that they previously spent passively listening to lectures, for hands-on activities and application of knowledge, which used to serve as homework (Ash 2012, S6). The essence of the flipped classroom is that students take the responsibility to study course content outside the class so that applied learning activities such as problem solving and case studies can be effectively incorporated during face-to-face contact sessions (Goodwin and Miller 2013, 78–80).

Although the flipped classroom approach has been implemented and widely used for some time, limited scientific research exists to proof its efficacy in an introductory

nutrition course. There are, however, some preliminary data that do suggest that it is an effective approach to teaching (Goodwin and Miller 2013, 78–80; Lasry, Dugdale and Charles 2014, 35–36). This way of teaching may also make more time available for activities that stimulate critical thinking, such as problem solving and applying knowledge to relevant and controversial topics (Gullen and Zimmerman 2013, 63–64). According to Goodwin and Miller (2013, 78–80), the flipped classroom promotes better interaction between student and teacher. Bergman and Sams (2012) also point out that when a teacher is not standing in front of the classroom talking *at* students they can actually start talking *with* students.

2. PROBLEM STATEMENT

Initially, I implemented a flipped classroom approach by providing students with reading material and questions that they had to prepare for class. During class-time, the work was discussed and elaborated on, using multi-media as a tool. This approach did not result in the desired outcomes. Even though I used various activities to engage the students, the key element of the flipped classroom, that of students coming prepared to class was still lacking.

This forced me to re-think my teaching approach and the tools that I used. My aim was to engage students more, promote better interaction with the study material and with me, guiding the students towards higher levels of thinking and learning without compromising their subject specific focus and requirements. I decided, instead of using stand-alone technology (such as power-points, short video-clips, etc.) in a flipped classroom, to develop multi-media with interactive elements for a flipped classroom that would provide students with interesting and creative ways to interact with the study material outside the classroom.

I decided to use Picciano's model of blending with purpose as a guideline (Picciano 2009, 6–8) to inform the re-design of my teaching, as it seems to fit the flipped classroom and the purpose of multi-media designed for a flipped classroom. Picciano's model (Figure 1) presents six basic pedagogical activities for blended learning as well as suggestions for approaches to achieve them (Picciano 2009, 11). Multi-modal learning in higher education is a growing phenomenon world-wide (Picciano 2009, 11–13). The term 'multi-modal' is often used interchangeably with blended learning. Halverson et al. (2012, 383–387) define blended learning as any combination of different methods of learning, different learning environments or different learning styles. This concept of multi-modal learning is not yet properly defined, but it can be broadly defined as the use of a wide variety of technology/media integrated with conventional face-to-face classroom activities (Picciano 2009, 11–13). This concept of multi-modal learning is often used by educators without even realising they do so (Picciano 2009, 11–13). In this course, a variety of media was integrated in a flipped classroom approach where students engaged with multi-media study material both during face-to-face sessions as

well as during individual homework sessions. Students also engaged in face-to-face learning activities and on-line learning activities.

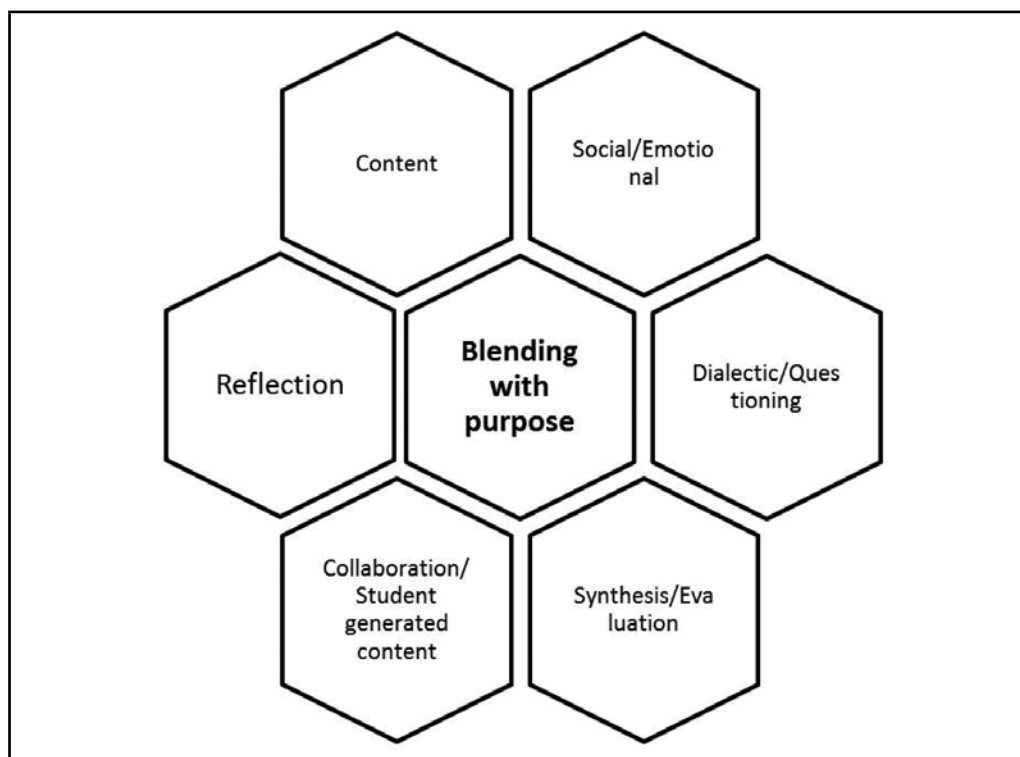


Figure 1: Picciano's multi-modal learning model for blending with purpose

Picciano clearly states that it is up to the lecturers (teachers) to decide on the approaches suited to their context (Picciano 2009, 11). Table 1 describes the way in which I used Picciano's model to give structure to my flipped classroom. The students used the multi-media to prepare for class. Before each class they were required to write a short test on the Learning Management System (LMS). During the class the outcomes for the specific class were given and from there we used various techniques to stimulate thinking and find information. These activities ranged from playing memory games, having debates, knowledge cafés or practical classes. After each class, the students gave feedback and I summarised the content that was covered in class, and information generated by students. Details were provided on what they needed to prepare for the next class.

Table 1: Applying Picciano's multimodal learning model for blending with purpose in the classroom

Picciano's model	Content	Social/Emotional	Dialect/Questioning	Synthesis/Evaluation	Collaboration	Reflection
Application	Multi-media Textbook Webpages	Face-to-face classes Facebook	Worksheets Direct question answering	Portfolios Assignments Multiple choice tests	Expo Knowledge Cafe – final combined answer	Looking back and summarising learning Reflective summary as part of portfolio
Where applied/ used	Content was supposed to be studied before class	Content was discussed in light of outcomes Groupwork was done Communication on Facebook	In-class Homework	Throughout semester End of semester as summative assessment	During classes Expo was part of summative assessment	After every class Part of summative assessment
Methods used	Online and offline	In class direct contact Online contact	Written sheets Online assessments Direct questioning Game show type questions	Online assessment Handed in e-portfolios or written portfolios	Student generated health message in the form of an expo Combined answers written out and posted online on LMS	Reflective summary after each session journalled Written reflection in portfolio Reflection in class on learning by means of feedback/ summary

Even though this approach is based on a well-structured educational framework, it does not mean that the way of implementation that I had chosen was effective. Furthermore, the whole concept of multi-modal teaching and flipped classroom approach at my university is something new and not quite established yet. This sparked the research question as to how does using a custom-made multi-media product in a flipped classroom influence students' learning experience? Did we meet them in their time at their level? Did they engage with the study material? Were they better motivated to come prepared to the classroom? In the following section, I describe the process of how I went about answering the research questions.

3. METHODS

3.1. Selection and description of participants

The study made use of a convenience sample based on a voluntary basis of all students who attended the course. The total number of students registered for the course was 122, but due to voluntary participation, not all students participated in all the data generation activities. The number of participants will be indicated for each activity.

The study was conducted in a second-year introductory nutrition course at a comprehensive South African university. The nutrition class was comprised of students majoring in different areas of Health Sciences, such as Nutrition, Dietetics, Consumer science, Human Movement Science and Physiology. Ethical approval for the study was obtained from the University Institutional Ethics Committee. Permission was obtained from the head of the department in which the students were registered. Students were informed about the purpose of the study and the confidential and anonymous handling of the data. Participation in the data gathering was voluntary.

3.2. Study design

The study was conducted according to basic design-based research. Design-based research is a systematic, but flexible methodology, aimed to improve educational practices through iterative analyses, design, development and implementation, based on collaboration among researchers and practitioners in real world settings (McKenney, Nieveen and Van den Akker 2006, 72). In this study I worked collaboratively with an educational researcher and an instructional designer to plan, design, implement and evaluate the process. I made use of a partially mixed sequential equal status research design. The research was conducted in sequential phases, with an initial quantitative phase, followed by a second quantitative phase and a qualitative phase (Leech and Onwuegbuzie 2009, 265–274). This provided informative rich data and a form of triangulation. Students' formal and informal feedback was included during all phases.

4. MEASURING INSTRUMENTS AND GATHERING OF DATA

For the initial quantitative phase, students completed a pre-course Likert-type questionnaire to determine their perceptions and expectations on the use of digital study material. The questionnaire was tested for content validity, by using the expertise of an experienced educational researcher with a nutrition background. The questionnaire was then tested for face validity by using a different group of students, who were not taking the course, but were also enrolled in the nutrition programme. This was followed by a second quantitative phase of weekly on-line polls completed by the students. The in-time online polls were used throughout the course when a single relevant question was posted on-line at a specific time. In addition, students had the opportunity to reflect on their experiences. Throughout the semester this was either e-mailed to me or posted on the university's LMS. We also made use of a more formal reflection during the assessment, of myself as the lecturer, which was conducted by our administrative assistant to make sure no element of intimidation was present. The quantitative data and qualitative data were continuously analysed and used to interactively redesign the electronic study material and tweak the teaching approach. In the final qualitative phase at the end of the semester, in-depth focus group discussions with the students gave information on the students' experiences of this multi-modal approach in the flipped classroom. The focus group interviews were conducted by an independent educational researcher, without the lecturer (me) present, to determine the true experiences of the students. The focus group questions were based on the results of the questionnaires as well as the student feedback, narratives and course polls. All interviews were recorded, transcribed and analysed. The size of the focus groups varied between 6 and 8 members. Data saturation was achieved after three focus group interviews.

Table 2: Informal anonymous questions polls answered by students on the LMS

Questions	Possible answers for respective question	Outcome(n=122 for total group)
The preparation tests before class help me (n=99)	Agree	85%
	Disagree	15%
I prefer the lecturer teaching and us listening without having to work and be prepared. NO class discussions (n=85)	Agree	37%
	Disagree	63%
After doing group work in class I feel that it enhances my learning experience (n=73)	Agree	60%
	Disagree	40%
I find it hard to prepare for class (n=92)	Agree	59%
	Disagree	41%
I find the class activities fun and enjoyable (n=72)	Agree	51%
	Disagree	49%
I always come prepared to class	Agree	69%
	Disagree	31%
The e-guide helps with preparation (n=88)	Agree	79%
	Disagree	21%

4.1. Data analyses

1.1.1.1. Quantitative data

The data from the pre-course questionnaire were analysed using standard descriptive statistical methods with the Statistical StatSoft® program (2012). The results from the in-time polls were captured as frequency of answers (yes/no), from which I made decisions regarding the following week's teaching.

1.1.1.2. Qualitative data

Comments, reflections and discussions as communicated via e-mail or the LMS to me and the instructional designer, regarding the practical implementation of the redesigned course were noted and influenced our decision making during further planning, redesign and problem solving. The focus group interviews were analysed according to a deductive analysis approach (Elo and Kyng 2008, 110). We coded the focus group discussions and other narrative data according to themes identified as negative expectations, experiences

and challenges and positive expectations, experiences and opportunities that students mentioned during the focus group discussions.

5. RESULTS AND DISCUSSION

Table 2 lists the questions asked in the polls. The compliance of students answering the informal polls was high, varying from 67 to 77 per cent. At the beginning of the semester, the students were informed that they would receive an electronic study guide for this specific module. Seventy two (72) students voluntarily completed the pre-course questionnaire online. Table 3 presents the perceptions of the students regarding electronic study material before commencement of the course.

Table 3: Pre-test of expectation of electronic study material

Questions	I find it easy to work in a virtual environment	I have never worked with an e-guide before	Electronic study material may make things easier	Electronic material will make studies more difficult	I prefer a hard copy over electronic content
Strongly disagree	6.94	6.94	4.17	23.61	4.17
Disagree	11.11	2.78	2.78	36.1	20.83
Unsure	26.39	2.78	16.68	20.83	16.67
Agree	30.56	13.89	41.67	19.44	41.67
Strongly agree	25	73.61	20.83	0	16.67

Results from the pre-course questionnaire indicated that about sixty per cent (59%) of the students preferred a hard copy study guide; indicating a somewhat initial negative attitude towards electronic study material. Although 83 per cent of the students had access to computers, most (88%) have not interacted with an e-guide or multi-media before, indicating that multi-modal teaching and learning were unfamiliar for them. This was supported by the fact that only forty per cent (40%) of the students were unsure or agreed on the statement that electronic study material could make their studies more challenging. Findings from the focus groups supported the results from the pre-course questionnaire and the polls, during which the students explained that, prior to the course, they had no idea what an e-guide was, what it looked like, or how they would interact with it:

I thought it was going to be just like an ordinary study guide, just on a disk and not in paper format. I did not think is going to be so creative as it was, I thought it was just going to be a digital book.

Some students afterwards indicated that they still preferred hard copy course material. This may be due to their learning styles, as they preferred to take notes with pen and paper:

I print in any case everything out, because I write on it.

If I take it (the study guide) to class and the lecturer says bullets 1 to 3 are important, then I can mark it in the book, where electronically I can't do that.

I study and learn by writing. Like I said, you see in class all the time people making notes and adding comments. I think the notepad and tablet is a great thing, but I am a person who likes writing stuff down.

An important criterion for implementing a successful flipped-classroom approach is that students should take responsibility for their learning, thus coming prepared to classes. When asked during an informal poll about their preparedness in order to participate effectively in the flipped classroom, 69 per cent indicated that they did not come to classes prepared. This perception changed over time, as in a later similar poll, 79 per cent of the students agreed that the e-guide made preparation for class fun and a prerequisite. The motivation for class preparation was found in the focus group results:

You just could not take part in the class if you did not do it (prepare). She taught her class by asking questions and opinions, and if you did not prepare, you did not really know what was going on. You listen and still learn something, but you cannot take part in the class discussions.

It was quicker [to prepare for class] than when they tell you to go through study unit 1.3 and then you have to go through this long thing while you still had to do assignments and tests in other subjects. So you just go through the e-guide – it is much faster and understandable so it takes less time.

I work with my text book for assignments and tasks, but I do not learn so much. I will much rather look at the video, and when I see something interesting, I will go and read more in the text book.

With the flipped classroom approach I wanted students to be able to access and engage with the material prior to the face-to-face sessions, and to prepare for problem-solving activities during the face-to-face sessions. These problem-solving activities usually included some form of group work. In a poll about group work, 60 per cent (n=73) of the students agreed that group work enhanced their learning experience. The student feedback on the lecturer evaluation also indicated that the students enjoyed the way in which classes were held.

With regard to the students' expectations tested in the pre-course questionnaire, in terms of working with the electronic study material, 19 per cent of the students expected that electronic material would make their studies more challenging (Table 3). Seventy-six per cent (76%) suggested that added video material and animations could help them understand difficult concepts better, thereby indicating that the majority of

students expected that the electronic guide would be helpful. Results from the focus group confirmed that the students in fact did find the electronic guide helpful:

I understand it better with the videos and the other media on the disk, a person understands better what is going on there

... but on the e-guide everything is there, so you do not forget to look at it, so the videos helped a lot.

The focus group discussions showed that students were initially not positive about the e-guides, anticipating problems regarding access to Internet and the relating cost involved in order to access the content. At the beginning of the semester, the lecturer posted the guide to the university's LMS. Students experienced many technical issues with the LMS as they were not able to download the content and the course content was not accessible off-line. Due to these issues, the e-guide with the multi-media components and activities were copied to a DVD to increase students' accessibility to course content. This provided the students with the opportunity to access the e-guide anywhere, anytime, on devices that could incorporate a DVD. This solved the problem for students who could depend on Internet access for the course content. However, this action limited the portability of the course content to some extent:

Because with a textbook you can sit anywhere and try and figure it out, with this you have to sit at a computer. I don't know, this is my experience! With a textbook I can sit anywhere. But I think that if you could have the guide on a tablet in the class and you are forced to work on something in class that you have to submit after class it will work better.

A small percentage of students (5%) did not personally own any technological device to access the material. However, they had access to computers on campus networks. Although the lecturer ensured that the study material was nevertheless available in hard copy format and could also be used in the class, some students were of the opinion that it placed them at a disadvantage, not being able to use the interactive multi-media material. During the poll, the students (78%; n=69) also indicated that they would have liked to have better access to the e-guides in class, as the Internet was not available in classes for access to mobile devices.

1.1.1.3. Experience of the lecturer

Compiling and formatting the interactive study material in an e-format was time and labour intensive. The instructional designer considered various aspects: which elements will add value when animated; which elements were nice-to-haves; how much content to include; how many references should be provided; and would a video clip be more appropriate than a scholarly article. As the subject matter expert, I had to give up some of my ideas to make the guide more interactive, but I also learned a lot about effective learning with electronic material. Once the master copy was compiled, constant

developmental changes were made during the implementation phases, based on feedback from students, or technical challenges relating to the university's IT infrastructure.

I had weekly meetings with the instructional designer to discuss the changes. My ideas often had to be changed or modified, as they could not always be executed as anticipated, due to numerous technology issues. For example, the current LMS are not able to stream the multi-media; there were problems with the streaming of the content that resulted in the last-minute decision to provide the content to the students on a DVD. Although this seemed as a solution, further issues arose with this decision. Lecturers who attempt the use of multi-media, face extensive technical barriers. Close attention will be paid to these issues in terms of future development, as well as the introduction of action plans to address them.

It was not possible to test for significant differences between the pre-test and post-test due to students' weak compliance with the post test. Yet, as the semester progressed, a positive trend could be seen in the impact of using a multi-media e-guide on the flipped classroom approach. Overall, the implementation of multi-media proved to be valuable. I observed that students prepared better for class, they were more engaged in class activities, and additional time was allocated to application and problem solving rather than lecture-centred information sharing.

6. CONCLUSIONS AND RECOMMENDATIONS

In this study, a traditional face-to-face course in nutrition was re-designed according to Picciano's model for a multi-modal flipped classroom approach using custom made interactive multi-media study material. Students were confronted with not only a new method of teaching, but also the integration of learning technology. For many this was a paradigm shift from what they were used to (passively listening to lectures), to accepting the responsibility to come to class prepared and being involved in active learning. The general feeling was, however, that the animations and interactivity of the e-guide improved their experience and understanding of the course, and that the e-guide enhanced their learning. This was of significance to me as a lecturer who designed the multi-media, as it confirmed that custom-made multi-media tools are beneficial to student learning. Regardless of the many mind transitions the students had to make, evidence suggests that the multi-modal learning, combined with a flipped classroom approach, had a positive effect on the nutrition students' learning experience.

Based on the findings of this study, we can conclude that the multi-modal model learning provided an integrated model that could be applied effectively using the flipped classroom approach in an introductory nutrition course. In this case, blending truly became a palette of different colours of paint that together created a canvas of new learning environments (Picciano 2009, 13).

This study also identified important barriers that need to be addressed at the institution where this course is presented, and for lecturers from other institutions to

take cognisance of too. Close collaboration between the lecturer and an instructional designer is critical throughout the design, development and implementation process. The goals and objectives of activities built into this environment should be clear-cut and well thought through, not only in terms of educational approach, but also from a technological perspective. Technical issues regarding the mobility of the multi-media, Internet access, and the institutional infrastructure should be a campus-wide consideration to ensure students' optimal engagement in a multi-modal flipped classroom approach during contact sessions and during off-campus learning.

7. ACKNOWLEDGEMENTS

This research was funded by the North-West University. The study design, data collection, analysis or interpretation of data, the writing of the report or the decision to submit the article for publication was not influenced by the funder. The authors wish to acknowledge Ms Liana Venter for designing the multi-media and giving valuable lessons in the field of instructional design.

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