

Learning to Surf: Explaining the Flipped Classroom (FC) to Science Students Using an Analogy

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Abstract Most of the literature in educational technology targets academics, educational designers, and policy makers. To date, there are no scholarly papers which help students to understand and ‘buy into’ educational technology. We expect students to engage with contemporary ways of teaching and learning, without fostering any attitudinal change. According to the current literature, Flipped Classrooms (FC) have become increasingly popular in higher education since 2012. Research done in this field has increased considerably in the last four years, judging by the number of scholarly published papers across different disciplines. A review of the literature indicated the implementation of FC suffers from several deficits, such as a rigorous and consistent approach, effective theoretical frameworks, and evaluation structures. Research is also pointing to the need to support students in transitioning from traditional classroom style to FC. To facilitate this transition, a communication strategy is required to help students adopt this model of learning. It is in the best interest of educators to ensure that students understand the rationale behind the FC. This paper outlines how the FC can be explained to science students using a ‘learning to surf’ analogy.

Keywords: *flipped classroom, flip learning, flipped learning, inverted classroom, analogy in education, metaphors in education, science education*

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1. Introduction

Flipped classroom (FC) is a pedagogical and instructional approach in which the learning is student-centred rather than teacher-centred, and enhanced by technology [1]. A flipped classroom allows the transformation of the transmissive lecture into a program of pre-class preparation, in-class tasks, and post-class work [2]. FC was popularised in 2007 in high school chemistry classes, where PowerPoint with audio was uploaded by teachers and students were asked to watch the upload outside the classroom. When they returned to the classroom, they engaged in activities based on the pre-class preparation [3]. The key ingredient of the FC approach is ‘active learning’ [4,5], where students ‘learn by doing’ rather than being passive. The validity of this approach was substantiated in a recent meta-analysis (225 studies) that revealed an increase in grades and reduction in failure rates in undergraduate STEM disciplines which use active learning approaches when compared to traditional lecturing [6].

They are many advantages of the FC for students. It offers flexibility and more time to consolidate ideas so that education can fit in around their busy lives [7]. The FC approach encourages students to gather, select, evaluate, and interpret information, and to develop independent learning skills [3,8]. It helps them to develop

a logical and analytical approach to problem solving [9], [10]. When FC interventions are designed thoroughly, pre-class preparation (online content) is connected to face-to-face activities and aligned with assignments [1]. During class, students have the opportunity to ask difficult questions of instructors [11] and apply knowledge in a collaborative ‘learning by doing’ environment [7,12]. The flipped classroom may also help students with English as an Additional Language (EAL) [8,13], and lead to better management of working memory [14].

The literature reports some obstacles to implementing the FC. From the educator’s perspective, getting technology skills and access, and developing appropriate digital resources can be difficult and time-consuming. Developing active learning activities for the classroom also requires sound pedagogical approaches and evaluative strategies. From the student’s perspective, the capacity to engage in self-directed learning and do homework, and the willingness to change from passive to active learners, may also be challenging [15].

A search of the FC literature since 2012 returned 445 publications (429 peer-reviewed journal papers and 16 conference proceedings). Fifty-three percent of the research carried out was in science disciplines. Most of the literature on FC refers to case studies, and none of them rely on particularly rigorous research designs. Research in the area of science includes: Pharmacy [16,17,18], Medical Education [12,19], Biology [20,21], Organic Chemistry [22,23,24], Nursing [25,26], Engineering

[27,28], Physics [29,30], Nutrition [31], Agriculture [32], Linear Algebra [33], Computing [34], and Veterinary Science [35]. Other examples include Education [36,37,38], Sociology [39], Languages [13,40], Law [41], Digital Media [42], and Tourism [43].

There is limited evidence-based research on the effectiveness of FC [2]. Flipped classrooms are considered to be under-evaluated, under-theorised and under-researched in general [2,44]. A scoping review concluded that there is no single framework used to implement all FC, but the literature highlights common features. Content is delivered in advance using pre-recorded materials, educators test students' understanding of the material, and promote higher-order thinking activities in the classroom [45]. In the mean time, educational institutions are rolling out the FC model, even if there is no strong evidence of its effectiveness. Haste is sometimes the price of innovation. As educators, we need to make students' learning experiences relevant to the 21st century. The absence of evidence of benefit is not evidence of absence of benefit, and it is widely considered that the evidence is still coming in [46].

However, the literature does reveal that students need support in transitioning from traditional classroom style to FC, to 'buy into' the new instructional model. This support can be achieved by communicating to them the advantages of the FC and how it will develop their thinking skills [11,31,43]. Assuming that students will automatically see the benefits of the FC may threaten the success of its use. Communicating and setting up expectations for students to 'buy into' the FC is essential [47]. The purpose of this paper is to explore how to best explain to students the benefits and workings of the FC model by using an analogy.

2. Teaching with Analogies

An analogy is a comparison of certain similarities between objects, ideas or events and has two components: the analogue and the target. The analogue is the familiar situation and provides a model through which learners can make assumptions and inferences about the unfamiliar or new situation or object, called the target [48]. The value of analogy in teaching lies not in any absolute measure of the similarity between the target and the analogue. Rather, the worth of analogical analysis lies in the mental inquiry it promotes, the knowledge produced by this inquiry, the cognitive engagement of the learner, and the communication produced. For an analogy to be productive in teaching and learning scenarios, it should be contentious enough to provoke and challenge thinking but agreeable enough to resonate with others' experience of the phenomenon under study [49].

The role of analogies in the learning process has been analyzed from several theoretical perspectives [50]. It has been used successfully in science education [51,52]. The literature reports analogies to be effective in prompting students to build understanding in two ways: through hands-on interactions with tangible resources [53], or by making conceptual links between familiar scenarios or events [54].

For the purpose of this paper, the analogue or familiar situation will be the different ways of learning to surf, and

the target will be the different ways to learn in higher education. The idea is to provoke inquiry and the cognitive engagement of the learner to visualize why the FC could be an excellent way to learn the subject content. It should also highlight how FC develops individual inquiry, collaborative effort, social interaction, cultural diversity, self-direction, and encourages students to take responsibility for their learning [3,8].

3. The Analogy

We tell the students, we are proposing the following scenario: imagine going on holidays, and deciding to learn to surf. When going to the surf school to request information, you are given the following choices:

3.1. Option 1: Learning to Surf by Lecture

This option includes a couple of hours with the instructor in a classroom setting. Students will be learning the theoretical underpinnings of surfing, from the physical principles of positioning the body on the board to paddling and postures. Students will also learn how to choose an appropriate board, wetsuits, and accessories. They will also learn characteristics of a good surf beach for beginners, how to check surf reports and forecasts, surf etiquette, exercises to develop endurance in the water, and so on [55,56,57]. With this option, students are passive learners [58], as they will be watching the instructor and then trying to reproduce what they have learned when they have the chance to go to the beach. If this occurs several weeks later, students may forget what they have learned, as it was not reinforced with practice. Being able to maintain motivation and attention in a two-hour lecture may also represent a challenge [59]. This type of instruction is teacher-centred, the traditional transmissive lecture [60]. This way of learning may suit students who expect to remain passive in an osmosis of information [61].

3.2. Option 2: Learning to Surf by Lecture and a Practical Lesson

This option includes the classroom and a two-hour lesson at the beach. The instructor will teach the students *in situ* how to lay on the board, how to paddle, how to position their feet on the board, balance the body and finally how to 'pop-up' (stand) on the board [55,56,57]. In this option, students are active learners [4,5]; they have the opportunity to practice what they have learned on the spot. However, if they do not understand a posture or movement, they will need to ask the instructor for further clarification. Students may get overwhelmed and get lost easily. This may occur because of the several steps involved in the process leading up to the pop-up and the limited capacity of working memory [14]. This type of instruction is still teacher-centred, but with the advantage of a practical lesson [60].

3.3. Option 3: Learning to Surf by Pre-lesson Material, and a Practical Lesson

This option is slightly different; the instructor prepares a set of videos online that students can engage with in their own time in the week before going to the practical

lesson. Students have the advantage of deciding when and where to learn, using their mobile devices and controlling the video via play/pause/stop buttons. In these videos, they will not only be learning theoretical concepts, but the instructor will also give them tips and positions to practice from home. Students will be testing their balance and flexibility skills before the practical lesson. In this case, they will have an active role in the process of learning and can practice as much as they want while watching the videos. The students will be independent learners, able to decide how much they engage with the material. When they go to the lesson, they will be prepared and perhaps able to pop-up straight away. If the first attempt fails, the instructor can look at their technique and give them individualized feedback to improve it. This type of instruction is student-centred and is considered in many disciplines to be superior to the traditional way of learning [62].

The analogy discussed here has been documented on a video vignette on YouTube called 'The Flipped Classroom Explained with Learning to Surf Analogy' developed by our team in Honolulu, Hawaii.

4. Discussion

We predict students will learn better with option three, for the following reasons. First, they will have the flexibility and time to practice surfing positions at home and can fit learning into their busy schedules. Second, students will be able to select, evaluate, and interpret the information in the videos before the practical lesson, and thus develop independent learning skills. This method of instruction will help them to develop a logical and analytical approach to problem-solving in surfing techniques. They can ask difficult questions and seek the instructor's feedback on the spot while applying the skills learned from the videos during the practical lesson (active learning). They can interact with other students, helping each other to succeed, and reinforce their technique during the practical lesson. For students with English as an Additional Language (EAL), the use of video provides real advantages, as they can replay them as many times as needed. Finally, in this mode of instruction students can better manage their working memory, avoiding the cognitive overload which typically happens in lectures. This option constitutes a flipped classroom approach that students will be exposed during their studies in a higher education institution.

A saying of Confucius summarizes the advantages of the FC and active learning: 'Tell me, and I will forget, show me and I may remember, involve me and I will understand.'

5. Conclusions

The surfing analogy is a good way to explain how FC works. It is in the educators' best interest to communicate about FC to students so that they buy into and engage with this innovative and contemporary mode of instruction. Like any sport or activity, learning to surf takes time, patience, and physical coordination. Similarly, getting used to FC takes time and perseverance. Students may not

like it at the beginning, but after some experience, they will get used to it and develop lifelong learning skills which will help make them successful professionals.

This paper has been written to help science students to understand the FC; the educator can share the video to trigger students' attention, then ask them to read this paper and reflect with their peers. An activity can be easily built around this paper, for example, allocating students to small groups to discuss in class which is the best learning option for them. A discussion board can be set up inside the learning management system. This paper and the video can be used in any discipline as a teaching tool to engage students with the basic concepts of flipped classrooms. It also has the added advantage of helping educators better understand how the FC model work if they are attempting to encourage their colleagues to adopt these contemporary practices.

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