Qualifier Question (Spring 2018)

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Question

My mentor Jace van Auken asks:

Video games are one way teachers have worked to make their subject matter appeal to students. Describe some other strategies used to accomplish the same. What pedagogies exist in these strategies? For each strategy what are/were the successes? What are/were the failures? Identify similarities and differences between each.

Introduction

For the past few weeks, my research has revolved around educational games (or serious games). It is one strategy teachers use to make their subject matter more appealing to students. This drives engagement and makes learning more effective. However, teachers have other strategies that can do the same without including serious games. In this paper, I will analyze these other strategies. For each strategy, I will discuss the pedagogies used and its successes/failures. After analyzing all strategies, I will conclude by comparing all strategies to each other. Note: there are countless strategies that teachers can use, but I trimmed it down to five I found interesting.

Strategy 1: Self-Determination Theory

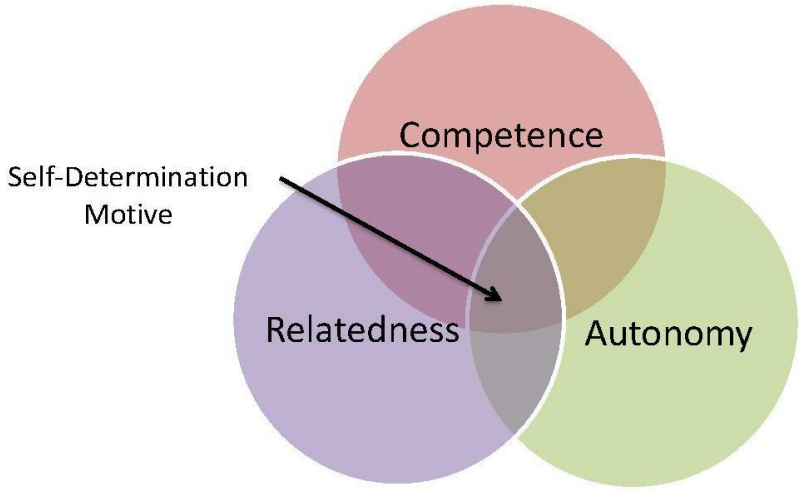
Background

Along with STEM, gender issues are prevalent in physical education (PE). Research[1] shows there is a large proportion of girls inactive during PE classes. A combination of social, behavioral, and environmental reasons contributes to this disengagement. Additional research[2] indicates that girls feel that PE classes are geared towards boys and are far too competitive in nature. Girls see physical activity (PA) as a leisure pursuit whereas the activities in traditional PE classes do not align with this[3]. This alienates girls from PE classes and therefore makes the subject matter less appealing.

Theory

The Self-Determination Theory[4] (SDT) suggests that educational motivation is heightened with the fulfillment of the needs of autonomy, competence, and relatedness in students. SDT is a form of self-regulated learning. Self-regulated learning[5] is when students are metacognitively, motivationally, and behaviorally active in meeting their educational goals. Focusing on improving the student's competence (and perception of competence) by giving suitably challenging activities with some degree of choice will then lead to intrinsic motivation. Note that just giving a choice will not change the engagement level. It

is by creating a more supportive and enjoyable environment that you will have students be more engaged.



Source: Deci, E.L., & Ryan, R.M. (2000). The "What" and "Why" of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry, 11*, 227-268.

Study

This qualitative longitudinal study[6] took place in Scotland from 2008 to 2011. The target group was girls with age range of 11 to 16 across four schools. The girls were surveyed about their disengagement. The teachers then created a list of possible activities which girls mentioned they wanted. Note, there was only a limited set of choices possible for the PE facility due equipment limitations. For each PE class, there would be observations made and interviews conducted. The results were mixed with success and failure. There were students who had increased perceived competence. These students had their friends supporting and encouraging them. Additionally, the friends would help teach how to do the PA. This ties in with social learning. However, there were students who maintained their low perceived competence. Some students felt like they still weren't good enough for the PA compared to the more athletic girls in the class. Additionally, students believed some PE teachers showed favoritism to some students. The teacher-instructor relationship building was a part of relatedness in SDT, but it seemed to have caused an issue for students who did not have that relationship built. This could be due to the large number of students and small number of teachers.

Strategy 2: Five Acts of Instructional Behavior Framework

Background

Singapore's Ministry of Education encourages teachers to provide students with greater choice of ownership in learning. This is so students can engage in class using inner goals or intrinsic rewards.

Theory

The Five Acts of Instructional Behavior[7] (FAIB) is built using SDT. Its goals are spark intrinsic motivation within students. Let's breakdown FAIB:

Act	Behavior
1	Nurture inner motivational resources.
2	Provide explanatory rationales.
3	Rely on informational, noncontrolling language.
4	Display patience to allow time for self-paced learning to occur.
5	Acknowledge and accept student's expression of negative effect.

Study

The study[8] developed and evaluated a 5-week school-based intervention program that influences student's motivation in STEM courses. Using project-based learning, teachers provide explicit goals for the activity to drive inner motivation. There were 2 environments: one that applies FAIB and one that does not (as the control). The FAIB environment would do the following:

Act	Contextual Behavior
1	Use activities that were based off the student's interests.
2	Offer rationale when students had to engage in uninteresting aspects of the activity.
3	Teacher's intervention must be informative and non-controlling to promote autonomy.
4	Display patient for student's attempting unfamiliar tasks.
5	Teacher must accept and welcome negative emotions about the activities

These are specialized variation of the five acts. Notice that act one is similar to personalized learning. Participants included 393 secondary students (213 males, 175 females, 5 unspecified) from 8 schools with the age range of 13 to 17. The results were the following:

- Increased perceived autonomy-support, competence, and relatedness in experimental group.
- Experimental group showed higher self-efficacy and self-regulation.
- For experimental group, effort and intrinsic interest in subjects were maintained throughout the five weeks. For the control group, effort and intrinsic interest decreased over the five weeks.
- Control group's grades dropped. Experimental group grades maintained.

This study had clear successful results with no real failures. The only "negative" is that the use of FAIB requires some restructuring of classes.

Strategy 3: Augmented Reality

Background

Augmented reality (AR) is an emerging educational medium that has been recently popular amongst grade schoolers, but the educational community is unsure about it's usefulness in effective learning.

Theory

AR technology is ideal for simulation-based learning[9] (SBL). SBL is a technique which replaces real experiences with guided, immersive, interactive, virtual ones. SBL can be the way to develop theoretical skills in an environment which allows simulated practice.

Study

The study[10] was an analysis on 26 publications which compares AR to non-AR applications in an educational setting. In general, the student's motivation to learn was much higher using AR over the non-AR alternative. Additionally, even if the AR was more difficult to use over the non-AR alternative, students still found the AR application more engaging. AR succeeded in driving engagement, but it did have some technical downfalls:

- Attention tunneling occurred when the students using AR would ignore error messages as if they were generic Windows error prompts. The loss to detail hinders the learning experience because the error messages had vital information on them (especially in medical simulations).
- Other than being difficult to use the AR (which didn't really seem to be a problem for the students), it was very difficult to integrate AR into the classroom effectively.
- There were major learner differences amongst students. Students with low or average grades benefited from using AR, but students with high grades did better with non-AR applications. This could be because high grade students have already mastered the non-AR application format or that it caters to their learning styles.

Strategy 4: Storyline

Background

Originating from Scotland in the 1960s, Storyline is a social constructivist, cross-curricular education technique where a fictional world is created to teach first and second languages with support of other subject matters. Currently the Storyline program targets all age groups across the world.

Theory

Storyline is cross-curricular meaning it teaches multiple subject matters at once. Although the primary goal is to learn to read and write a language, the student will also learn to do STEM and art in that language. Storyline uses task-based learning (TBL). TBL is when learners work on meaningful tasks which require the use of the subject matter to be learned and resulting in a concrete outcome. Note, these meaningful tasks do not necessarily relate to one or another. In Storyline, all tasks are under a single context (or story). Additionally, Storyline uses social constructivism. Social constructivism[11] emphasizes on the cultural context in learning about what happens in society and constructing knowledge based on what is learned. Social constructivism is a combination of social learning and constructivism.

Study

The study[12] observed a 5-week program with 32 Swedish children (ages 11-13). The goal was to teach English (along with match, science, and art) to the children. The children would interact with teachers in a guided and story-driven educational experience within a home/classroom. There are two key elements to this experience:

1. The children would be given slightly open-ended tasks.
2. The children got a chance to observe how the teachers spoke to each other as the story progressed.

An example for number one would be “how can you live in a more sustainable way?” The students discuss on how they would solve the problem. There is no one single correct answer. This seems to be a form of problem-based learning. Groups of four will have a set of tasks to complete. Two hours a day, as the children worked on their tasks, new key questions are asked. These key questions revealed:

- Structure of the story.
- Introduction of developments.
- Links to the curriculum.

Data collection included student’s journals, self-assessments, recorded interviews, and observations. The results were successful. Students found the program fun. The students showed an increased ability to understand the spoken language. Students not only learned to speak within the groups but to the whole class as well.

Strategy 5: Lightboard

Background

There are two popular ways of recording a flipped classroom presentation:

1. Using a whiteboard.
2. Sharing or screen casting a PowerPoint.

Both techniques have major disadvantages. The first has the present’s body obscuring the content on the white board. Both lack proper human interaction between viewers and presenter. Both also require extensive editing. Lightboard is a technique where you film with a glass board and mirror while the camera faces the presenter. Its goal is to address the problems caused by whiteboards and PowerPoints.

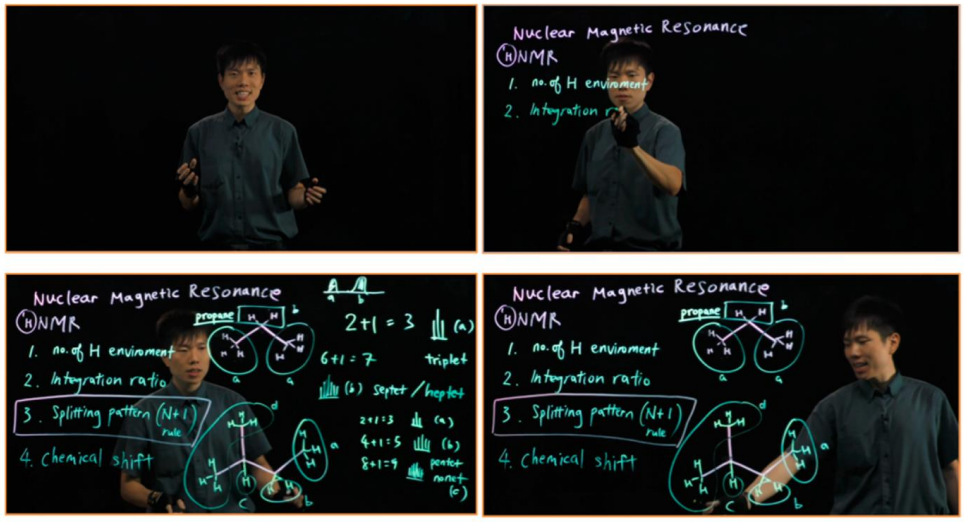


Figure 2. View of the presenter in the Lightboard video. Clockwise from top left: introduction by speech; commencement of writing; midway through the lecture; end of lecture.

Theory

Flipped classroom model is a pedagogy which starts outside of the class. Instruction is given through homework then consolidation with a teacher. Traditional classroom model is a pedagogy that does the complete opposite by starting inside the class. The instructions are given by the teacher then consolidation through the homework.

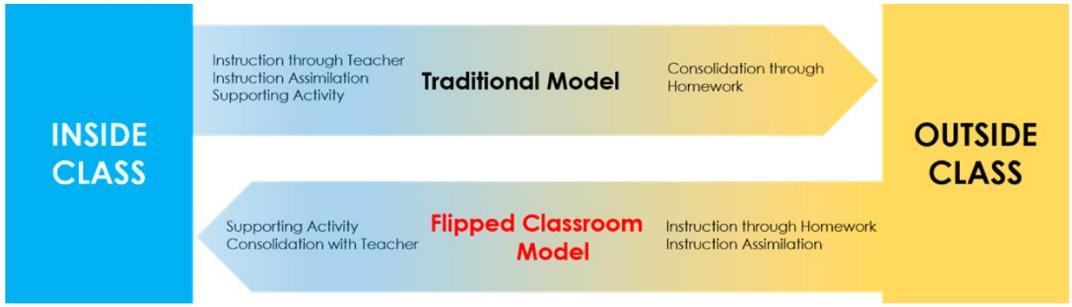


Figure 1. Traditional model vs the flipped classroom model.[10]

Flipped classroom model uses the self-directed learning pedagogy. This is when students actively engage in the learning process rather than being passive learners. Learners often do the same with Khan Academy and Georgia Tech's OMSCS presentations.

Study

The study[13] uses lightboard to teach an intro to organic chemistry class (CM1401) such that it will engage chemistry students better by providing greater visual connection with the teacher. The study happened at the National University of Singapore and ran for about 2 years. There were a few rules the teachers had to adjust to:

1. Cannot wear jewelry or shiny objects during filming.
2. Have a script in mind of what is to be taught in the video prior filming.
3. Similar to a whiteboard, writing should be large.

The results for the students was successful. Students stayed engaged and enjoyed the Khan-styled video format with the eye contact from the teacher.

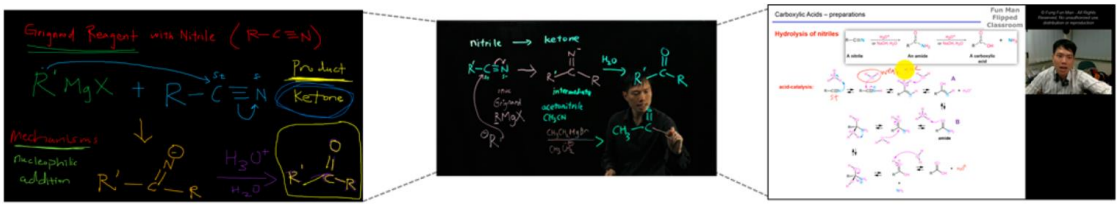


Figure 3. Both features of good lecture videos that students and lecturers wanted (left, Khan-style tablet writings; right, lecturer eye contact) were efficiently represented in a Lightboard video (center).

However, there were failures for the teachers. Teachers could not use physical model kits due to the light inversion used. Additionally, the content of the lecture had to be meticulously planned because the entire video must be recorded in one sitting to avoid need for postprocessing.

Comparison

Pedagogy

Below is a chart of each strategy and what pedagogy is used in it. The green represents that it's intentionally used, the yellow represents that it's influenced by or inadvertently used, and the orange represents it's not used at all.

Pedagogy	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5
Self-Determination Theory					
Self-Regulating Learning					
Intrinsic Motivation					
Inner Motivation					
Metacognition					
Social Learning					
Five Acts of Instructional Behavior					
Project-Based Learning					
Personalized Learning					
Simulation-Based Learning					
Cross-Curricular					
Task-Based Learning					
Constructivism					
Problem-Based Learning					
Flipped Classroom Model					
Self-Directed Learning					

As you can see, strategies 1 and 2 have a lot of overlap. This is because both derive their work from self-determination theory. Strategies 1, 2, and 5 use inner motivation to some degree. Strategy 5 uses it in synchronization with self-directed learning. As I researched, I looked for variety thus each strategy has a unique pedagogy used. Strategy 1 has metacognition, strategy 2 has five acts of instructional behavior, strategy 3 has simulation-based learning, strategy 4 has constructivism, and strategy 5 has flipped classroom model.

Other Features

Other than pedagogy, there are other features that are similar or different in each strategy. The green represents "yes", the yellow represents "sort of", and the orange represents "no".

Feature	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5
Requires Technology					
Engaged Students					
No Complications for Students					
No Complications for Teachers					
Applicable for More Than One Primary Subject					

Strategies 3 and 5 requires technology whereas the remainder did not. All strategies engaged students to some degree. Strategies 1 and 3 had mixed results depending on the student's learning needs. Strategy 1 had minor complications for students when students were in a class with competitive female students or did not have their friends with them. Strategy 3 was filled with AR technology issues for students. Strategy 1 had minor complications for teachers when it came to management of the new activities as well as avoiding accidental favoritism. Strategy 5 created major complications for using lightboard due to it's rigorous preparation. Strategy 4 really can't be applied to more than one primary subject since it's about speaking/writing another language. Although there were other subject matters used in support, it assumed the students were already knowledgeable in those subject matters and just didn't know how to apply it in another language.

Conclusion

I've discussed five different strategies on how teachers make their subject matters more appealing to their students. I've discussed the results and pedagogies that went into each strategy as well as comparing the strategies to each other. After learning the failures of each strategy, I know some key mistakes to avoid when considering the development of my educational game.

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