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Glossary

STEM – Science Technology Engineering Mathematics

Executive Summary

This report assesses Science Ventures learning strategies used to teach STEM based material to youth ranging from grades kindergarten through high school. This report will be covering the advantages and disadvantages between traditional learning and active learning strategies. Traditional learning strategies are the most predominantly used in education institutes. They are lecture based and focus on teaching facts and what the students are required to know. This type of learning requires the students to learn through the use of memorization and recitation techniques [1]. Although this strategy has stood the test of time it lacks by not helping the students develop crucial real-world skills such as critical thinking, problem solving, and working in a team. Active learning strategies has been around since the early 1900s, and it is based on engaging the students from a top-bottom strategy by having the students learn through the use of in-class written exercises, games, problem sets, audience-response systems, debates, class discussions, rather than a bottom-top facts based lecture strategy [2]. Active learning strategies have proven to be beneficial teaching strategy for STEM materials. Some evidence even supports that on average traditional lecture courses are 1.5 times more likely to fail than students in courses with active learning [3]. Students also have showed to gain greater confidence and appreciation of the material.

1. Introduction:

Science Venture is a non-profit organization that has been around since 1991. They are based out of the University of Victoria. They collaborate with schools, communities, and indigenous communities to deliver innovative STEM based programs to Vancouver Island youth, ranging from ages 5 through 18 years old. Their mission is "To inspire all Vancouver Island youth to explore their potential and discover their vital role in the world through life changing science, engineering, and technology experiences." They are a small organization that have been able to prevail by staying current with technology and by utilizing University of Victoria students for there predominate work force. They have adapted most of their workshops to use active learning strategies, however there are a few outliers, which use traditional learning strategies.

1.1 Background information:

Science Venture has several different types of programs they offer such as: school workshops, camps, clubs. This makes planning a curriculum exceptionally difficult because the curriculum must be so flexible to different variants like age, gender, and grade. Other barriers that they face is employee training, which is a consequence of using predominantly University of Victoria students as employees. This problem is somewhat a double-edged sword, as in they get a large variation in knowledge and perspective from

getting students from different faculties at the university and stay current because of the turnover of student employees.

1.2 Scope:

For this report, two different learning strategies will be assessed, which are traditional and active learning. These two different learning strategies will be generalized into two categories because there are so many variations and sub-categories; therefore, traditional learning will reference a lecture bottom-top based learning strategy and active learning will reference learning through a top-bottom application learning strategy. These generalizations will help in assessing the advantages and disadvantages associated with each of the different learning strategies. This will also be beneficial in determining, which strategy will be best suited for Science Ventures programs.

1.3 Problem Definition:

To determine which learning strategy would be most effective in teaching STEM base material to youth. The strategy should also be easily adopted by current and new employees.

2. Discussion:

To compare the two learning strategies in question, many factors must be considered.

An affect learning strategy must be flexible and able to work with a variety of youth of different ages, gender, grade, and cultures. It should also be able to motivate and engage the youth to explore the content further rather than scorn them away from it. Therefore, finding the most affect strategy encompasses being extremely versatile and capturing the student's interest to pursue the material more in-depth.

2.1 Different Learning Strategies:

The two learning strategies that are going to be assessed are traditional and active learning. The first part will discuss traditional learning and its advantages and disadvantages associated with it. The second part will discuss active learning and there advantages and disadvantages associated with it.

2.1.1 Traditional Learning:

Traditional Learning has been the predominate teaching strategy in educational institutes since the first university in the year 859 AD [1]. This teaching strategy is a bottom-top style because it requires mastery of facts given in a "need to know basis" lecture style from a teacher. Than reinforced by doing independent assignments outside of class.

Traditional learning has also been predominantly independent based with little to no group work.

This learning strategy typically consists of three steps:

1. Lecturing the students on the material that they will be required to know.
2. Students are responsible to use memorization and recitation techniques to reinforce the material.
3. Assigning problems to finally illustrate the functionality of the material.

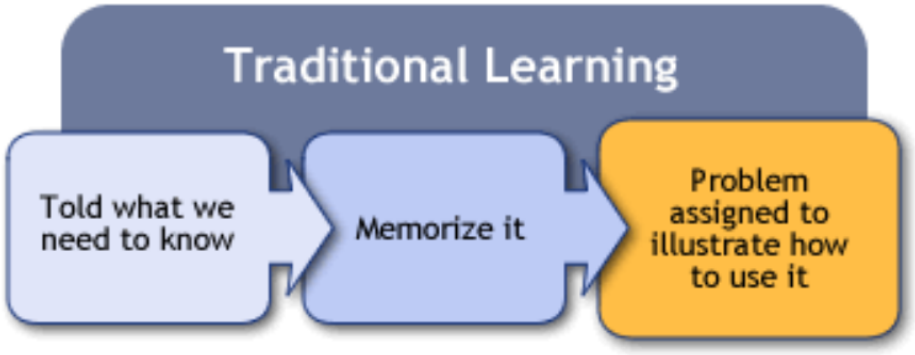

Figure 1 - Traditional Learning Strategy [4]

2.1.1.1 Advantages:

The following is a list of advantages for traditional learning strategies:

- Have been around for a millennium.
- Have lower overhead costs and time.
- Have proven to be a successful learning strategy.

2.1.1.2 Disadvantages:

The following is a list of disadvantages for traditional learning strategies:

- Primarily focuses on memorization and recitation techniques to reinforce the material.
- Increased failure rates by 55% over active learning. [2]
- Acquires less real-world employment skills.
- Students lose interest in material.

2.1.2 Active Learning:

Active learning has recently become popular term in education; however, the teaching methodology is not new. Professors form the early 1900s were emphasizing the importance of active learning strategies on student's knowledge of comprehension [1]. This method of teaching is a top-bottom style because it encourages students to learn through use of in-class written exercises, games, problem sets, audience-response systems, debates, class discussions [2]. Rather than focusing on memorization of facts, active learning encourages students to achieve higher-order objectives such as analysis, synthesis, and evaluation [3].

This learning strategy typically consists of four steps:

1. Introduce an idea and allow the students to explore it.

2. Guild the students into a discussion of the topic and allow the students to debate what they have discovered.
3. Present real-world problems to the students to reinforce their conceptualization of the topic.
4. Let the students present there finding to the class to reinforce their understanding of the topic, and gain communication, and presentation skills

Figure 2 - Active Learning Strategy [5]

2.1.2.1 Advantages:

The following is a list of advantages for active learning strategies:

- Students in active learning course are on average 1.5 times more likely to be successful, over traditional learning course. [3]
- Students showed enhanced performance levels and qualitative experiences. [1]
- Students gain valuable employable skills.

2.1.2.2 Disadvantages:

The following is a list of disadvantages for active learning strategies:

- Requires more preparation time for class.
- Requires change of curriculum.

3. Conclusions:

Traditional lecture strategies have predominantly been used for teaching of STEM material. Although affective through the test of time, may not be the best option for teaching STEM material. Active learning strategies have showed consistent improvements over traditional learning strategies. Students whom were enrolled in active learning base courses were 1.5 times more likely to pass the course. Students were also found to have better comprehension of the material and gain interest in the material [3]. Active learning also supports students developing lifelong skills such as, problem solving, critical thinking, and communication skills [1]. Although the implantation of active learning is greater than traditional learning. The evidence supports that active

learning would give the students greater benefits from there education and inspire them to dig deeper into the material. These results lead to the conclusion that active learning is a superior teaching method than the traditional learning method.

Science Venture already teaches mostly active learning bases material in their programs and have been successful. They should continue to change any lecture based material into an active learning based to support a greater student benefits from programs.

4. Recommendations:

In order to further explore the comparison between the two teaching styles, two different studies could be implemented. First a more in-depth study of the affect of active learning teaching style has on youth. Second a more direct study on the benefits towards the different STEM topics: science, technology, engineering, and mathematics.

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Trad image - http://gameagile.com/dissertation-project/

Active learning img - http://timothyharfield.com/blog/tag/active-learning/