International Journal of Multidisciplinary Education and Research – IJMER
Volume 2 : Issue 1 [ISSN 2475-2649]
Publication Date: 30 April, 2015

Exploring Innovative Teaching Methods

To bring up the interest of students to learn Physics in Malaysia in the near future

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Abstract — Currently, the Malaysian Physics curriculum aims to provide opportunities for students to acquire science knowledge and skills, besides developing thinking skills & strategies, and to apply this knowledge and skills in their everyday life, but also to inculcate in their noble values and the spirit of patriotism (KBSM, 2012). In order to achieve the objective of Physics curriculum of Malaysia, it is first very important to explore the factors affecting the interest and performance of Malaysian students in Physics, and from here identify the possible steps that can be taken to improve the situation. Some suggestions are given by the author for future methods that educators may implement to increase the number of students taking Physics in higher education.

Keywords—Physics, interest, innovative, creative teaching

I. *Introduction*

Physics is the study of matter, energy, and the interaction between them. It is undeniable that physics is an important study that forms the basis of most present and future technology. Physics is also an abstract subject and most people find it more difficult to understand and digest than the other two science subjects, which are Chemistry and Biology. This is one of the factors that led to a situation whereby students lack of interest in physics (Abd Karim et al., 2006; Lee, Yoong, Loo, Khadijah, Munirah, & Lim, 1996 – cited in Saleh, 2012).

Knowing that physics is one important basis of knowledge to move humankind to a more advanced future, and also to work towards Malaysia's vision of becoming a developed country by 2020, it is therefore important to recruit more students to take up physics. The number of students taking science subjects, especially physics or subjects relevant with physics at the higher education level have been declining year after year (Abd Karim et al., 2006 – cited in Saleh, 2012) and this is not only happening in Malaysia but globally. The alarming situation had aroused the concern of scientists and educators. Different methods had been studied and tested in bringing up the level of students' interest in studying physics.

Currently, the Malaysian physics curriculum aims to provide opportunities for students to acquire science knowledge and skills, develop thinking skills & strategies, and to apply this knowledge and skills in their everyday life, but also to inculcate in them noble values and the spirit of patriotism (KBSM, 2012).

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In order to achieve the objective of physics curriculum of Malaysia, it is first very important to explore the factors affecting the interests and overall performance of Malaysian students in physics, and from here identify the possible steps that could be adopted to improve the situation. Some suggestions are given by the author for future methods that educators may implement to increase the number of students taking physics in higher education.

II. *Factors that affect the interest and performance of Malaysian students in physics*

There are only a few researches being conducted on the factors affecting the learning of physics in Malaysia. Most of the researches done are on the problem of learning science as overall, not specifically about physics itself. The main factor affecting the students' performance in physics is the teaching method adopted by the teachers. If in terms of science subjects as overall, these factors include student's ability & talent, language, student's attitude, student's thinking skills, and social support (Talib, Luan, Azhar, & Abdullah, 2009).

A. Teaching method

Conventional teaching method by teacher is "chalk-and-talk", or teacher-centered learning where teacher is the one talking in front of the class all the time, and students just act as passive learners trying to absorb as much knowledge as they could. According to the Higher Education Leadership Academy at the Ministry of Higher Education Malaysia 2011 statistics, it shows that 50% of the lessons delivered by 41 schools across Malaysia under the study were unsatisfactory. Researchers had followed 125 lessons, and most of the lessons did not engage students into learning. It was conducted by using the teacher-centered learning method. Teachers were satisfied if the students achieved shallow understanding of the physics topic. Most emphasis was on memorizing the questions and answering techniques, instead of instilling higher level of thinking skills into students. Assessments were mostly tested on student's ability in recalling concepts (70% of all lessons observed) rather than to analyse and interpret data (18%) or synthesise information (15%) (Preliminary Report Malaysia Education Blueprint 2013-2025, Ministry of Education Malaysia, September 2012).

Research done by Saleh (2012) cited that according to Mohd. Salleh (2004), Sidin (2003) as well as Syed Zin & Lewin (1993), many students eventually lost their interests in physics studies were due to the explanation being too academic. Teachers failed to see from the student's point of view, and teachers couldn't bring the abstract concept to the

students' level and assist the students to understand those concepts. The mechanistic and passive teaching method had affected student's interest greatly, moreover, when teachers focused on calculation more than conceptual understanding (Campbell, 2006), it often drove the students farther away from liking physics.

This type of one-way teacher-centered approach failed to connect the student's learning to student's real-life experience. Many students couldn't picture and failed to absorb the concept being taught which caused their failures to answer the questions during physics test, which eventually produced bad academic results (Gabbin, 2002 – cited by Saleh 2012). Teacher-centered approach might only work for certain students, like those who could learn through note-taking, have good memorizing ability, and who is left-brain dominated (Sousa, 1998; 1995 – cited by Saleh 2012). Some other students who have different learning styles will be left out. This creates an unbalanced learning opportunity thus contributing to the vast difference in physics academic achievement (Saleh, 2012).

B. *Learning styles*

According to Felder and Silverman (1998) Model of The Characteristics of Learning Style, there are four main elements of learning style dimensions (Felder, and Soloman, 1997), as summarized in the table below:

Table 1: Felder and Silverman Model of The Characteristics of Learning Style (1988)

Dimension 1	**Sensory** Sensory learners prefer concrete, practical, and procedural information. They look for the facts.	**Intuitive** Intuitive learners prefer conceptual, innovative, and theoretical information. They look for the meaning.
Dimension 2	**Visual** Visual learners prefer graphs, pictures, and diagrams. They look for visual representations of information.	**Verbal** Verbal learners prefer to hear or read information. They look for explanation with words.
Dimension 3	**Active** Active learners prefer to manipulate objects, do physical experiments, and learn by trying. They enjoy working in groups to figure out problems.	**Reflective** Reflective learners prefer to think through, to evaluate options, and learn by analysis. They enjoy figuring out a problem on their own.
Dimension 4	**Sequential** Sequential learners prefer to have information presented linearly and in an orderly manner. They put together the details in order to understand how the big picture emerges.	**Global** Global learners prefer a holistic and systematic approach. They see the big picture first and then fill in the details.

Talib's (2009) finding states that learning preferences and styles of students could evidently determine how well the students could learn. If the teacher's pedagogical approach met the learning styles effectively, it could greatly help to bring student's learning skills to their optimum level. This was also showed in Meehan (2005) and group's report.

Although researches had reported that there are many different learning styles available, yet the teaching approach today is still not adhering it, causing the students reeling in boredom towards science subjects (Saleh, 2012).

C. *Ability or Talent in learning science*

In Jiar & Long (2012) research, they found that student who is good in mathematics normally would do well in science subjects too. One can predict a student's physics achievement by looking at their mathematic skills and ability.

Besides Jiar & Long (2012) research, Talib (2009) found that 4 out of 6 teachers and lecturers who were being interviewed, agreed that good student tends to score well in science subjects, as they tend to ask more questions and inclined towards a high level of curiousity. Curiosity is one of the important qualities of science students.

III. *Methods to improve student's learning*

Researchers had been implementing different methods in cultivating student's interest in taking science subjects, and thus enhancing their academic achievement. These methods are summarized as below:

A. *Brain Based Teaching Approach*

According to Saleh (2012), Brain Based Teaching Approach (BBTA) is a strategy implemented based on the Brain Based Learning Principles developed by Caine & Caine (2003, 1997, 1991), Jensen (1996) and Sousa (1995) through related brain research and studies. It is a teaching approach based on the structure and optimum function of the brain of an individual to bring out the optimum learning experience of that person. This approach connects the learning steps and brings the student into the learning mood and environment in a step by step manner.

Saleh (2012) has used this stimulation approach to work on 100 Form Four secondary school level students, with another 100 in a controlled group, dealing with problems of the differences in students' learning styles concerning the subject of physics education.

Results showed that there was no different in understanding a tested physics topics among the experimented

group, which consists of students with different learning styles. This means that BBTA had been proven to be effective in bringing up the level of student's understanding in learning physics to the same par, regardless of learning styles and ability.

B. *Matching the use of technology with student learning styles*

In Alias et al (2013) article, they have conducted a research on matching the use of technology with student's learning styles, to see whether it could help to improve the mastery physics concepts among students. The research was conducted based on the Social Constructivist Theory for the process of teaching and learning, followed by Felder and Silverman Model (1988) for learning style theory and next Taba Model (1962) for the design of the Curriculum (Alias et al., 2013).

After analyzing the student's learning style, researchers designed the physics curriculum by integrating the use of technology, teaching technique, and appropriate activities by using the modified Delphi technique. The result supports the literature that technology and learning style have potential to ease the understanding of abstract concepts (Hein, 1997; Offerjost, 1987; Ross & Lukow, 2004; She, 2007, Tsoi, Goh, & Chia, 2005; Wong, 2001 – Cited in alias et al., 2013)

C. *Enhance student's scientific skills and values*

Talisayon (2008) has a different point of research in learning of physics. He proposed that the teaching of physics should shift from sole heavy focus on concept to installing scientific skills and value to student's learning experience (Talisayon, 2008). He also proposed the shift of this focus from content based to skills and value, mainly because of that the actual working environment required physics graduates to have more generic skills, like communication skills, ICT skills, scientific skills, and etc, which are transferable to other areas in their work, life, and personal growth (Talisayon, 2008).

By instilling good scientific skills to the future workforce, it would not only enhance the work performance of the future graduates, but also to enable them to improvise their skills and abilities to carry out life-long learning on their own. This is definitely one important point to be noted by educators, whereby, skills and values should be enhanced and not just focus on content heavily. When a person possesses good scientific values and skills, the knowledge learned became meaningful. It will contribute towards the good mankind and benefit the society effectively in large scales.

D. *Instructional congruence*

This method integrates the student's experiences and cultures into science instruction, making students feel the closeness thus improving the achievement of students in science education (Zain et al , 2010). Zain (2010) highlighted that instructional congruence bridging student's experience to the content makes students feel comfortable and familiar when they learn science. It also helps students to identify their future career after learning science at their schools (Zain et al., 2010).

Result showed that instructional congruence created positive attitudes among students toward learning of science. Zain (2010) proposed that a longitudinal research design should be further used to examine changing attitudes resulting from instructional congruence in science education. This method actually is more towards affective domain, and concern more on the development of healthy emotion within students. More studies should be done on the usage of this method in terms of learning of physics.

E. *Futuristic method – Virtual Reality*

Virtual Reality is a computer stimulated environment that allow humans to interact with that environment. It is a "Real-time interactive graphics with three-dimensional models, combined with a display technology that gives the user the immersion in the model world and direct manipulation." (H. Fuchs, G. Bishop et al. 1992 – cited by Mazuryk & Gervautz, 1996).

Trindade, Fiolhais, & Almeida (2002) has done a research on how virtual reality has helped the students to have better understanding in the subjects of physics and chemistry, by using 3-D virtual environments which stimulate space reasoning. Result shows that virtual reality helps students, especially those with high spatial abilities to have a good grasp on the conceptual understanding. It helps the students to visualize the situations which a photo or video may not be able to show from the other perspective point of view.

IV. Conclusion

Educators were often concerned about student's learning skills ever since there was student-teacher relationship. Methods had been developed and implemented in various educational institutions to bring about the effective learning experience.

By referring to the various articles reviewed in this paper, it can be concluded that the teaching method that matches student's learning style is the core concern for educators. Regardless of how beautifully designed the pedagogy is, it boils down to the fact that whether it bring effective learning? Whether it really helps the student to achieve optimum learning? How much time should be implemented for a particular method?

Further research should be done on comparing BBTA (Saleh, 2012) with other approaches, measure student's achievement to see whether other methods can bring student's learning to a higher level as compare to BBTA. How would the researcher know that the student has reached their optimum level?

Further research should also be done on the impact of using ICT in teaching physics, whether in the end both teachers and students rely on computer to do the work too much, and turn into addiction (S. Kennewell, 2008).

The effectiveness of a teaching method not only relies on the creativity of a teacher, researchers also play an important role here, to find out the long term effect of that particular teaching method. For example, at first the public thought by using some digital gadget like iPad could help to calm a child down and make the child sit down quietly while the parents were busy with their personal errands and stuffs. Much later, it proved that in a long run, this had sadly caused a child to develop inferiority complex as the child lost much ability to socialize with others. Same goes to the use of technology and virtual reality in teaching pedagogy. Will one day robots replace human-teacher?

Another important point to ponder about is, when the use of technology become more and more common, will the future students lost the opportunity to have a close touch with the physical world? What learning energy does the virtual reality can bring to a learner; that is better than the actual physical environment?

It is indeed interesting to see and interact with 3-D environment. The question here is, will this 3-D environment limit the imagination of students? Will it cause addiction? What value will the students learn from virtual reality? Will they miss out some learning processes that are important to mould their thinking skills?

Educators should bear in mind that besides gearing students towards the understanding of the concept of physics and producing good achievement in their academic, it is also important for students to learn the good values and skills of science, so that they can carry on, to learn on their own throughout their lives.

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The challenge for science educators is that, how we can transfer the scientific values and thinking skills to our future generations in such a fast pace and exam-oriented era?

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