

USE OF DIGITAL GAMES TO ADDRESS THE DECLINE OF STUDENTS' PARTICIPATION IN SCIENCE

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ABSTRACT

Over the last two decades, the number of science students in secondary schools has declined significantly in Australia. The decline is likely to have a negative impact on the economic development of Australia in the future since scientific and technological knowledge will be vital for its development. As a result, this issue has raised concern among the stakeholders. Options on how interest in science subjects can be improved among the students are being vetted. Introduction of digital games in the curriculum is seen as major step towards making science an interesting subject among the students. It has been argued in this paper that if teachers can find ways to incorporate in the curriculum, it may contribute to increasing Australian students' interest and participation in science.

Keywords: Science Education, engagement, digital games, motivation, pedagogy

THE CASE OF SCIENCE LEARNING IN SCHOOL

Science learning is important to both the students' lives and the nations' economy. Students and teachers, therefore, need to be made aware of the importance of science. Sensitizing them with the importance of science could be one of the steps to draw their interest in it. Whilst in the past science was only offered to students whose future expertise was to be based on science, it is argued that science needs to be offered to all students since the world we are living in is a world of science and technology and, therefore, people need to have the science knowledge (Luu, 2009).

Luu (2009) argued that science knowledge is important for the development of a country's economy (Luu, 2009). Over the last couple of years, technology has been on the rise. Most business transactions are done using technology. Therefore, for business to flourish, technology will be of ultimate importance. Therefore, individual with the technological knowledge has to be produced from colleges and secondary schools. Business is important in the economy of a nation. Since most businesses are now using technology, people must have the knowledge. Apart from business, science and technology is being applied in many other sectors which help in the development of a nations' economy (Luu, 2009). In a report by Batterham (2000), it is stated that the economic success of Australia will depend on workforce that has science knowledge. The workforce that is expected to drive the economy will be required to have knowledge in science, engineering and technology fields. Students, therefore, have to learn science if the economy is to be stable in the future. Science has to be introduced to students' right from the primary education, and they should be made aware of its importance as well as be made to appreciate the subject. The curriculum, therefore, need to be changed, and incorporate science learning to all students so as to produce workforce that has knowledge in science (Fensham, 2004) and which will help in driving the economy. In today's world of work, people need to have basic science skills and knowledge so as to be competent with the society. Students, therefore, need to be equipped with science knowledge for them to be competent in the labor market. It is for this reason that the subject must be made interesting to all students so that they accept it as part of their curriculum (Luu, 2009).

Science is also important because we apply it in our day to day life. The environment is well understood through learning science. All the decisions we make will be influenced by science at some point. For instance, when we decide on what we should eat, science knowledge is required so as to choose a balanced diet. In addition to that, science will help us in solving problems. Solving a problem that affects our lives may at times require the application of research findings. It will be difficult to carry out a research when one does not have the necessary scientific knowledge. Science also

influences political decisions, for example in the global environmental issues as political decisions have a direct impact on our lives, poor political decisions will mean poor living conditions. Science knowledge must be acquired to ensure that the decisions that are made are the best for everyone (Let's Talk Science, 2011).

All students, therefore, need to learn science regardless of whether their future career of choice is science-oriented or not. This is because science will enhance their understanding of the subjects they take which are non-sciences. For instance, a music student will be able to understand how people hear sounds by learning the science involved in the hearing process. Also, science will be very important in humanity subjects such as geography and history. A geography student will need to understand the science of the universe so as to advance his or her understanding of the subject. Science also helps students to develop and enhance their communication and numerical knowledge (Let's Talk Science, 2011).

Science is crucial for survival of mankind. Science is used in understanding the weather and predicting it. Being able to predict the weather will enable us to take precautions in case the weather is to be adverse. Therefore, science knowledge is important in enhancing the living conditions of all individuals. Science will help people to avoid tragedies in case of disaster. It is important for students to be armed with scientific knowledge right from the primary level through secondary to the tertiary level (Ng, 2010). According to Ng (2010), an individual with science knowledge is able to become a dynamic person. We are living in a dynamic world where things are changing at a high rate. The environment is changing; technology is changing as well as the life styles. For one to cope with the changes, one has to be dynamic. It is science subjects that will help the individual understand the changes and be dynamic. It will help in adjusting to the new situations that come along with the changes (Ng, 2010).

Rennie (2006) also gives her views on the importance of learning science. In the world we are living in, success will be based on the actions that we take in our lives. Science helps to mold an action oriented individual. A person who has science knowledge is able to take actions which are relevant depending on the situations they are faced with. In addition, science knowledge will help the individual to question what the other people suggest or claim. Not all the claims brought forward are correct. Some of the claims might be misleading. Rennie highlights the importance of science knowledge in questioning such claims. She also talks about the importance of science in decision making, conducting investigations and understanding the universe (Rennie, 2006).

Despite science supports almost every sector of human life and a nation's economy, over the last 20 years, students' enrolment in science subjects has declined notably in Australia (Lyon, 2006). It has been observed that in the period between 1978 and 2002, there was a decrease in biology cohort from 55% to 20%, chemistry cohort from 30% to 15% and physics cohort from 27% to 12%. Grossly, the total number of students studying science at the post-secondary level declined by over 31% between the year 1989 and 2002. In the same period, students pursuing PhD in science subjects also declined from 46.9% to 37.2% (Australian Centre for Education Research Masters, 2006). It is also observed that science experts and professionals are also declining in Australia? (Batterham, 2000). This raises an alarm to all the concerned parties to take actions to address the decline issue. If the issue is left to go, it may mean that there would be few science experts and professionals in future and that Australia would have to depend on other nations for science expertise. This may result in a blow to Australian economy (Australian Centre for Education Research Masters, 2006). It is therefore argued that steps must be taken to improve students' interest and participation in post-secondary science subjects (Hanks, 2010). This paper discusses the notion of students' declining interest and participation in science subjects and how this notion could be challenged by incorporating technology (e.g., engaging students in digital games) in teaching-learning approaches in science.

Declining Students' Participation and Interest in Science - What Does Research Say?

Goodrum, Hackling & Rennie (2001) argued that in order to address the declining issue, it is important to identify the reasons as to why students are not interested in the science subjects. This section provides an account into the reasons as articulated in the research literature.

One of the main reasons why students do not like the science subjects is the attitude which they develop towards science in the compulsory school years. According to Goodrum *et al.*, (2001), the negative attitudes that students develop towards the science subjects is the key explanation that can be given for the declined number of science students in Australia over the last 20 years. The negative attitude has also a close relationship with the teaching methods teachers use to teach the subjects. If the teaching methods for the subject are poor then it is expected that the students are not going to find it interesting, and as a result, they will develop a negative attitude towards science. The consequence of this will be either poor performance in the science subjects by students or they will be disinterested in pursuing further education in science. It is therefore reasonable to argue that the teaching methods used to teach science subjects should be interesting and motivating to the students (Goodrum *et al.*, 2001).

Another reason as to why students are likely to drop the science subjects is due to lack skilled and qualified teachers for science subjects (Tytler, 2007). As noted previously, teachers have influence on shaping students attitudes towards science as well as their performance in science subjects. If teachers are not skilled and qualified in this concern, it is reasonable that they will not be able to deliver the best to the students. This will reasonably affect students' performance in science subjects negatively, and they will be likely to develop a negative attitude towards the subjects and eventually drop themselves from science subjects (Tytler, 2007).

It has been argued in the previous research that the traditional nature of the curriculum has contributed to the declining of students' participation in the science subjects. The argument continues, the traditional curriculum often does not have the ability to make science interesting to students. It poses challenges to teachers on how they make science interesting for the students and how they incorporate activities and approaches, which could create meaningful learning environment for the students. This traditional nature of the curriculum is often a case for students' negative attitudes towards science in the latter years. Most students are interested and confident with the science subject in their early years in school but as they advance in their studies, their attitudes and confidence to study the subject goes down. They, therefore, drop the subjects as they advance to secondary and tertiary level education (Tytler, 2007).

Lyon (2006) gives three issues that have been linked with students' lack of interest in science subjects. According to Lyon, decontextualized content of the current curriculum that is being used is one of the reasons as to why students taking on science subjects are declining at a rate that cannot be overlooked. Lyon also claims that the science subjects have been made unnecessarily difficult for the students. Science subjects should not be as hard as the current curriculum presents it. In addition to these, lack of interest in the science subjects has been contributed by the transmissive pedagogy that the science teachers have been using in their teaching. Students are not given a chance to express their views and opinions on the subjects. As a result, they feel demoralized, and they will be more likely to drop the subject as they advance in their education. This not only affects the students who are weak in the subjects, but it also affects even the science strong students and they will be a high likelihood that they will drop the subject later in their education (Lindhal, 2003).

Engaging Students in Science Education

Science students are needed in the future, and, therefore, efforts must be made to draw their interest into the subject. All the involved stakeholders must make efforts to engage students in the science education. They must decide on the best steps which will help the students be motivated to find their interest in science. The teachers should help the students in this. They should have good methods of teaching. Parents should also play their part in engaging students in science subjects. In addition, students also have their part to play. Therefore, cooperation will be ultimate to achieve this. Engaging students in learning science will enable them learn and participate in the classroom. Lack of interest by the students is one of the main reasons as to why science students have decreased. Therefore, engaging students in learning science will involve creating interest for the subject in the students (Martin, 2005).

Motivation is one factor that will aid engagement of students in learning science. Students need to be motivated to like the subject. According to Martin (2005), motivation is an energy that will help provide more energy towards students' engagement in learning science. Motivating the students will

give them the urge to work towards their goals and this will improve their engagement (Martin, 2002). Once they are motivated to work for their goals, they will be engaged in the subject since that will be the way towards achieving their goals. For teachers to succeed in motivating the students, they first need to understand the students' attitude towards the subjects. If the students have a negative attitude they should try to motivate them towards changing the attitude. This will be a step towards getting the students engaged in the subjects (Martin, 2002).

Behavioral engagement will also be important to help the students be engaged in learning science. Engaging the behavior of the students will improve the students' attitude towards the subjects. Once their attitude has been improved, they will hence be able to develop learning skills for the subject as well as academic skills. This will also be important in engaging students in teaching the subject (Munns *et al.*, 2006). According to Munns *et al.*, (2006), emotional engagement can also be helpful in engaging students in the science subjects. This will improve their feelings towards the subject. If they have a positive feeling, they will be able to participate more in the subjects. The students' feelings towards the subject have a direct effect on their engagement in learning it (Munns *et al.*, 2006).

There should also be professionally trained teachers who teach the science subjects. The knowledge that teachers have on the subject is essential for the students' engagement in it. Teachers should be well trained so that they can teach effectively using the best teaching methods so as to create interest in the students and hence increase their engagement in the subjects (ICSU, 2011). New education models need to be implemented. One of the reasons that have been associated with loss of interest in science subjects by the students is the use of traditional teaching curriculums. It is, therefore, the high time that the model is changed, and better methods of teaching implemented which will engage the students more (ICSU, 2011).

Digital Games

Digital games are seen as an integral way of encouraging students to participate in science subjects. ICT is an important subject and will have much impact on the future economy of the nation. It is, therefore, important to encourage students to embrace ICT. To do this, teachers need to find ways to make ICT interesting to students. ICT can generally be used to increase the students' interest in science subjects. According to Luu (2009), introducing technology in teaching science subjects can have a great impact on the interest of students. It said to impact motivation to the students, as well as engagement. Creation of exciting elements in the science subjects will help in creating interest in students. Teachers are still using the traditional methods of teaching in science subjects. In addition, there is a narrow range of transmissive pedagogy. According to Tytler (2007), failure to use technology in teaching science subjects have an impact in the students' interest and their motivation. Tyler says that introducing technology in teaching science subjects can help increase the interest of students in science subjects. He, therefore, goes on to suggest that changes need to be implemented in the curriculum.

Technology is important in the society and students need to learn how to use it productively. The students, therefore, need to understand this importance so as to acquire an interest in them. They should be availed with ICT tools and applications. Games are important in creating interest in the students (Bruniges, 2003). Games are interesting to most people; children and adults. Children spend much time playing games. Games assist in the development of the students' brain. Most people play games for fun while there are others who play games for challenge. Since games are interesting, teachers should find ways on how they can use them in teaching so as to create interest in students for the science subjects.

A game is an activity that is usually structured and is mostly for fun though it can be used for educational purposes. A game should have time limitations and the outcome should not be certain. Digital games are those games that are played on digital equipment such as computers. Therefore, a digital game must have visual digital information; it should be able to process input that has been fed by the player and give the outcome. Digital games are mostly played by children according to Facer (2001). However, adolescents also play games for fun. Games have been seen as a way that can be used to improve learning among children. Teachers, as well as researchers have been thinking on how

the games can be used to improve students learning especially in the science subjects. Games as a tool for learning have a number of benefits to students which will be discussed in this section of the paper.

Games are played for reasons of fantasy, curiosity and challenge. However, most of the people who play games do it for fun (Kirriemuir & McFarlane, 2004). Others do it for challenge while there is a small number of people who play games for money. Games can be used to improve the learning of a student, for instance, action games allow the player to identify with a certain character. The effect of the game is that it can improve the player ability to control financial expenditure as well as control building works. On the other hand, strategy games help the player to improve his or her strategic ability. This will help the students in their learning strategies. Games also help the players to improve in their ability to observe which is essential especially for the science subjects. They improve the concentration level of the students as well as the reflex of the students. They have been used in a number of countries as part of the curriculum (Squire & Jenkins 2003). According to Squire & Jenkins, games such as the Age of empires, Sims, Creatures, Shenmue and final fantasy among others can be very helpful in the learning of science subjects such as mathematics, biology and social sciences. Choosing digital games can, therefore, be very helpful in the learning of science subjects. They will improve the understanding of the students as well as the interest they have on the subject. The use of digital games should be implemented in the Australian curriculum in a bid to improve and increase the number of students taking the science subjects (Squire & Jenkins 2003).

CONCLUSION

As noted previously, science students have been declining in Australia over the last 20 years. It has become an issue that need to be addressed with agency since it might have bad implications to the whole nation in the future. It might cause a down fall in the economy since the economy relies so much on science and the science experts will be the drivers of the economy. Lack of the work force with the science knowledge will mean that Australia will have to depend on the international community for the science knowledge. Strategies have been put forward which can be applied to improve science participation by the students. One of the reasons that have come out very strongly as the reasons for the decline in the number of students in science is the lack of interest. So the strategies put forward should be aimed at improving students' interest. Use of digital games in the curriculum could be of importance in this bid.

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