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Reviewing Science Education Research in Socioculture Perspective

Shafiah Abdul Rashid[1], Zanaton H. Iksan[2], Khadijah Abdul Razak[3], Azman Yusof[4], Mariati Mohd. Salleh[5]

[1,2&3]Fakulti Pendidikan, Universiti Kebangsaan Malaysia, Bangi, Malaysia
[4&5]Universiti Kuala Lumpur MICET, Melaka, Malaysia
Corresponding authors' email: shafiaharashid@yahoo.com; zanaton.iksan@ukm.edu.my; khadijah.razak@ukm.edu.my; azmanyusof@unikl.edu.my; mariati@unikl.edu.my
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Abstract. In order to ensure that our country is able to provide enough human capital in the future, Malaysia is striving hard to improve the quality of its science education system. Various strategies have been regulated but still, the percentage of students taking science stream keeps dropping each year. Thus, science education scholars need to focus their attention by examining the impact of socioculture factor on students' interest in science. This article reviews a few socioculture point of views which affect science education progress. It discusses the pros and contras that arise when modern science that originates from the west clashes with the culture, traditions and beliefs of non-western students. This study is important to ensure that the human capital produced by our education system is capable of competing at the global stage without sacrificing our identity, beliefs and cultural heritage.

Keywords: Islam, Western science, indigenous, collateral learning, religion

INTRODUCTION

As a rapidly developing nation that is prone to facing various trials and tribulations of the 21st century, Malaysia's survival relies heavily on its young generation's capabilities to weather the highly challenging future. It is made more competitive with the need to upkeep the values crucial to Malaysians as a sovereign nation. The nation will not develop by itself, as there is the need to groom individuals through a proper transformation of the education system. The field of science is no exception from undergoing the transformation, to ensure that the nation could remain relevant with all the changes taking place the world over.

The history of science education in Malaysia had showcased the commitment of the government in increasing the percentage of students studying in the field of science and technology. Whenever the education system undergoes policy changes, science and technology has always been accorded special attention as it is an important asset in spearheading the country's economy and development. Malaysia's Education Development Plan 2013 – 2025 (PPPM) was not spared from tabling the achievements and strategies to enhance the students' academic performance in science. This is to enable them to meet the minimum requirements to enroll in science streams at the tertiary level, and to secure employment in the field.

Statistics showed that the percentage of students enrolled in science, technical and vocational streams was merely 45% in 2011. In fact, the percentage of students who fulfilled the criteria to take up the science stream but rejected the option had increased to 15%. Based on figures projected by the National Scientific Research and Development Council, the nation will need 493,830 scientists and engineers by the year 2020, but instead, MOSTI foresaw that there will be a shortage of manpower numbering up to 236,000 (MOSTI, 2012).

Scholars have determined that one of the main problems is the fact that students lack the interest to pursue their studies in the field of science (Ralf, et. al., 2014; Kementerian Pelajaran Malaysia, 2012; Siti Nurhidayah Sahari, 2012); Fatin Aliah Phang et. al., 2011). Thus, various studies have been conducted to identify factors that caused the lack of interest among learners. Various strategies had also been introduced by the Ministry of Education to promote interest towards science, to inculcate scientific thinking and higher order thinking skills, and to enhance problem solving skills based on scientific methods. The progress, however, is still far from expected.

THE DEVELOPMENT OF SOCIOCULTURE RESEARCH IN SCIENCE EDUCATION

In the past 30 years, many developed countries have conducted studies that not only focused on the aspects of nurturing the interest of learners in science education, but they also investigated the aspects of a community's socioculture. Research into the aspect of socioculture was made popular based upon Piaget's cognitive theory (Piaget, 1975) and Vygotsky's social theory (Vygotsky, 1998). Piaget (1975) believes that meaningful lessons would only take place if a learner could assimilate and accommodate their existing knowledge with their newly acquired knowledge. Vygotsky, (1998) concurs with the opinion, but he stressed that the new knowledge is not just influenced by the learner's experience and existing knowledge, but also by the people surrounding the learner, including the family, friends and community. Thus, Vygotsky, (1998) pointed out that socioculture also plays a vital role throughout the assimilation and accommodation process. His theory has been debated, investigated, and expanded in many other studies conducted in the field of education, known as the Vygotsky's Constructionism Theory or Vygotsky Social Constructionism Theory.

Due to rapid development, the world of science has undergone various processes of reform and paradigm shifts where science is construed as hermeunetic, by taking into consideration its historical and cultural aspects. Prior to that, the field of science was adjudged a neutral body of knowledge towards culture, which was fair and value-free. However, science is now viewed as an imperfect body of knowledge**,** lopsided and greatly influenced by western values (Stanley, & Brickhouse, 2001; Syed Muhammad Naquib al-Attas, 1977).

The proponents of social constructivism have challenged science's relativity and truth as all observed natural phenomena are perceived by scientists who are normal beings. Hence, any theory proposed is not only confined to a scientist's cognitive assimilation and accommodation process, but also influenced by the scientist's faith and cultural elements. In other words, the interpretation of natural phenomena is influenced by one's worldview, borne out of faith, whether individually or socially (Stanley, & Brickhouse, 2001). Hence, a number of research were carried out on the impact of sociocultural influence on science education, like studies by Cobern, (1996) on Worldview Theory; Aikenhead, (1996) with the Cross Culture concept and Jegete, (1995) that introduced Collateral Learning in science education.

In the early 2000s, the concept of pure science or also known as *Indigenous Science* became the education agenda for the indigenous people like the Maoris in Australia and New Zealand, the Inuits in Canada and other former colonial countries such as Kenya (Jones, & Hunter, 2003; Absalom Dumsell Phiri, 2008). The scholars then come into conclusion that modern science was in fact a colonial science, i.e a strategy to control the mindset of the people of its former colonies (George Zhou, 2012; Nindi Kitonga, 2011). Hence, indigenous science was introduced to retain the traditions of the indigenous people from being eradicated by modern scientific theories that would only accept a fact as true when it could be proved scientifically. Indigenous science was then taught in these countries with the aim of educating the young to appreciate their traditional rites, such as knowledge on traditional medicine and agriculture that have been practiced effectively for generations.

In this country however, research on socioculture influence in science education have not been given priority. Nevertheless, some socioculture influence can still be detected especially among Malay students who keep a strong hold on their religious culture. This fenomena probably sparked by Islamization agenda spearheaded by local or foreign contemporary Islamic theological scientists such as Seyyed Hossein Nasr, Ismail al-Faruqi, Ziauddin Sardar and Syed Muhammad Naquib al-Attas. However, most of those scholars focused more on the aspects of epistemology, while others concentrated on the aspects of reinforcing faith, morale and good moral values. The issues of the dropping number of students interested to pursue their studies in science and the issues of how cultural elements play a role in influencing the lack of interest in science have not been given serious emphasis by scholars.

THE IMPORTANCE OF SOCIOCULTURE RESEARCH IN SCIENCE EDUCATION

In general, socioculture research in science education need to be carried out to provide benefit to the vested parties, that are the ones supporting western science and the faction against it. If the supporters of western science do not take the initiative to conduct research on the impact of socioculture in science education, they might face obstacles in nurturing learners' interest towards science. If the learners are not given the exposure to embrace the culture of science, their cognitive would not be able to comprehend their science lessons, thus whatever is learned will only be transferred into their short-term memory. Students may be able to get good grades in examinations, but they will abandon the science stream if given the opportunity. This phenomenon will cost the nation dearly in the future. From the perspective of opponents to western science, they believe that the absence of sociocultural research in science will give ways to western science to shape the youth's mind without any surveillance. This situation will erode the natives' traditions and heritage, or even pose threats to their religion, as not every religious dimesion could be tested and proven scientifically.

CROSS CULTURE THEORIES IN SCIENCE EDUCATION

The early scholars in the field of socioculture in science education were Cobern, (1996), Costa, (1995), Larson, (1995), Aikenhead, (1996) and Jegete, (1995) who held on to the Cross Cultural Theory to explain students' acceptance of science. This paper will focus exclusively on the Cross Cultural Theory from the perspective of Aikenhead, (1996). Aikenhead, (1996) confers that whenever a student is exposed to science lessons in school, there are three possibilities of cognitive mapping taking place – assimilation, Fatima's Rule or *enculturation.* These have been proven in current research by Erman Har and Kamisah Osman (2012); Anna Karina Monteiro, (2015) and Celestine Nakeli Elimbi (2017). Assimilation is a situation where a learner tries to construct knowledge by rejecting his existing body of knowledge. The existing knowledge is formed based upon his social experience with his family, friends and community from the aspects of intellectual, values or faith. Through the assimilation process, a learner is trained to think rationally, objectively and empirically, therefore rejecting the indigenous science ideas that they have learned informally since young Cobern, & Aikenhead, (1998). This will lead to the detruction of a learner's traditions, culture and even religious faith when the existing body of knowledge has not been scientically proven to be true. As a result, the learner's thoughts is not holistic and lacks integration in the aspects of physical, emotional, spiritual and intellectual.

'Fatima's Rule' is a term introduced by Larson, (1995) based upon a student named Fatima in his chemistry class. It reflects the situation where the learner was unable to construct or harmonize the new scientific knowledge she was learning with her existing body of knowledge. As a result, the student became a passive, quiet learner

as categorized by Hawkins, & Pea, (1987). Costa, (1995) as the *'I Don't Know' student.* At times, in the effort to save oneself from being left behind by the education of modern science, a learner attempts to learn science based on a short-term period, which may result in excellent examination results. However, since it is not meaningful learning, the learner will abandon the science stream to dabble in other fields if he/she was given the opportunity to do so.

The third cognitive mapping is *enculturation* where a learner undergoes the knowledge accommodation and assimilation processes in an incomplete manner. In this situation, a learner has placed his new modern scientific knowledge parallel to his existing knowledge, which results in *collateral learning* situation where the knowledge are categorized into different 'boxes or compartment' in his cognitive mind (Costa, 1995; Hawkins, & Pea, 1987). When faced with a phenomenon that requires him to explain scientifically, he will be able to do so by retracting information from the so-called "scientific compartments" in his mind. When asked to explain the same issue from the aspect of meta-physics or religion perspective, the learner will be able to explain according to his 'box of confidence towards his culture, traditions and faith'.

In this situation, the learner is actually incapable of fully comprehending the lessons as he could merely provide scientific or non-scientific information based on the compartmentalized ideas in order to accommodate the two contrasting worlds. The learner do not even have any idea on which compartment represent the truth. Thus some science education scholars have criticized *collateral learning* as it depicts that scientific thinking has not been inculcated properly into the students' thought as learners do not place full faith towards science. On the other hand, some other scholars believe that *collateral learning* is the best option to develop a nation through the progress in science and technology as it allows the opportunity of upholding one's identity, traditional heritage and religious beliefs.

THE PRACTICE AND TREAT OF COLLATERAL LEARNING IN INTEGRATED SCIENCE AND RELIGION CURRICULUM

The concept of *collateral learning* was first proposed by Jegete, (1995) which was popular among researchers in their attempt to explain how a learner adapts himself to match various world views that contradicts his own perspective (for instance, the study by Celestine Nakeli Elimbi (2017), Anna Karina Monteiro, (2015), Siseho, (2013), and Nindi Kitonga (2011). In Malaysia, research on *collateral learning* in science is not carried out directly, but the concept has been embedded in studies involving the integration of science and Islam as in studies by Aziz Rekan et. al., (2016), Azman et.al, (2016), Faszly Rahim et.al., (2014), M. Arip et.al., (2011) and Shafiah, (2015). All studies promote the benefits of integrating science-religion curriculum, missing the pitfall trap awaited due to there is no instrument designed to measure how a student map the knowledge in his cognitive, whether science is placed at par with religion, or at a higher or lower level than his/her religion.

Currently, the majority of Muslim students in Malaysian secondary schools take science subjects (or Chemistry, Physics and Biology for pure sciences students) and Islamic Education (or al-Qur'an Sunnah and Syariah Islamiyah for religious stream students). This situation allows for *collateral learning* when the learners indirectly and unconciously integrate both fields in their cognitive minds. Problem arises when scientific explanation opposed religious opinion in issues such as socioscientific dilemma or those concerning natural phenomena cause-and-effects. In this situation two probability might occur; (1) student understand that whenever opposed facts occur between science and religion, then science would submit to the religious stands. Or (2) whenever opposed facts occur between science and religion, then the truth belongs to science i.e religious views must be adapted to be in tandem with scientific findings (Indal Abror, 2008). This second viewpoint is definitely a threat towards students' faith which calls for religion to submit to the findings of science.

Hence, all *stakeholders* who involved in the integration of science and religion curriculum should not be content with the present situation. It is true that the concept of science and religious integration school is better for the well being of students, and able to produce balanced individuals. However, there are traps along the way that must be given thorough attention to ensure that the nation could continue to progress in science and technology without sacrificing the faith and identity of its highly religious citizens, especially the Muslims.

CONCLUSION

The existence of various cognitive mapping in constructing scientific knowledge has implied that socioculture does play an important role in influencing learners' interest towards science. Thus we need to scrutinize the approaches and policies introduced in the education system to ensure whether we are producing assimilists, Fatimas or enculturists. Failure in doing so will put the nation at risk of losing potential scientists and technologists, or producing graduates that lose interest in their religion and heritage. Hence, there is a dire need to conduct a proper study that could pinpoint the right measures in ensuring that our human capital could be reinforced in terms of knowledge without sacrificing their religious faith and identity.

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