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Determining Students' Intention: The Role of Students' Attitude and Science Curriculum

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ABSTRACT

The objectives of the present study are to determine the role of students' attitude and how science curriculum influences their intention to learn science subjects. A quantitative correlational research design was used. Data were collected through the survey method by using a questionnaire distributed randomly to 341 secondary school students of seven post-basic schools from Al-Sharkiyaha North governorate in Oman. The data were analysed using SPSS version 23.0. Pearson correlation findings revealed that students' attitude and science curriculum had a significant positive relationship in enhancing students' intention to learn science in post-basic education. This study offers insights for policymakers, school administrators and teachers on understanding the role of students' attitude towards learning science subjects, and the nature and design of the science curriculum on students' intention to continue learning science subjects in post-secondary education. The findings indicated that by employing effective instructional strategies and engaging curriculum, school teachers could facilitate students to develop positive intentions to continue learning science subjects in post-secondary education.

Keywords: Intention, attitude, science curriculum, Oman, post-basic school.

INTRODUCTION

Understanding students' intentions to learn science in high school is an important concern for international science education (Martin-Gamez, Prieto-Ruz, & Jimenez-Lopez, 2016; Sheldrake, 2016) as there is a decline in the interest of the young in pursuing scientific careers. Science is an important subject because it offers answers to numerous questions that

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most people ask out of curiosity regarding, for example, about climate change, food production, energy resources (Oriahi, Uhumuavbi, & Aguele, 2010). Besides, it is an important factor for a nation to prosper (Furman, Porter, & Stern, 2002). Numerous definitions of nature of science exist. Nature of science has been defined as a way of knowledge acquisition or rigid beliefs and values during knowledge development (Lederman, 1992). In another definition it is explained as what science is and what roles it contains, who the scientists are and what roles do they entail, scientific clues, observations, phenomenon, rules, laws and scientific methods, and understanding how science is executed (Taşar, 2003).

Science is a compulsory subject from grade 1 to grade 10 in Oman (Murphy, Ambusaidi, & Beggs, 2006). The school science curriculum constitutes four courses: Biology, Chemistry, Physics, and Technology Science (Ministry of Education, 2012). These courses require students to develop their scientific literacy and provide the foundation for the study of science subjects, as well as cultivating a positive attitude to science (Daşdemir, 2016). Students must score high grades in the science subjects to get enrolled in scientific disciplines in higher education, for example, engineering. Scholars have emphatically and consistently highlighted the importance of enhancing favourable attitudes toward science. The results from Australia, England, and Sweden have revealed that students find science subjects too gloomy to interest them and too boring to study (Lyons, 2006).

Additionally, school science is often described as unrelated, difficult, and boring to learn in comparison with other topics. Therefore, teachers are concerned about students' intention as it is essential in supporting students' achievement (Lashari, Kaur, & Awang-Hashim, 2018). Without students' interest in science, they may not make the effort to learn and understand the concepts that they are taught (Helldén, 2005).

There are various factors affecting students' intentions to learn science, such as student interest in science (Mamlok-Naaman, 2011), attitude (Osborne, Simon, & Collins, 2003), perceived utility of science (Bøe & Henriksen, 2015), and intrinsic motivation (Benlahcene, Lashari, & Lashari, 2017; Regan & DeWitt, 2015). However, students' attitude to learning science, and science curriculum were concurrent themes (Hofstein & Mamlok-Naaman, 2011; Mamlok-Naaman, 2011; Stuckey, Hofstein, Mamlok-Naaman, & Eilks, 2013; Yunus & Ali, 2013). As many students currently tend to choose non-science subjects such as, Economics, Literature, Secretarial Studies, Banking, and Finance, it is therefore critical to develop positive attitudes and interest in science.

In the Arab world, there is a declining trend in students' intention to learn science in secondary schools (Erdemir, 2009). Moreoever, the number of Arab students registering in scientific courses in higher education is low, with the World Bank showing that only 20 per cent of tertiary-level students registering in science and engineering (Said, Summers, Abd-El-Khalick, & Wang, 2016). Oman is not an exception to this decline: ofthe number of students studying science, is less than 35 per cent select Biology, and around 40 per cent of them chose Chemistry and Physics. This situation is a matter of concern because there is a total absence of high-quality advanced studies, and a low number of qualified engineering and science (E&S) workforces (Said, Summers, & Wang, 2016).

Researchers have found that the reasons for students not preferring to study science are students' attitude and the science curriculum (Hofstein & Mamlok-Naaman, 2011; Oriahi et al., 2010; Said et al., 2016; Yunus & Ali, 2013). The science curriculum is the fundamental factor that affects attitude towards science. Some people consider science as an unfavoured subject because of the amount of information they have to study and the enormous time spent on memorising facts in the science courses (Erdemir, 2009; Holbrook & Rannikmae, 2007). For example, Jegede (2007) contended that students found chemistry too broad to learn as its concepts take time to be understood. Moreover, it is difficult to learn the overloaded syllabus and teachers must conduct extra classes to cover all the subjects.

Recent studies have found a mixed picture regarding the intention to learn science subjects and science-related curriculum in students of developing countries.Therefore, research should widen its focus by focusing on the Arab countries such as in Oman, where literature is scarce.

The purpose of this study is to investigate the relationship between students' attitude to learning science, their intention in learning science,and the relationship between the science curriculum (Biology, Chemistry, and Physics) and students' intention in learning science.

Previous Studies

Attitude towards science courses

A large number of studies have addressed students' attitude towards science courses. Ajzen (1991) defined attitude as "an attitude toward any concept is simply a person general feeling of favourableness or un-favourableness for that concept". Many scholars have investigated high school students' attitude towards science subjects or becoming future scientists (Aktamış, Hiğde, & Özden, 2016). The findings showed a decline in students' attitude, and thus recommending enhancing student's attitude towards science subjects. Siegel and Ranney (2002) studied attitudes over time about science subjects. The results concluded that students' attitude towards science subjects could be increased through innovative issue-based activities, that is, relating to what is being taught in class to real life. Studies by Yunus & Ali (2013) revealed that students would appreciate Chemistry courses if they were allowed to experiment with what they had learnt in the laboratory. Also, tutors' attitude while delivering lectures also influenced students' attitude to the subjects. Similarly, experimental study results concluded that the positive attitude of a teacher was found to affect students' attitude positively to learning Physics compared to the controlled group of traditional teaching methods (Erdemir, 2009).

School science curriculum

Researchers have shown the effect of strategies of science learning on students' intention towards science. Hofstein and Mamlok-Naaman (2011) examined the influence of problem-solving strategies in a Chemistry course. The result indicated that students in the experimental group developed more positive intention towards Chemistry after the treatment. Similarly, Hagay and Baram-Tsabari (2015) maintained that students who paid attention to science and understood scientific concepts would have better positive attitudes towards the study of science unlike those who face challenges in the field of science. A study by Holmegaard, Madsen, and Ulriksen (2014) on the intention towards science as well as science learning concluded that people are committed to science, desire more to take science courses and continue to read about science when they have a better knowledge of science.

Students' attitude and students' intention toward learning science

It is imperative to say that attitude toward school curricula is considered as one of the major elements affecting individuals to choose or refuse a specific subject. Many researchers have examined the influence of attitude toward science (e.g. Osborne & Dillon, 2008; Said et al., 2016; Awan, Sarwar, Naz & Noreen, 2011; Trumper, 2006). They observed that negative attitude to a topic would result in the lack of intention. In addition, it was found that students choose certain subjects in senior secondary school to avoid certain topics or courses. On the other hand, a significant positive attitude toward science leads to a positive commitment to a subject that is related to science, which further influences lifetime interest as well as learning

science. In the same way, significant positive attitudes toward science have been established to stimulate students' interest in science teaching (Kaya & Boyuk, 2011), and science-related careers (Hagay & Baram-Tsabari, 2015; Hofstein & Mamlok-Naaman, 2011).

There are also researchers who have shown that there is no clear (or negative) relationship between attitudes towards learning science and the intention of studying science (Osborne & Dillon, 2008). A study by Archer et.al (2010) has demonstrated that students with a positive perception of science, who are attentive to natural occurrences, who are able to identify the overall significance of science or the role that science subject plays in their future are, however, not so concerned in the Biology topics they encounter in the schoolroom. Therefore, research has yielded mixed results ,and more studies are required to shed further light on the issue.

School Science Curriculum and Students' Intention to study science

School curriculum has been recognised as one of the major elements that enhance high school students' intention of learning science subjects (Hofstein & Mamlok-Naaman, 2011). A study by Helldén (2005) and Holbrook and Rannikmae (2007) highlighted that the theoretical understanding of the science curriculum, as well as appreciating the nature of science, is likely to be immaterial for our daily life functions, such as applicability in the home, the environment, and future science-related changes and developments that can occur in society.

Currently, there is is a great deal of support for the claim that the major reason for the decline in the interest in science in general, and the physical sciences (Physics and Chemistry) in particular, is directly related to the nature as well as content of the present curricula, concerning both their content and their pedagogies (Hagay & Baram-Tsabari, 2015). In many countries, school science curricula have been shown to be overloaded with content that wholly highlights the internal content structure of the related academic discipline (Aguele, Omo-Ojugo, & Imhanlahimi, 2010). in the result is curricula differentiated by isolated facts that are separated from their scientific origins (Bybee & McCrae, 2011), as well as containing low levels of orientation towards issues relevant to students' daily lives,or of societal interest (Holbrook & Rannikmae, 2007).

METHODS

Given that the aim of the current research was to investigate the relationship among a number of different variables, the researcher adopted a survey research design, a quantitative research method (Alreck & Settle, 1994). A questionnaire was used for data collection as it is an efficient data collection tool (Sekaran & Bougie, 2010).

a) Participants

Participants were selected from seven post-basic schools in Oman. The total population of these schools was 2964. In order to obtain a representative sample size, the researchers used stratified random sampling, i.e. the process of segregation or stratification, followed by a random choice of subjects from each stratum (Sekaran, 2010). The stratified sampling divides the population into groups. These groups are called strata. An individual group is called a stratum. With stratified sampling, the population is divided into groups (strata), whereby a simple random sample from each group (stratum) is taken, and data is collected from each sampling unit that is randomly sampled from each group (Ahmed, 2009), as shown in Table 1 below. Hence, a sample of 341 secondary school students from seven post-basic schools in

Oman was collected using simple random sampling technique. The participants consisted of 209 females (61%) and 132 males (39%).

Table 1. *Stratified Sample for the study*

Population	Groups(Strata)	Simple Random	Sample
All post-basic students in the schools under Al-Sharkiyaha North district.	7 different post-basic schools under Al-Sharkiyaha North district	All Students in Grade 11 from each ofthe 7 post-basic schools.	341

b) Procedure

The researcher saught permission from the seven post-basic schools. Students completed the consent form, which informed them about the purpose of the study. Participants were assured of anonymity and were informed that they could refuse or discontinue to participate at any time during data collection process. Questionnaires were posed bilingually: English and Arabic using Back Translation Method (Brislin, 1970) to deal with the issues regarding reliability and validity which can influence the results as an adapted questionnaire from another language with different cultures can influence the validity of local culture. Therefore, the translation process was done in order to assure the measurement properties are still the same as the original one (Juniper, 2009). Participants took 20-25 minutes to complete the questionnaire.

c) Measures

i)Demographic Profile

The demographic profile was used to gather a clear understanding about the distribution of respondents in terms of gender, and the interest in the field of study.

ii) Students' intention to studying science courses

Liñán & Chen (2009) developed a 5-point Likert-type scale that consistedof items indicating different aspects of general intention. In order to meet the aim of the current study, the researcher modified all five items to apply to an educational context. Similar items have been used by previous studies such as Zhao, Seibert, and Hills, 2005, and Armitage and Conner, 2001. Three distinct types of intention measures were identified: self-prediction ("How likely it is . . ."); desire ("I want to . . ."); and behavioural intention ("I intend to . . ."). This last type provides slightly better results in the prediction of behaviour (Armitage & Conner, 2001). The alpha coefficient values in the original study ranged from .773 to .943. Thus, theoretically, the scales are considered as reliable (Liñán & Chen, 2009). However, in the present study good internal consistency was obtained (Cronbach's alpha= .72).

iii) Students' attitude toward science courses

Students' attitude towards science courses were measured using Swirski and Baram-Tsabari's (2014) scale that addresses general, specific, relatedness, and competence in science. The questionnaire consists of 20 items ranked on a four-point Likert scale (strongly disagree - strongly agree). The researcher used 12 items which were directly related to measure students' attitude based on the interest of the present study. Moreover, the neutral

option was removed to simplify the scale for the students as it was conducted in a primary school context. Good internal consistency was obtained (Cronbach's alpha = .86.).

iv) School science curriculum

School science curriculum was measured using Kardash and Wallace's (2001) six-factor school science curriculum scale that consists of 68 items. Factor 1 was labelled as 'pedagogical strategies'; factor 2 as 'science faculty'; factor 3 as 'perceived competence in science'; factor 4 as 'passive'; factor 5 as 'students' grades' in their science classes; and factor 6 as 'laboratory experiences learnin'g. The reliability for the 68-item scale was .94, which indicates that factors analysis was highly appropriate for the data set.

However, the present study adapted only the 11 items of factor 1 which included items that are related to classroom presentation of information and connections with real-life experiences. In addition, the study adapted items from factor 3 which reflected students who view science as exciting and relevant, who enjoy science classes, and who feel competent in their ability to understand and do science. Furthermore, a few items that tap students' perceptions of the laboratory activities associated with their science classes are within factor 6. Good internal consistency was obtained as Cronbach's alpha was found to be .73.

FINDINGS

a) Preliminary analysis

The researchers examined the preliminary data screening test to recognise any possible violations of the multivariate assumptions about the application of multivariate data analysis (Hair, Money, Samouel, & Page, 2003) which includes (1) missing value analysis, and (2) valuation of outliers (Jnr, Money, Samouel, & Page, 2007).

i) Missing value analysis

Missing data were identified using Missing Value Analysis (MVA) which was found to be 1.8% of values across all scales and were consequently substituted by means replacement because the missing data was less than 10% (Tabachnick & Fidell, 2007). Item-mean substitution (IMS) reproduces dataset as accurately as other imputation methods (e.g. multiple imputation) across various missing patterns (Tabachnick & Fidell, 2007).

ii) Outliers

Outliers are identified as the existence of outliers in the data points that can extremely misrepresent results by giving unpredictable outcomes (Osborne & Overbay, 2004). Multivariate outliers were identified by employing Mahalanobis distance. Sixteen multivariate outliers (i.e., 8, 13, 35, 52, 47, 81, 86, 90, 107, 112, 120, 141, 165, 206, 297, and 310) were identified and then removed from the dataset because they could influence the precision of the technique of data analysis. Hence, a total of 325 samples were used to run the analysis.

b) Primary analysis

i) Descriptive analysis

The demographic profiles of the 325 respondents were gathered in order to provide a clear understanding of the distribution of the respondents in terms of gender, and interest field of study. These properties were included in order to give the demographic profile information

on the sample. Table 2 presents the descriptive statistics demographic profile for each item in this study.

Table 2. *Summary of Demographic Profile*

Demographics	Frequency	Percentage
Gender		
Male	132	41
Female	193	59
Interest		
All three science subjects (biology, chemistry, and physics)	75	23
Two subjects only	102	31
One subject only	55	17
Technology science only	93	29

c) Hypothesis testing

i) Correlation Analysis

Correlation analysis was run to test the relationship between all study variables namely students' attitude toward the learning of science, and school science curriculum, and students' intention to learn science. Pearson's correlation analysis is ranged between +1 and -1 and such value explains the strength of relationship between independent and dependent variables which is to categorise low, moderate or high based on the value of the Pearson's correlation analysis.

Table 3. *Correlation among study variables*

		SI	SA	SSC
Study Intention	Pearson Correlation	1		
	Sig. (1-tailed)	.000		
	N	325		
Study Attitude	Pearson Correlation	**.360****	1	
	Sig. (1-tailed)	.000		
	N	325	325	
School Science Curriculum	Pearson Correlation	**.411****	**.357****	1
	Sig. (1-tailed)	.000	.000	
	N	325	325	325

**. Correlation is significant at the 0.01 level (1-tailed).

The results revealed positive and significant relationships among students' attitude, and school science curriculum, and students' intention to learn science course.

DISCUSSION

The purpose of the present study was to examine the relationship between the attitude toward science course, and school science curriculum on the intention of learning science among students in post-basic education in Oman. The results indicated that students' attitude was significantly and positively related to their intention to learn science subjects. Moreover, school science curriculum was also found to be positively and significantly linked to students' intention.

Students' attitude was found to be associated with their intention to learn science subjects in high school. This finding was supported by earlier studies which investigated the relationship of students' attitude toward science and their intention to continue studying

science, especially in precollege students (Kaya & Boyuk, 2011; Osborne & Dillon, 2008; Said et al., 2016; Awan et al., 2011; Trumper, 2006). The findings revealed that negative attitude toward a subject led to absence of intention. Additionally, a positive attitude toward science resulted in a positive commitment to science which might further affect lifelong intention as well as continuous learning in science.

The result of the second research question indicated that school science curriculum is significantly related to the intention to continue studying science ($r = .41$, $p < .05$) which is consistent with previous studies (Hagay & Baram-Tsabari, 2015; Holbrook & Rannikmae, 2007; Helldén, 2005; Yunus & Ali, 2013). Poor perception of school science curriculum is related to students' intention to avoid learning Biology, Physics, and Chemistry in post-basic education. This positive relationship was also in line with earlier researches indicating that school curriculum had been recognized as one of the key elements that enhanced secondary school students' intention towards learning science subject (Hofstein & Mamlok-Naaman, 2011). This is consistent with the findings of Holmegaard et al. (2014), who suggested that pupils were committed to science subjects when they had better knowledge of science, an aspiration to take more science subjects and continue to read about science. Moreover, similar results have been found in the studies by Holbrook and Rannikmae (2007) and Helldén (2005) who emphasised that appreciating the nature of science as well as the theoretical understanding of science curriculum is likely to be irrelevant for daily life functions, that is, related to the home, the environment, and for future science-related changes. The result of this study was supported by Hagay and Baram-Tsabari (2015) who found that the key reason for the decrease in the intention for science in general and specifically Physics and Chemistry, was directly linked to the nature as well as content of the present curriculum, concerning both the pedagogies and their contents. This could be largely the consequence of a curriculum differentiated by isolated facts separated from the scientific contents (Bybee & McCrae, 2011), as well as the low levels of orientation towards related concerns taken from pupils' daily life or for social interest (Holbrook & Rannikmae, 2007). Hence, pupils were unsuccessful in making connections between different concepts as well as facts presented and their practical implementation, losing the 'big picture' of science. Specifically, all these issues have a possible influence on their intention. In the same context, the current paper expects that school science curriculum is positively related to intention for learning science courses among school students.

The present study focused on the relationship of students' attitude toward science subjects, and school science curriculum on students' intention to learning science in post-basic schools in Oman. The findings from the analysis had confirmed that there are significant and positive relationships among the study variables. It was found that students' attitude toward science education was negative. The findings also confirmed that school science curriculum was the most important variable to lessen the intention toward science courses among students in post-basic schools in Oman.

Limitations and Recommendations

The present study has several limitations. Firstly, the current study sample was small which may not reflect the larger population. Future studies with larger sample size will offer a more comprehensive view of international students. Moreover, the sample was collected from seven post-basic schools located in North governorate in Oman. Therefore, it offers limited generalisability

Secondly, the field of this study focused on the combination of three science subjects; Biology, Chemistry, and Physics together. It is not possible to identify which of these subjects had more positive students' attitude. Therefore, future researchers need to study each subject

individually. Finally, future study is needed to focus on other potential variables such as motivation (students' cultural experience, pedagogy in teaching science) that can influence students to engage themselves effectively toward science courses.

Implications for practice and research

The findings of this study have significantly contributed to the science education literature. The study has implication on science teachers. The teachers should put effort to enhance students' attitude toward science as the study shows poor students' attitude can affect intention to learn science. Moreover, school administrators can introduce teacher development trainings that will provide guidance to science teachers to use different methods to make the science subjects more interesting. Furthermore, the present study may enable the curriculum developers to introduce more areas of science which need to be taught through experimental method and to include more real-life examples in the science curriculum as these may enhance students' interest.

CONCLUSION

The present study was conducted to investigate the relationship between students' attitude toward science subjects, and school science curriculum on the intention to learn science in post-basic schools in Oman. The findings from the analysis had confirmed that there are significant and positive relationships among the study constructs. It was found that students' attitude toward science education was negative. The findings also confirmed that school science curriculum was the most important variable to reduce the intention toward science courses among students in post-basic schools in Oman.

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