Attitudes of Fourth and Eighth Grade Jordanian Students toward Science: A Cross-Sectional Study

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Abstract

Tracking changes in students' attitudes toward science is an important issue in quality science education. This study investigated how students' attitudes toward science change as they move from fourth grade to eighth grade. For the goal of this study, a nationwide sample comprised of 2345 Jordanian students who responded to the "Arabic Speaking Students' Attitudes towards Science Survey (ASSASS)". Analysis of results focused on the following two variables: gender and the school type (public, private). Results indicated that the attitudes toward science, for male and female eighth grader students, declined significantly in two sub-scales of ASSASS: "attitudes toward science and science learning" and "intention to pursue science studies". However, females still have more positive attitudes to science compared with males in the two grades. Moreover, results of the study revealed that students' attitudes toward science were affected by school type, in favor of students in the private schools. The study suggested further work about other variables that may affect attitudes toward science.

Introduction

Students’ attitudes toward science play an important role in their interest, attention, and response to science and technology. Moreover, attitudes form a part of scientific literacy, that is, a person’s scientific literacy includes certain attitudes, beliefs, motivational orientations, self-efficacy, and values (The Organization for Economic Co-operation and Development: OECD, 2013). Scott and Mallinckrodt (2005) argued that students are more likely to proceed to post-secondary schooling in any of the Science, Technology, Engineering, and Mathematics (STEM) fields if they have high self-efficacy in science.

The attitude one holds towards an object or something affects his/her behaviors. Trying to understand students' attitudes toward school science and/or Science, Technology, Engineering, and Mathematics (STEM) related subjects, and developing instruments to measure these attitudes are still one of the most important aims for researchers in science education (e.g. Kennedy, Quinn, & Taylor, 2016; Lyons & Quinn, 2010; Potvin & Hasni, 2014; Han & Carpenter, 2014). Moreover, the enduring focus of researchers remains on understanding how students’ attitudes toward science change over time. This field of research has got a global interest in many countries[e.g. in USA (Desy, Peterson, & Brockman, 2011), Australia (Kennedy, Quinn, & Taylor, 2016), Qatar (Said, Summers, Abd-El-Khalick & Wang, 2016), Indonesia (Sofiani, Maulida, Fadhillah, & Sihite, 2017), and Oman (Al-Araimi, Ambusaidi, Selim & Al-Amri, 2018)]

Science educators identified some variables that may affect students' attitudes toward science. Ogguniyi (1982) found that students’ positive attitude toward science could be enhanced by the following teacher-related factors: teachers' enthusiasm, teachers' resourcefulness, helpful behavior, and teachers' thorough knowledge of the subject matter and their making science quite interesting. The research revealed that applying quality teaching positively affectstudents' attitudes to science and scientific attitudes as well (e.g. Mussen, 2007; Demirci, 2017; Fitriani, Zubaidah, Susilo & Al Muhdhar, 2020). Osborne, Shirley and Collins (2003) pointed out that the quality of teaching science is one of the significant factors that determine students’ attitudes toward science. Trefil (2008) in his book "Why Science?" wondered about the reasons behind the vanishing of pupils’ interest and eagerness to learn science once they enroll in school and engage in science classes. Furthermore, Trefil remarked that unqualified elementary teachers are one of these reasons. As a result, negative attitudes of students toward science may grow up.

Some research studies revealed that prospective elementary teachers do not feel confident or comfort to teach science and do not prefer to teach it (Smolleck, Zembal-Saul, & Yoder, 2006; Wilkins, 2010). Dunlop and Fraser (2008) remarked that many elementary teachers have a rooted phobia of teaching science. Wilkins (2010) also pointed out that teaching all the academic subjects by elementary teachers places vast burdens on them; as they are supposed to teach all these subjects neglecting their preferences. In this context, the study conducted in Jordan by Abed, Asha, and Ibrahim (2014) revealed that elementary teachers have low preferences to teach science in the primary stage compared with the other academic subjects. The same results were revealed by...
Manning, Esler, and Baired (1982). In another Arab country, in Qatar, there is a scarcity of quality teachers; as the teachers were frequently required to teach the subjects outside their field of expertise (Brewer, Augustine, Zellman, Ryan, Goldman, Stasz, & Constant, 2007).

In addition to the aforementioned variables, gender is one of the crucial variables that may affect students' attitudes toward science. Research on students' attitudes related to gender reported conflicting results. The study conducted by Sofiani et al., (2017) revealed no significant difference in attitude toward science regarding gender. Another study reported that female students have more positive attitudes towards science than male students (Susilawati, Aznam&Paidi, 2022). The study conducted by Desy et al., (2011) found that females are more anxious about science, less enjoyed, and less motivated by science than males.

The continuing decline in enrollments in post-compulsory science courses and STEM related subjects is remarkably noted in many countries; in Australia (Kennedy, Quinn, & Taylor, 2016), in the USA (Sadler, Sonnert, Hazari, & Tai, 2012), and England (Murphy & Beggs, 2003; Pell & Jarvis, 2001). The study conducted by Murphy and Beggs (2003) shows a strong decline in pupils' enjoyment and interest in science in the final two years of primary school. Some reasons that have been suggested by Murphy and Beggs (2003) for such decline are inappropriate curriculum content with a repetitive topic that does not accommodate students' interest, practice for high stake national tests in which teaching is content-centered [introduce science as a body of knowledge], and lack of experimental works. In England, a study conducted by the Institute of Electrical Engineers: IEE (1994) showed a decline in children's interest in science between the ages of 10 and 14.

The Arab Human Development Report (United Nations Development Programme [UNDP], 2003), which reported the scientific production in Arab countries, states the low number of students enrolling in scientific disciplines in higher education in all Arab countries, in comparison to other countries such as Korea. Although Jordan is distinguished among Arab countries in this field, the same report also states that "...the number of scientists and engineers working in research and technological development in Arab countries is not more than 371 per million citizens. This is much lower than the global rate of 979 per million..." (p. 4). One of the main interpretations of such status is introduced by Osborne, Simon, and Tyler (2009); as they pointed out that the level of students' interest in science at an early age of schooling is a critical variable for pursuing scientific-related careers. As such, students' attitudes toward science are a critical variable that determines the success or failure of development plans in any country.

Context of the Study
An Overview of Education in Jordan
The Hashemite Kingdom of Jordan (Jordan) is an Arab country which is located in the heart of the Middle East. The country has an area of 89,342 square kilometers. More than (78.4%) of the total area is "Badia" or semi-desert. According to the last population and housing Census conducted in December 2015 by the Jordanian Department of Statistics (DOS), the population of Jordan is 9,531,712 million; with approximately 69.4 percent and 30.6 percent of the population being Jordanian and Non- Jordanian, respectively. About 42.04 percent of the population resides in Amman; the capital of Jordan. Because of the successive immigrations to Jordan, the population multiplied ten times within 55 years (DOS, 2016). As a country with scarce natural resources, Jordan strives to take its place as a modern country, where education takes utmost importance. Policy-makers in Jordan put the investment in human resources at top of their priorities, as one of the crucial goals for sustainable development plans. In this context, education in Jordan has always been an important component of the success, health, prosperity, and security of its people (Ministry of Education: MoE, 2014).

Jordanian educational system consists of three cycles: pre-school [pre-primary] education, basic [primary] compulsory education which starts from first grade to tenth grade, and secondary education which lasts for two years (eleventh and twelfth grades). Basic education in Jordan is divided into two cycles: the lower elementary (first – third grades) and upper elementary (fourth – tenth grades) (MoE, 2014).

The current state of science education in Jordan
Science teaching in basic education in Jordan aims at preparing learners to (1) absorb basic scientific facts and generalizations and their experimental bases, and use them to explain natural phenomena; (2) think scientifically, using the process of observation, data collection, organization, analysis, deduction and making decisions and judgments based on them; (3) comprehend the scientific basis of the forms of technology and use them properly; and (4) be keen on the safety, cleanliness, beauty and wealth of the environment (UNESCO, 2011, p.12).

Unfortunately, some weak indicators in attaining the aforementioned goals of science education have come from the results of the Trends in Mathematics and Science Study [TIMSS]. In 1999 TIMMS results, Jordan ranked 30th with 450 points (UNDP, 2003). In 2003 TIMSS results, although Jordanian 8th-grade students ranked first among all Arab countries in science, they still below the international average. In 2011, 2015, and 2019 TIMSS results, Jordanian students were ranked (28, 32, and 31) with (449, 426, and 452 points) respectively among the participating countries (National Center for Human Resources Development, 2021). In general, the rounds that
Jordan participated in TIMSS and Programme for International Student Assessment [PISA] revealed a good performance in comparison with other countries in the region but below the international averages (The World Bank, 2009). In general, Jordanian students' results in the aforementioned tests validate a general STEM weakness up till grade 10 (Arabian Business Consultants for Development, 2017).

To improve science education and achieve the ambitious goals of education in general and goals of science education in specific, the Ministry of Education (MoE) in Jordan; the only responsible party for education, launched some initiative reforms in the educational institution over the last decades. One of the major reforms in the Jordanian educational system was held and announced in year 2000 [Vision Forum for the Future of Education]. Education Reform for Knowledge Economy (ERIKE I & II) is emanated from the recommendations of the aforementioned forum (MoE, 2008). ERIKE(I & II) continued from (2003) to (2014) aiming to prepare qualified students who have the necessary knowledge, skills, and competencies needed for the knowledge economy. Moreover, developing curricula, evaluation, and professional development of teachers (MoE, 2014; MoE, 2008).

Despite all the above-mentioned reforms, UNESCO’s (2011) report pointed out some weaknesses in Jordanian curricula and teaching methodologies (e.g. the curricula are based on a narrow traditional concept and the teachers had the main role in teaching). These indictors stimulate MoE in Jordan to launch a curriculum development process aiming at giving students more roles in their learning, acquiring the skills of decision making, problem-solving, and critical thinking. To evaluate the probable improvement in students’ achievement in the different subjects, the National Center for Human Resources Development implemented a nationwide project of evaluation. This project focused on fourth grade and eighth grade students’ achievement in Arabic language, mathematics, and science. Unfortunately, the evaluation results did not live up to expectation, as the major results in students’ achievement in science revealed that students’ means did not indicate the mastery level, girls’ results were better than that of boys, urban students were better than that of rural ones, and the means of science achievement of the students who attended the private schools were the best in general UNESCO’s (2011). In conclusion, the education system in Jordan still faces many challenges, that’s why the MoE announce its “Education Strategic Plan (2018-2022)” to overcome these challenges (MoE, 2018).

A closer look at teacher preparation in Jordan

The faculties of education in Jordanian universities are the only parties that graduate "qualified" teachers with Bachelor's (B.A.) degrees in education. Faculties of education prepare teachers in two programs: Early Childhood Education and Classroom Teacher. Except for the English language, preservice teachers in both degrees enroll in 4- year generic preparation programs to teach children and pupils all academic subjects (i.e. Arabic language, mathematics, science, vocational education, Islamic education, social studies, art, and physical education).

Early childhood education teachers are supposed to teach children in the pre-school/ pre-primary cycle (kindergarten) – this cycle is noncompulsory. Here is an example of the courses that preservice teachers are required to study in some of the prestigious universities in Jordan. Related to science and its teaching methodologies, preservice teachers in early childhood education programs are required to take a 3-credit-hour course entitled, Mathematical and Scientific concepts, a 3-credit-hour course entitled Developing Thinking Skills, and a 3-credit-hour course entitled Teaching Methodologies. The first two courses are compulsory, whereas the third is optional.

Regarding the ClassroomTeacher program, preservice teachers are supposed to teach pupils in the lower elementary cycle these are the first three grades of compulsory education. Classroom teachers are supposed to take two to three courses in science and science teaching methodologies with 3- credit- hours for each (e.g. Scientific Concepts and their Teaching Methods I and II, Concepts in Natural Sciences, Teaching Science for Beginners, Science for Elementary School Teachers I and II, and Science Teaching Methodologies). Even though, these courses have different titles in different universities, to some extent they have the same syllabi (Abed & Abd-El-Khalick, 2015).

Teachers in the upper elementary cycle (fourth- tenth grades) and secondary education (eleventh -twelfth grades) are specialized in the different academic subjects (e.g. physics, biology, geology, chemistry, mathematics, Arabic language, English language, history, social studies, etc.). The vast majority of teachers who are working in these two stages had graduated from non-educational faculties (e.g. faculty of science, faculty of arts, faculty of Islamic studies). In general, those teachers did not get any educational qualifications; simply they had graduated from the university and had been employed at schools as teachers*. One of The World Bank reports about Jordan pointed out that the majority of teachers who enter classrooms are lack training in classrooms skills or pedagogical methodologies (The World Bank, 2009). In Jordan, a study conducted by Al-Tarawneh and Al-Hawwari (2015) had pointed out some problems that encounter students- teachers at

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* Some in-service teachers previously graduated from faculties of education with a B.A. degree in education majoring in-field teacher. The field teacher program had been canceled before about two decades
cooperative schools during practicum program. Moreover, other research studies recommended the need for developing "teacher-preparation" programs (e.g. Al-Kassab, Abuali, & Alsalti, 2021). Lack of preservice training at higher education institutions and scarcity of criteria for teacher employment has motivated the MoE to offer training programs for newly hired and in-service teachers as well. One of these initiatives was the founding of Queen Rania Teacher Academy (QRTA) in 2009, aiming at raising the quality of teaching through developing teachers' skills and newly hired teachers as well. One of the basic activities of QRTA is developing teachers' teaching skills in the core content area of the Arabic language, mathematics, English language, and Science (MoE, 2014). MoE also has adopted some criteria for employing teachers, such as the results of a competitive exam and holding an interview with the candidates.

Unfortunately, a report was conducted and supported by the European Commission aiming to evaluate the training programs of newly hired teachers, reported that the training programs are insufficient to prepare teachers to use the developed teaching methodologies in classrooms (MoE, 2014). With a closer look at science teaching in the compulsory education stage (first -tenth grades) in Jordan, we can see that teacher, neither in the lower elementary stage nor in the higher elementary stage are well prepared to teach science. The weak preparation of elementary teachers in pre-service programs and lack of well in-service training results in a lack of content knowledge, negative attitudes toward science, and a lack of self-confidence to teach science. Such a case is not only in Arab countries; in Jordan (Abed & Abd-El-Khalick, 2015) and Oman [one of the Arab countries] (Murphy, Ambusaidi&Beggs, 2006), but also other non-Arab countries (Milner, Sondergeld,Demir, Johnson, &Czerniak, 2012; Minogue, 2010; Murphy, Ambusaidi&Beggs, 2006).

Rationale of the Study and its Importance

As with other Arab countries, the education system in Jordan emphasizes the importance of lifelong learning for all students to create a skilled workforce that can participate in economic development (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2011). Nonetheless, the ratio of enrollment in vocational secondary education in Jordan declined from 18 percent in 2000 to 12 percent in 2005 (The World Bank, 2009). Moreover, according to the 2008 World Bank report "The Road Not Traveled: Education in the Middle East and North Africa", only 20% of Arab students at the university level enrolled in "science and technology" field of study. Although the enrollment percent of Jordanian students in such field of study is high to somewhat (30.0%), it still below the percent of other countries, e.g., China 46.8, Korea 41.1, and Malaysia 40.0 (The World Bank, 2008).

The noticeable decline in students' attitudes toward science promotes carrying out a similar survey to investigate whether this trend is the same in Jordan, and if so, what are the probable reasons for such decline in attitudes. Whereas the study conducted by Osborne, Simon, and Tytler, (2009) revealed that the age of 10 to 14 is the critical age for students to engender their interest in science and for their pursue scientific-related careers. Also, the student's life experience before the age of 14 is the most significant determinant for these traits. The current study focuses on these two critical ages, (i.e. 10 years and 14 years) (fourth and eighth grades male and female students). As the current study tried to investigate students' attitudes toward science in general, not toward physic, chemistry, biology, or geology in specific; the reason for selecting these two grades refers to the implemented science textbooks in Jordanian schools, that's to say the science textbooks in fourth. and eighth. grades are titled in “Science”, whereas science textbooks after eighth grade are separated in different textbooks (i.e. biology, chemistry and geology, and physics).

It is important to say that students in the fourth and eighth grades are taught by specialized science teachers, rather than classroom teachers as is in the grades before fourth. Moreover, according to Willett (1994), measurement of change over time is important in educational research because "education is intended to foster learning, to bring about changes in attitudes, achievement, and values" (p. 671).

Purpose of the Study

This is a cross-sectional descriptive study; it comes to investigate the attitudes of elementary stage Jordanian students toward science. Specifically, this study focuses on how these attitudes may change at two critical ages: 10 years and 14 years.

The following main question guided the study: How are Jordanian students' attitudes toward science change as they move from fourth grade to eighth grade?

To better focus on the impact of any factors that may affect students' attitudes toward science, the authors considered the following variables: gender and school type.

Method
For this study, the "Arabic Speaking Students' Attitudes towards Science Survey" (ASSASS) which was developed by Abd-El-Khalick, Summers, Said, Wang & Culbertson (2015) was administered to a selected nationwide sample of Jordanian students who finished 4th and 8th grades very recently.

Participants

A nationwide sample consisting of 2345 Jordanian students participated in this study at the beginning of the 2019-2020 scholastic year. Participants were selected from three geographic regions where the schools were located: 914 students from the north governorates (39%), 1062 from the middle governorates (45.3%), and 369 from the south governorates (15.7%). Participants were already enrolled in two school types: Public schools which are funded by the Jordanian Ministry of Education [n= 1245, (53.1%)] and private schools which are privately funded [n= 1100, (46.9%)]. It has to be noted that both school types follow the same science curricula. From the sample, 964 were 4th graders (41.1%) [540 male students, 424 female students], and 1381 were 8th graders (58.9%) [737 male students, 644 female students].

The ASSASS Instrument

The ASSASS was administered in this study. This instrument was developed in the study conducted by Abd-El-Khalick et al., (2015), which aimed at developing and validating an instrument to assess Arabic-speaking students' attitudes toward sciences. ASSASS was designed to address Qatari students' Interest in, and Attitudes toward, Science (QIAS). To get the Arabic version of ASSASS, one of the researchers of this study emailed the first author of the aforementioned study (Abd-El-Khalick et al., 2015). The ASSASS instrument comprised of 32-item statements distributed into five sub-scales as follows: (1) 'Attitudes toward science and science learning, which addressed students' attitudes toward science and science learning (e.g. 'I enjoy science', 'We do a lot of interesting activities in science class'); (2) 'Unfavorable outlook toward science', which represented students' perceived ability to learn science (e.g. 'I cannot understand science even if I try hard), the utility of science (e.g. 'Scientific work is only useful to scientists'); (3) 'Control beliefs', which pertain students' self-efficacy toward science learning (e.g. 'I am confident that I can understand science'); (4) 'Behavioral beliefs about the benefit of science', (e.g. 'We live in a better world because of science'); and (5) 'Intention to pursue or engage in science in the future, (e.g. I will take additional science courses in the future). Respondents in this study specify their extent of agreement or disagreement on a 5-points Likert scale (strongly agree=5, agree=4, not sure=3, disagree=2, and strongly disagree=1).

The applicability of ASSASS to Arab students was verified by other studies (e.g. Said, Summers, Abd-El-Khalick & Wang; 2016; Summers, Wang, Shuai, Abd-El-Khalick & Said; 2019). To validate the ASSASS for this study and get more validation indicators, a panel of experts in science education revised the instrument to establish its face validity and made comments about any changes if needed. Next, the instrument was pilot-tested with 100 students from the population of the study. The overall Cronbach's alpha coefficient of internal consistency for the instrument was high (.88), and the reliability coefficient of the five sub-scales was good: attitudes toward science and science learning (.86), unfavorable outlook toward science (.78), control beliefs (.73), behavioral beliefs about the benefit of science (.80), and intention to pursue science studies (.71). These measures support the applicability of ASSASS for the current study.

Data Analysis

Descriptive statistics (mean scores (M) and standard deviations (SD)) were generated for ASSASS five sub-scales. Analysis of Variance (ANOVA) was used to examine the significance of the differences amongst mean scores.

Results

Results Related to GradeLevel

Table 1 presents the mean scores (M) and SD for ASSASS five sub-scales. ANOVA comparison of mean scores indicates that students' mean scores on two of the five sub-scales: "attitudes toward science and science learning" and "intention to pursue science studies" declined significantly with higher grade levels [p<.0000] for both]. The decreasing pattern in students' mean scores does not apply to the three other factors; that's to say the differences are not statistically significant (0.066<p<0.778).

<table>
<thead>
<tr>
<th>ASSASS Sub-scales</th>
<th>Grade</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes toward science and science learning</td>
<td>4th grade</td>
<td>3.84**</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>8th grade</td>
<td>3.62</td>
<td>0.75</td>
</tr>
</tbody>
</table>
Unfavorable outlook toward science  
4th grade 2.72 0.68  
8th grade 2.67 0.70  
Control beliefs  
4th grade 3.92 0.92  
8th grade 3.99 0.89  
Behavioral beliefs about the benefit of science  
4th grade 3.74 0.79  
8th grade 3.73 0.72  
Intention to pursue science studies  
4th grade 3.49** 0.83  
8th grade 3.30 0.86  

*N: (4th grader= 964, 8th graders=1381)  
** The mean difference is significant at the 0.05 level

Results Related to Gender

ANOVA comparison between students' mean scores (M), disaggregated by gender, revealed significant differences in all ASSASS sub-scales in favor of female students (0.000< p < 0.014), with exception of the second sub-scale (i.e. unfavorable outlook toward science), the differences are not significant (Table 2). This result gives the induction that females still have more positive attitudes toward science compared with males.

Table 2. Descriptive statistics on ASSASS sub-scales disaggregated by gender*

<table>
<thead>
<tr>
<th>ASSASS Sub-scales</th>
<th>Gender</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes toward science and science learning</td>
<td>Male</td>
<td>3.64</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.79**</td>
<td>0.79</td>
</tr>
<tr>
<td>Unfavorable outlook toward science</td>
<td>Male</td>
<td>2.67</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2.70</td>
<td>0.76</td>
</tr>
<tr>
<td>Control beliefs</td>
<td>Male</td>
<td>3.90</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4.02**</td>
<td>0.89</td>
</tr>
<tr>
<td>Behavioral beliefs about the benefit of science</td>
<td>Male</td>
<td>3.69</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.79**</td>
<td>0.75</td>
</tr>
<tr>
<td>Intention to pursue science studies</td>
<td>Male</td>
<td>3.34</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.42**</td>
<td>0.87</td>
</tr>
</tbody>
</table>

*N: (Male= 1277, Female= 1068)  
** The mean difference is significant at the 0.05 level

Results Related to School Type

As noted in Table 3; mean scores (M) of students who enrolled in private schools, have significantly more positive indicators in three sub-scales of ASSASS (i.e. "Attitudes toward science and science learning", "Control beliefs", and "Behavioral beliefs about the benefit of science"). In contrast, the mean scores (M) of students who enrolled in public schools have an advantage over the rest sub-scales (i.e. "Unfavorable outlook toward science and "Intention to pursue science studies") (0.000< p < 0.006).

Table 3. Descriptive statistics on ASSASS sub-scales disaggregated by school type*

<table>
<thead>
<tr>
<th>ASSASS Sub-scales</th>
<th>School type</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes toward science and science learning</td>
<td>Public</td>
<td>3.67</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>3.76**</td>
<td>0.78</td>
</tr>
<tr>
<td>Unfavorable outlook toward science</td>
<td>Public</td>
<td>2.97**</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>2.36</td>
<td>0.57</td>
</tr>
<tr>
<td>Control beliefs</td>
<td>Public</td>
<td>3.71</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>4.24**</td>
<td>0.81</td>
</tr>
<tr>
<td>Behavioral beliefs about the benefit of science</td>
<td>Public</td>
<td>3.60</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>3.89**</td>
<td>0.70</td>
</tr>
<tr>
<td>Intention to pursue science studies</td>
<td>Public</td>
<td>3.44**</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>3.30</td>
<td>0.90</td>
</tr>
</tbody>
</table>
Conclusion and Discussion

This study is unique because it sheds light on some variables that may affect students’ attitudes toward science, containing grade level (age), gender, and school type. Consequently, students’ intention to pursue studies in science.

Grade level, the main focus of this study, results showed that differences are significant in two of the five ASSASS sub-scales (namely, attitudes toward science and science learning, and intention to pursue science studies). This finding confirmed, unanimously on these two sub-scales, the earlier work of Ziade et al., (2016). The study was conducted by Susilawati, Aznam and Paidi (2022) uncovered that the enjoyment of learning science gets less when primary school students enter secondary school. In general, the declining pattern of students' attitudes toward science is confirmed by many earlier findings (i.e. Kennedy, Quinn, & Taylor, 2016; Sadler et al., 2012; Pell & Jarvis, 2001; Murphy and Beggs, 2003). Ziad et al., (2016). This declining pattern seems to apply well in the case of Jordan, the context of this study. One of the critical reasons behind such a falling pattern in attitudes is the gap between “what science is” and “what is taught in science classrooms”, and “how it is taught”. That’s to say, neither science curriculum nor science teaching methodologies are effective in making students do/practice science. In Jordan, some works confirmed that both science teachers and classroom teachers are not well prepared to teach science effectively (i.e. Abed & Abd-El-Khalick, 2015; Zou’bi, T. and Alsalamat, M. (2010); Abed et al., 2014; Abed, 2009).

Gender was found to have significant effects on all ASSASS five factors in favor of girls, with exception of the second sub-scale (namely, unfavorable outlook toward science) the differences were not significant. This result comes following the results of some earlier research (e.g. the study conducted by Deborah and Beriter, 2012) which confirmed that Kenyan girls have a favorable attitude toward science, the study of Bajaj and Devi, 2021, and the study of Susilawati, Aznam and Paidi (2022) which confirmed that girls have more positive attitudes toward science than males. In another aspect of the results regarding gender effects on attitudes, some research either revealed no significant difference between males and females or little differences (e.g. Sofiani et al., 2017; Murphy & Beggs, 2005; Pell & Jarvis, 2001). Ziad et al., (2016). Across several countries, Keeves & Kotte (1996) challenged the aforementioned indicators and drew attention to discrepancies in students' reported attitudes toward science in favor of male students. One of the most remarkable results can be seen in the study conducted by Osborne, Driver, and Simon (1998). This study revealed that science attitudes and interests are developed early in primary school. The study also pointed out that the positive attitudes towards school science appeared to peak at (or before) the age of 11 and decline thereafter by quite significant amounts, especially in girls. In general, gender effects on students’ attitudes toward science are subject to many reacted variables (i.e. culture, societal forces, and educational practices).

Regarding school type, results indicated the superiority of students at private schools over their counterparts at public schools in three sub-scales, whereas students at public schools show superiority in the remaining two sub-scales. The results of the current study confirmed the earlier findings of Bajaj and Devi (2021) but were not supported by other research results (Maison, Kurniawan, and Zain, 2021). Moreover, according to UNESCO’s (2011) report, students who attended private schools achieve the best in science. If we considered the type of school as a proxy for quality science teaching, we can say that students benefited more from private schools compared to public schools.

Recommendations

Results of this study indicated that students’, males and females, attitudes toward science declined dramatically with age. The need for revising and developing science curricula is still critical and inescapable. Any development of curricula should cast behind back the traditional view of science; the curricula that present science as fragmented knowledge and insulated from students’ needs, interests, and real life. Moreover, “worth” curricula do not diminish the importance of well-prepared science teacher in all grade levels. The results obtained from this study need more researches to track, in-depth, other variables that may affect students’ attitudes (e.g. achievement in science, students’ socioeconomic status).

References


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