Teachers and Students' Perceptions of Science and Scientists: A Comparative Study

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Article Info	Abstract
	Teaching science is still relying mainly on frontal teaching and assessed by paper-and-pencil-tests. Also, students in developed countries view science production through doing experiments in a lab, that's why these students hold a negative view about science and scientists and they do not like to choose their future careers in science. The purpose of this study is to explore Lebanese and Omani school science teachers' and their students' perceptions of science and scientists. Using the Draw-a-scientist-test (DAST), qualitative and quantitative data were collected from 26 Lebanese and Omani teachers and their students (N= 571) enrolled in Grades 4 till 9, in both countries, from the public sector. Results showed that the main sources of Lebanese and Omani students of their drawings are the television and the internet. In addition, these sources are significant with the increase in students' levels. Also, Lebanese students have more stereotypical image of the scientist than Omani counterparts. Overall, Lebanese and Omani students have a positive attitude towards science and scientists, as their teachers, but they emphasized the social and the private life of the scientist. Overall, students choose to have a future career in science and technology; but Omani students choose to have a career in science and technology more than the Lebanese ones. In addition, female students showed a higher interest in doing science in the future more than technology. Finally, Lebanese students do not have common contemporary or past Arab scientists as their Omani peers, but only scientists from the western culture. Data revealed that Einstein was the most popular idol among the sample of the study.

Introduction

Literature has shown that students dislike science because it is taught by the frontal teaching and assessed by paper-and-pencil-test. This implies that students view science production through the only way of doing experiment in a lab. Besides many factors, such as TV programs, those show scientists as nerds and working alone in a lab, doing inventions that harm nature and life. That's why many students do not like to choose in the future careers in science. In reality, this is true for the western culture, but for developing (non-western) countries, students have a positive attitude towards science and scientists. They hold the idealistic view about a scientist, who can cure from disease, find solutions to environmental problems. In Lebanon, results showed that

views of prospective teachers about NOS improved significantly after attending only one course and that the majority of students agreed on the importance of learning more about science for their professional development (El Takach, 2018; Sinno & El Takach, 2020). This researcher used the DAST tool in the history and nature of science course, as well as in science teaching courses, held at the Faculty of Education, in order to ignite the discussion regarding prospective science teachers for pre- school and elementary cycles.

Also, another study done by El Takach and Yacoubian (2020), on 2345 students, enrolled in Grades 7-9 at Lebanese public schools all over Lebanon. The participants held positive attitudes towards scientists and many students were usually positive about pursuing careers in science and technology. Results showed that the stereotypical image of a scientist being a Caucasian, male, working in a lab, and conducting experiments mainly in chemistry were prevalent. There was absence of contemporary scientists and female scientists among the preferred names of scientists mentioned by the students. Students in lower grades had more diverse images of scientists. Compared to their teachers, more students thought that scientists make inventions in the field of technology. The stereotypical images increased among students of higher grades and became more similar to those of their teachers and the authors of the textbooks that they use (El Takach & Yacoubian, 2020).

In Turkey, results of the study on 5th Graders done by Türkmen (2008) resemble previous research using DAST to explore students' image of scientists. He found that the perception of scientists being male, Caucasians, elderly-aged, working indoors with chemistry was prevalent but, the elements of those scientists having glasses and facial hair, wearing lab coats, with crazy hair and doing dangerous and secrecy things decreased. Eventually, indicator of technology and smiling face increased in young Turkish students' drawings. Even, a number of students view scientists as realistic people rather than as mythical creatures. More and more studies about the image of scientist or DAST (Draw-A-Scientist-Task) are published since Chambers (1983). In addition, research investigated the cultural views (e.g., Sjøberg, 2000) and the integration of technology in the drawings (e.g., Celik & Bayrakçeken, 2006; Sjøberg, S. & Schreiner, 2006). But, there have been few studies reporting the image of the scientist from nonwestern countries (Türkmen, 2008). Moreover, there are no comparative studies between non- western cultures, in particular between Arab countries.

The purpose of this study is to explore the perceptions of Omani and Lebanese school science teachers and students of science and scientists. For this study, a mixed method design is utilized. Using the Draw-a-scientist-test (DAST), qualitative and quantitative data was collected from the participating teachers and their students (Grade 4 till 9) in both countries. The research questions are:

1. What are Lebanese and Omani science teachers' perceptions of science and scientists? Do Lebanese and Omani science teachers hold similar perceptions?
2. Do Lebanese and Omani students have similar perceptions about science, technology and scientists?
3. What are Lebanese and Omani students' favorite scientists? Are there common scientists for the two countries?
4. What are Lebanese and Omani sources of their scientists?
5. Do Lebanese and Omani science teachers influence their students' perceptions about science, technology and scientists?

The Educational System

Lebanon

Education in Lebanon is centralized; all educational institutions in the public sector, is regulated by the Ministry of Education and Higher Education (MEHE). In Lebanon, English or French along with Arabic are taught from the early years in schools. English or French are the mandatory medium of instruction for mathematics and science for all schools. Education is compulsory from age 6 to age 14 (World Bank, 2006). Lebanon's adult literacy rate was 93.9% in 2014 and the percentage of the population as a whole with at least some secondary education (aged 25 and above) is 54.2%. For the percentage of the female population with at least some secondary education, the figure drops to 38.8% (UNDP, 2014).

The Center for Educational Research and Development (CERD) is an autonomous staff organization under the trusteeship of the Ministry of Education and Higher Education. The CERD's tasks include drafting academic and vocational curricula for the pre-university educational stage, carrying out any revisions and modifications as needed, and preparing all means and ways for applying these curricula, including required teaching methodologies. In addition, CERD devises the curricula for all subject areas, including mathematics and science, provides teacher training sessions. The Lebanese curriculum (CERD, 1997) is applied at most of the public and private schools in Lebanon. Many private schools can also apply a foreign curriculum (French, English, or international) too (Skaf & Habib, 2008).

The current structure of the educational system in Lebanon divides pre-university education into three stages. Kindergarten: ages 5–6, Basic education: elementary level (includes cycle 1, grades 1–3, and cycle 2, grades 4–6) and intermediate level (cycle 3, grades 7–9). Secondary education: cycle 4, grades 10–12. In cycles 1 and 2 of basic education (elementary level), mathematics and science courses are given by non-specialized teachers. The same teacher may, for instance, teach mathematics, science, and language courses. In cycle 3 (intermediate level), there are two classes of teachers: non-specialized and specialized. All teachers in secondary education must be specialized. A teacher who teaches a chemistry course, for example, must be a university graduate with a degree in chemistry (Skaf & Habib, 2008; 2011). Schooling in Lebanon is compulsory through grade 6 (i.e., kindergarten plus the 6 years of elementary education). Private schools usually include all the pre-university classes (kindergarten, basic education, and secondary education). As for public schools, there are some that have only basic level grades, others also include kindergartens, and most include secondary level classes. Public schools are financed by the Ministry of Education, while private schools are financed by student fees and donations.

Oman

Education in the Sultanate at all levels and stages is one of the most important objectives of the modern Omani renaissance, which was launched in 1970. Prior to that, education took place in the Katatib for teaching and memorizing the Koran; special scientific workshops were also held in mosques. Then, there were only three elementary schools where the number of students did not exceed (909). All the students, then, were all males

(Al Mabsali, 2015). It should be noted that the number of public schools reached 1125 in the academic year 2017/2018. Those public schools included 579024 male and female students and 56,385 teachers. While there were only 309 private schools that included 56,040 male and female students and 7,591 teachers (Education Annual Report, 2018). The Governmental school system includes Basic Education, which is divided into two cycles: the first cycle from grade one to grade four, the second cycle from the fifth to the tenth grade, and the post-basic education includes grades 11 and 12. There is also continuing education which includes literacy and adult education. The private sector includes international schools that teach one or two foreign languages. In addition, pre-school education which is a non-compulsory education is provided solely by the private sector (School Profile, 2019). As school education in the Sultanate has tremendously developed, higher education has also witnessed a paradigm shift. The number of students enrolled in higher education inside and outside the Sultanate reached 23837 students during the academic year 2018-2019. While there were 56 higher educational institutions operating in the Sultanate; those were distributed between universities and public and private colleges (Education Annual Report, 2018).

In the endeavor of the Ministry of Education in the Sultanate of Oman to search for the best ways to develop the curriculum in general, and the curricula of science and mathematics in particular, the ministry contracted with Cambridge University Press to devise instructional curricula, as well as train all those working in the field of education. The newly developed school curricula rely on the application of international syllabi in Science and Mathematics which are based on international standards and on the Cambridge International Examinations (CIE). The implementation of the newly devised curricula would take place in phases. The first phase would cover grades one till four, and then grades five till eight. The contract also included the printing of the student book, the workbook and teacher guide. It also included the technical aspect of complementary digital resources through the presence of accompanying e-books. It also included the development of a curriculum assessment tool. Centers for teacher training and research to collect data, analyze it and solve problems were also installed (Ministry of Education, 2017).

Method

Data Collection Tools

The tools used within the present research were mainly based on the DAST-Tool (Chambers, 1983) and the ROSE-Study (Sjøberg & Schreiner, 2006) and the Draw a Scientist Test – Checklist (DAST-C) (Finson & Beaver, 1995). The questionnaires, in Arabic and English, (Appendixes A and B) aimed at collecting teachers and their students perceptions of science and scientists. The administration of the questionnaires happened at the same time, in Lebanon and Oman, between November 2018 and February 2019. The teachers themselves administered the test to their students. The number of schools was in total 8, 5 schools in Lebanon and 3 schools in Oman. As for the tools used, they were in Arabic and English. Students had the liberty to write down their answers in the language they prefer. In Lebanon, both the Omani and Lebanese data was coded, categorized, and reviewed by the authors. Data entry was done with the help of the faculty statistician. For more clarity and to solve any conflict within data, the researchers were in contact through regular e- mails and WhatsApp messages and calls.

Variables

In this research, the independent variables are: teacher gender, student gender, grade level, teacher nationality, student nationality. As for the dependent variables: student perceptions of science, technology and scientists, teacher perceptions of science and scientists.

The Study Group

Table 1 shows the students sample from Lebanon and Oman.

Table 1. Distribution of the Sample per Gender, per Grade and per Country

Student	Lebanon			Oman			Total
Grade	Male	Female	Total	Female	Male	Total	
Grade 4	7	7	14	28	25	53	67
Grade 5	36	45	81	29	27	56	137
Grade 6	42	48	90	30	22	52	142
Grade 7	21	11	32	27	27	54	86
Grade 8	22	10	32	16	24	40	72
Grade 9	10	17	27	22	18	40	67
Total	138	138	276	152	143	295	571

The number of teachers is 13: 12 female and only 1 male teacher. Students involved in the study, are enrolled in five public middle schools, four of which were in Beirut and one in Saida, in the Southern suburb, during the academic year 2018-2019. Students from the Faculty of Education in their last year helped in distributing and supervising the administration of Teachers' and Students' Questionnaires in these schools. The Lebanese sample consists of 276 students, distributed as: Grade 4 (N=14), Grade 5 (N= 81), Grade 6 (90), Grade 7 (N= 32), Grade 8 (N= 32), Grade 9 (N= 27). As for Gender, the sample consists of an equal number of 138 male students and 138 female students. The Omani teachers comprised 13 teachers, 6 female and 7 male teachers. The students sample involved 295 students, disseminated in 3 middle public schools, located in the North of Oman, in Ibra district, A'sharqiyah Province. Students were distributed in Grades as follow: Grade 4 = 53, Grade 5 = 56, Grade 6 = 52, Grade 7 = 54, Grade 8 = 40 and Grade 9 = 40. Finally, the sample is formed of 143 male and 152 female students.

Results and Discussion

Results related to Research Question 1: What are Lebanese and Omani Science Teachers' Perceptions of Science and Scientists? Do Lebanese and Omani Science Teachers Hold Similar Perceptions?

Qualitative data from Teacher Questionnaire (Appendix A) are coded and categorized. For the teachers and the students, the score of Stereotype indicators ranges between 0 and 11. For the comparison of scores according to

Type of participants and Gender, Independent Sample t-test was used for the comparison between scores. For the comparison of scores according to Grade, ANOVA test was used to compare the means (see Table 2).

Table 2. Frequency, Percentages of Stereotypes in Teachers' Drawings and Comparison between Teachers

Indicators		Teachers (N=26)		Total	p-value
		Lebanon (N=13)	Oman (N=13)		
Male gender only	N	4	7	11	0.234
	%	30.80%	53.80%		
Caucasian only	N	7	3	10	0.107
	%	53.80%	23.10%		
Clothing	N	3	3	6	1.000
	%	23.10%	23.10%		
Scientist's facial expression	N	5	2	7	0.185
	%	38.50%	15.40%		
Scientist working indoors	N	9	9	18	1.000
	%	69.20%	69.20%		
Symbols of research displayed	N	11	9	20	0.352
	%	84.60%	69.20%		
Symbols of knowledge	N	5	6	11	0.691
	%	38.50%	46.20%		
Technology represented	N	3	5	8	0.395
	%	23.10%	38.50%		
Relevant captions	N	2	3	5	0.619
	%	15.40%	23.10%		
Mythic stereotypes	N	4	5	9	0.680
	%	30.80%	38.50%		
Indications of danger	N	2	0	2	0.141
	%	15.40%	0.00%		
Total		55	52	107	

Table 2 shows that the Omani teachers drew the scientist as a male (53.80%), doing experiments (69.20%) and with little use of technology (38.50%), and working indoors (69.20%). As for the Lebanese teachers, they represented the scientist as Caucasian (53.80%), working indoors (69.20%), using lab research tools (84.60%) and with a least use of technology (23.10%). The results in the Table 3 show that Country did not have any effect on the scores of Stereotype indicators where P-value was greater than 5%. Table 4 reveals that Lebanese and Omani female teachers' mental image of the scientist is working indoors (66.70%), doing a lab experiment (83.30% and 66.70%). For Omani female teachers, half of them, the scientist was a white male (50%) and using technology (50%). In addition, Omani male teachers drew a male scientist (57.10%) alone in a lab (71.40%). On the whole, Lebanese and Omani teachers drew a scientist alone in a lab, indoors (69.20%), doing experiment (84.60% and 69.20%), with no indications of danger and in the absence of technology (23.10% and 38.50%).

Table 3. Comparison of Scores of Stereotype Indicators for Teachers between Lebanon and Oman

		N	Mean	SD	Levene's Test for Equality of Variances		t-test for Equality of Means	
					F	p-value	t	p-value
Country	Lebanon	13	4.23	2.55	0.201	0.658	0.281	0.781
	Oman	13	3.92	3.01			0.281	0.781

SD= Standard Deviation

Table 4. Frequency and Percentages of Stereotypes in Teachers' Drawings

Indicators		Lebanon		Total	Oman		Total
		Female	Male		Female	Male	
Male gender only	N	3	1	4	3	4	7
	%	25.00%	100.00%	30.80%	50.00%	57.10%	53.80%
Caucasian only	N	6	1	7	3	0	3
	%	50.00%	100.00%	53.80%	50.00%	0.00%	23.10%
Clothing	N	3	0	3	3	0	3
	%	25.00%	0.00%	23.10%	50.00%	0.00%	23.10%
Scientist's facial expression	N	4	1	5	2	0	2
	%	33.30%	100.00%	38.50%	33.30%	0.00%	15.40%
Scientist working indoors	N	8	1	9	4	5	9
	%	66.70%	100.00%	69.20%	66.70%	71.40%	69.20%
Symbols of research displayed	N	10	1	11	4	5	9
	%	83.30%	100.00%	84.60%	66.70%	71.40%	69.20%
Symbols of knowledge	N	5	0	5	6	0	6
	%	41.70%	0.00%	38.50%	100.00%	0.00%	46.20%
Technology represented	N	3	0	3	3	2	5
	%	25.00%	0.00%	23.10%	50.00%	28.60%	38.50%
Relevant captions	N	2	0	2	2	1	3
	%	16.70%	0.00%	15.40%	33.30%	14.30%	23.10%
Mythic stereotypes	N	3	1	4	4	1	5
	%	25.00%	100.00%	30.80%	66.70%	14.30%	38.50%
Indications of danger	N	2	0	2	0	0	0
	%	16.70%	0.00%	15.40%	0.00%	0.00%	0.00%
Total		12	1	13	6	7	13

In Table 4, because the frequencies are very weak, P-value is not accurate. So, the correlation is not possible according to the teacher gender. The results in Tables 5 and 6 show that the gender of teacher for Oman sample does not have any effect on the scores of Stereotype indicators where P-value was greater than 5%. No comparison by Gender since there is only 1 male teacher for the Lebanese sample.

Table 5. General Score of Stereotype Indicators for Teachers (N=26)

Country	Mean	Mode	Minimum	Maximum	SD
Lebanon	4.23	1.00	1.00	8.00	2.55
Oman	3.92	2.00	0.00	10.00	3.01

SD= Standard Deviation

Table 6. Score of Stereotype Indicators as a Function of Gender for the Omani Teachers

		N	Mean	SD	Levene's Test for Equality of Variances		t-test for Equality of Means	
					F	p-value	t	p-value
Gender	Female	6	5.67	3.61	5.322	0.042	2.228	0.048
	Male	7	2.43	1.27			2.086	0.082

SD= Standard Deviation

The figures below display some mental drawings of the scientist at work from the Lebanese and Omani teachers' sample (see Figure 1 and 2).

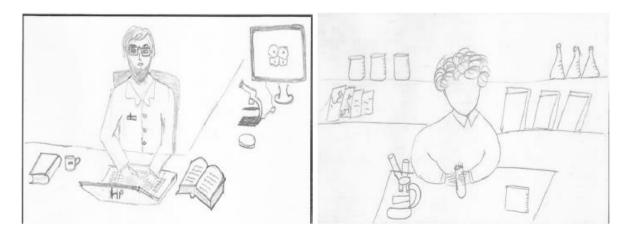Figure 1. Sketches of Some DAST- Lebanese Science Teachers

Figure 2. Sketches of Some DAST- Omani Science Teachers

To the Question: What is the scientist in your drawing doing? Table 7 reports that more than half of Lebanese and Omani teachers that their scientist is experimenting, inventing and testing (24.24%), and only 6.06% illustrated the scientist as an environment activist.

Table 7. Teachers' Answers about the Daily Routing of their Scientists

Daily Work of a Scientist	N	%
Doing experiment, working in the lab	17	51.52%
Discovering, inventing, testing, thinking	8	24.24%
Trying to find cure, therapy	3	9.09%
Reading	2	6.06%
He is a naturalist, environment activist	2	6.06%
Drawing of Newton	1	3.03%
Total	33	100.00%

To the Question: What kinds of things do you think this scientist does on a typical working day? Table 8 shows that half of teachers of both countries stressed the scientist mental work, only 1.47% mentioned the teaching of scientists.

Table 8. Teachers' Answers related to Scientist Work

Scientist activities	Frequency	%
Mental work (and scientific method) like, observing, planning, reading, writing, learn, communication, publishing, search in internet.	34	50.00%
Experiment, working in the lab, collect data.	15	22.06%
Leisure, sociable and private time like playing, drawing, shopping, visiting his relatives, praying.	6	8.82%
Help people, the poor, the society	6	8.82%
Discover and invent	3	4.41%
Operate, prescribe medicine.	3	4.41%
Teaching, help students, correct	1	1.47%
Total	68	100.00%

To the Question: What are the qualities of a scientist? Tables 9 and 10 depict teachers' answers related to the scientist attributes; teachers gave 38 positive attributes, such as, honest, creative, humble and innovative. Only one teacher mentioned the scientist as not a sociable person.

Table 9. Teachers' Answers related to Scientist Qualities

Scientist Qualities	Teachers	
	Frequency	%
Positive qualities	83	98.81%
Negative qualities	1	1.19%
Total	84	100.00%

Table 10. Teachers' Answers related to Detailed Scientist Qualities

Answers	Frequency	Answers	Frequency
Smart	16	Critical thinker	1
Patient	10	Well-Cultured	1
Accurate	8	Evaluate work	1
Creative	5	Good intuition	1
Curious	3	Quick	1
Ambitious	2	Has fear of God	1
Analyst	2	Genius	1
Hard worker	3	Good communicator	1
Honest	2	has determination	1
Punctual	2	Humble	1
Researcher	2	Innovator	1
Has integrity	2	Inventor	1
Up-to-date	2	Keeps records	1
Has passion	1	Motivated	1
Good time manager	1	Not sociable	1
Accepts other critics	1	Has perseverance	1
Thinker	1	Doesn't despair	1
Has Scientific curiosity	1	Reads a lot	1
Able to relate things	1	Stubborn	1
Total			84

Results related to Research Question 2: Do Lebanese and Omani Students have Similar Perceptions about Science, Scientists and Technology?

Table 11 displays data retrieved from 466 Lebanese and Omani students' drawings about the scientist at work: out of 276 and 295 questionnaires respectively, 246 Lebanese students drew their mental image of the scientist, while 220 Omani students' drawings illustrated the mental image of the scientist. Lebanese and Omani students drew a male scientist (74.00% and 81.80%), working indoors (49.60% and 40.50%), symbols of research displayed (42.70% and 35.50%) and technology was almost absent (22 % and 14.10%). Finally, Lebanese and Omani students do not hold the Frankenstein stereotype of the scientist, because their drawings do not illustrate mythic stereotypes or indications of danger. It is true that students do not exhibit the negative view about the scientist, but it was clear that the Lebanese sample have higher percentage of mythic scientists (42.70%) than their Omani peers (19.10%).

Table 12 highlights students' answers across Grades and country. It shows that the percentage of the male scientist, in students' drawings, increases with the students' levels, for both Lebanese and Omani students. But, it again drops only for Lebanese 9th Grades. Very few Omani students present mythic stereotypes, for instance in Grades 5 and 6 (31.00%). Also, their illustrations lack any presence of danger or relevant captions. Ninety six

Lebanese students drew a male scientist compared to 53 Omani students. The Caucasian scientist is the most present in Lebanese 6 Graders' drawings. The picture of the scientist working indoors varied across Grade and Gender too; 7th and 9th Omani Graders figured out their scientist as working indoors (52.20% and 63.60%), while the highest percentages are registered for 4th and 9th Lebanese Graders (64.30% and 83.30%).

Table 11. Frequency, Percentages of Stereotypes in Students' Drawings and Comparison between Students as a Function of Country

| Indicators | | Students ($N_{Drawings}$=466) | | Total |
		Lebanon ($N_{Drawings}$=246)	Oman ($N_{Drawings}$=220)	
Male gender only	N	182	180	362
	%	74.00%	81.80%	
Caucasian only	N	96	53	149
	%	39.00%	24.10%	
Clothing	N	81	42	123
	%	32.90%	19.10%	
Scientist's facial expression	N	95	40	135
	%	38.60%	18.20%	
Scientist working indoors	N	122	89	211
	%	49.60%	40.50%	
Symbols of research displayed	N	105	78	183
	%	42.70%	35.50%	
Symbols of knowledge	N	54	63	117
	%	22.00%	28.60%	
Technology represented	N	54	31	85
	%	22.00%	14.10%	
Relevant captions	N	14	4	18
	%	5.70%	1.80%	
Mythic stereotypes	N	105	42	147
	%	42.70%	19.10%	
Indications of danger	N	7	0	7
	%	2.80%	0.00%	
Total		915	622	1537

Technology is displayed poorly in students' drawings, for both countries; it increases across levels, but not for Grade 7. In addition, Lebanese students in Grade 9 illustrate this indicator the most (37.50%). For the Omani students, the highest percentage is for Grade 8 (25.80%). Omani and Lebanese students stressed on the scientist work in a lab: the total number of research symbols is 183, compared to 117 for the total number of the symbols of knowledge, depicted in their drawings. The highest percentages for the symbols of knowledge are frequent in Lebanese and Omani 6 Graders (30.00% and (47.60%), while the highest percentages of research are shown in

Grades 4 of the Lebanese sample (71.40%) and Grade 7 (56.50%) of the Omani group.

Table 12. Frequency and Percentages of Stereotypes in Students' Drawings as a Function of Country and Grade

Indicators			Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Total
Male gender only	Lebanon	N	8	48	56	20	29	21	182
		%	57.10%	68.60%	69.10%	76.90%	93.50%	87.50%	
	Oman	N	14	36	37	36	25	32	180
		%	51.90%	85.70%	90.20%	78.30%	80.60%	97.00%	
Caucasian only	Lebanon	N	4	21	44	10	10	7	96
		%	28.60%	30.00%	54.30%	38.50%	32.30%	29.20%	
	Oman	N	12	10	10	11	4	6	53
		%	44.40%	23.80%	24.40%	23.90%	12.90%	18.20%	
Clothing	Lebanon	N	3	26	25	6	14	7	81
		%	21.40%	37.10%	30.90%	23.10%	45.20%	29.20%	
	Oman	N	1	5	13	11	1	11	42
		%	3.70%	11.90%	31.70%	23.90%	3.20%	33.30%	
Scientist's facial expression	Lebanon	N	8	24	33	5	18	7	95
		%	57.10%	34.30%	40.70%	19.20%	58.10%	29.20%	
	Oman	N	0	4	12	11	4	9	40
		%	0.00%	9.50%	29.30%	23.90%	12.90%	27.30%	
Scientist working indoors	Lebanon	N	9	27	41	11	14	20	122
		%	64.30%	38.60%	50.60%	42.30%	45.20%	83.30%	
	Oman	N	1	13	19	24	11	21	89
		%	3.70%	31.00%	46.30%	52.20%	35.50%	63.60%	
Symbols of research displayed	Lebanon	N	10	24	38	7	13	13	105
		%	71.40%	34.30%	46.90%	26.90%	41.90%	54.20%	
	Oman	N	0	6	15	26	13	18	78
		%	0.00%	14.30%	36.60%	56.50%	41.90%	54.50%	
Symbols of knowledge	Lebanon	N	4	21	11	5	7	6	54
		%	28.60%	30.00%	13.60%	19.20%	22.60%	25.00%	
	Oman	N	7	20	9	10	7	10	63
		%	25.90%	47.60%	22.00%	21.70%	22.60%	30.30%	
Technology represented	Lebanon	N	2	13	22	1	7	9	54
		%	14.30%	18.60%	27.20%	3.80%	22.60%	37.50%	
	Oman	N	2	1	7	9	8	4	31
		%	7.40%	2.40%	17.10%	19.60%	25.80%	12.10%	
Relevant captions	Lebanon	N	0	4	4	0	4	2	14
		%	0.00%	5.70%	4.90%	0.00%	12.90%	8.30%	
	Oman	N	0	0	2	1	0	1	4
		%	0.00%	0.00%	4.90%	2.20%	0.00%	3.00%	
Mythic stereotypes	Lebanon	N	3	26	32	10	27	7	105
		%	21.40%	37.10%	39.50%	38.50%	87.10%	29.20%	
	Oman	N	0	13	13	7	2	7	42
		%	0.00%	31.00%	31.00%	15.20%	6.50%	21.20%	
Indications of danger	Lebanon	N	0	3	3	0	1	0	7
		%	0.00%	4.30%	3.70%	0.00%	3.20%	0.00%	
	Oman	N	0	0	0	0	0	0	0
		%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Total	Lebanon	N	14	70	81	26	31	24	246
	Oman	N	27	42	41	46	31	33	220

The results in Table 13 show that the score of Stereotype indicators for Lebanese students (Mean = 3.32) was significantly higher than the score of Omani students (Mean = 2.11) where P-value was less than 5% (P-value<0.001).

Table 13. Comparison of Scores of Stereotype Indicators for Students between Lebanon and Oman

		N	Mean	SD	Levene's Test for Equality of Variances		t-test for Equality of Means	
					F	p-value	t	p-value
Country	Lebanon	276	3.32	2.34	7.901	0.005	6.533	0.000
	Oman	295	2.11	2.07			6.507	0.000

SD= Standard Deviation

To the Question: What is the scientist in your drawing is doing? Students' answers are presented in Table 14.

Table 14. Lebanese and Omani students' Answers per Country and per Gender

Students' answers		Lebanon	Oman	Total	Female	Male	Total
Doing experiment, working in the lab	N	46	38	84	45	39	84
	%	20.70%	20.10%	20.40%	19.60%	21.50%	20.40%
Discovering, inventing, testing, thinking	N	42	32	74	40	34	74
	%	18.90%	16.90%	18.00%	17.40%	18.80%	18.00%
Reading	N	24	32	56	42	14	56
	%	10.80%	16.90%	13.60%	18.30%	7.70%	13.60%
Doing research on universe issues, such as, the outer space, the gravity, the solar system.	N	15	15	30	15	15	30
	%	6.80%	7.90%	7.30%	6.50%	8.30%	7.30%
Teaching	N	6	20	26	17	9	26
	%	2.70%	10.60%	6.30%	7.40%	5.00%	6.30%
Trying to find cure, therapy	N	17	8	25	12	13	25
	%	7.70%	4.20%	6.10%	5.20%	7.20%	6.10%
Doing sport, has leisure time	N	12	9	21	10	11	21
	%	5.40%	4.80%	5.10%	4.30%	6.10%	5.10%
Drawing of famous scientist, such as Newton	N	13	5	18	11	7	18
	%	5.90%	2.60%	4.40%	4.80%	3.90%	4.40%
Working on electricity	N	14	4	18	9	9	18
	%	6.30%	2.10%	4.40%	3.90%	5.00%	4.40%
Driving a plane, going to the moon	N	13	1	14	9	5	14
	%	5.90%	0.50%	3.40%	3.90%	2.80%	3.40%
Eating, sleeping, sitting in his office, builds houses, nothing	N	8	6	14	8	6	14
	%	3.60%	3.20%	3.40%	3.50%	3.30%	3.40%
Writing books. A speech	N	3	6	9	5	4	9
	%	1.40%	3.20%	2.20%	2.20%	2.20%	2.20%
Inventing robots, cars	N	2	5	7	1	6	7
	%	0.90%	2.60%	1.70%	0.40%	3.30%	1.70%
A naturalist, environment activist	N	4	3	7	3	4	7
	%	1.80%	1.60%	1.70%	1.30%	2.20%	1.70%
Using technology such as computer	N	2	4	6	2	4	6
	%	0.90%	2.10%	1.50%	0.90%	2.20%	1.50%
Helps people, the world	N	1	1	2	1	1	2
	%	0.50%	0.50%	0.50%	0.40%	0.60%	0.50%
Total	N	222	189	411	230	181	411
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the Question: What kinds of things do you think this scientist does on a typical working day? Students explained about their scientist at task besides, experimenting in a lab (15.90%), observing, writing (36.27%), and consider the scientist private and social life (12.42%). Only 9 students (1.12%) mentioned space and robots and the Lebanese sample mentioned creativity and imagination (46.30%), while Omani students pinpoint the discovery task of the scientist (19.30%) and 5% of Omani students indicate the profession of a scientist as a surgeon or physician. Furthermore, male students stressed on the imagination and test of new ideas (42.50%).

Table 15. Lebanese and Omani Students' Answers per Country and per Gender

Scientist on a typical working day		Lebanon	Oman	Total	Female	Male	Total
Mental work (and scientific method), like: observing, planning, reading, writing, communication, publishing, learn, search in internet.	N	122	170	292	177	115	292
	%	64.90%	84.20%	36.27%	81.90%	66.10%	74.87%
Imagine, create, testing new things	N	87	63	150	76	74	150
	%	46.30%	31.20%	18.63%	35.20%	42.50%	38.46%
Experiment, working in the lab	N	74	54	128	74	54	128
	%	39.40%	26.70%	15.90%	34.30%	31.00%	32.82%
Leisure, sociable and private time, like: playing, drawing, shopping, visiting his relatives, praying.	N	32	68	100	70	30	100
	%	17.00%	33.70%	12.42%	32.40%	17.20%	25.64%
Discover and invent	N	28	39	67	38	29	67
	%	14.90%	19.30%	8.32%	17.60%	16.70%	17.17%
Teach, help students, correct	N	7	27	34	25	9	34
	%	3.70%	13.40%	4.22%	11.60%	5.20%	8.71%
Operate, invent, prescribe medicine.	N	3	10	13	4	8	13
	%	1.60%	5.00%	1.61%	1.90%	4.60%	3.33%
Help people, the poor, the society	N	6	6	12	8	5	13
	%	3.20%	3.00%	1.49%	3.70%	2.90%	3.33%
Space	N	5	0	5	2	3	5
	%	2.70%	0.00%	0.62%	0.90%	1.70%	1.28%
Use computers, invent robots	N	2	2	4	2	2	4
	%	1.10%	1.00%	0.50%	0.90%	1.10%	1.02%
Total		366	439	805	216	174	390
		45.47%	54.53%	100.00%	55.38%	44.61%	100.00%

To the Question: What are the qualities of a scientist? Table 16 shows that both Lebanese and Omani students, as well as, male and females, have a positive view regarding scientists; students gave 924 positive attributes of the scientists and only 9 negative ones.

Table 16. Lebanese and Omani Qualities of their Scientists per Country and per Gender

Qualities of Scientist		Lebanon	Oman	Total	Female	Male	Total
Positive qualities	N	429	495	924	531	393	924
	%	96.19%	99.80%	98.09%	98.33%	97.76%	98.09%
Negative qualities	N	17	1	18	9	9	18
	%	3.81%	0.20%	1.91%	1.67%	2.24%	1.91%
Total		446	496	942	540	402	942

The majority of students (70.83%) stressed on the physical appearance of the scientist, such as the scientist has white hair (16.67%), slim (5.56%), and tall (11.11%), while (29.17%) named the profession and activities, such as he is painting (2.78%), teaching (8.33%) (see Table 17).

Table 17. Physical Appearance and Profession of the Scientist

Students' answers						Total
Appearance of a scientist	N	%	Profession and activity of a scientist	N	%	72
White hair	12	16.67%	Scientist	8	11.11%	100.00%
Old	10	13.89%	Teacher	6	8.33%	
Tall	8	11.11%	Painter	2	2.78%	
Slim	4	5.56%	Philosopher	2	2.78%	
Long hair	4	5.56%	Prayer	2	2.78%	
Short	4	5.56%	Artist	1	1.39%	
Wear Glasses	2	2.78%	Total	21	29.17%	
Wear white clothes	2	2.78%				
Has big ears	1	1.39%				
Has curly hair	1	1.39%				
Bald	1	1.39%				
Big Eyes	1	1.39%				
has Athletic body	1	1.39%				
Total	51	70.83%				

To the Question: What is your favorite subject? One third (33.33%) of the sample choose science, (20.73%) choose mathematics, (13.03%) choose English and only (0.21%) choose computer science (see Table 18). These findings are the similar to the Lebanese and Omani students, males and females too. Unlike Lebanese students, Omani students do not like Chemistry and Physics. Omani students' favorite subjects are Arabic, Religion and Sport.

Table 18. Students' Favorite Subject per Country and per Gender

Favorite subject		Lebanon	Oman	Total	Female	Male	Total
Science	N	79	77	156	81	75	156
	%	35.59%	31.30%	33.33%	32.79%	33.94%	33.33%
Math	N	55	42	97	48	49	97
	%	24.77%	17.07%	20.73%	19.43%	22.17%	20.73%
English	N	35	26	61	39	22	61
	%	15.77%	10.57%	13.03%	15.79%	9.95%	13.03%
Arabic	N	17	34	51	31	20	51
	%	7.66%	13.82%	10.90%	12.55%	9.05%	10.90%
Religion	N	3	26	29	16	13	29
	%	1.35%	10.57%	6.20%	6.48%	5.88%	6.20%
Sport	N	4	24	28	3	25	28
	%	1.80%	9.76%	5.98%	1.21%	11.31%	5.98%
Civic	N	5	4	9	5	4	9
	%	2.25%	1.63%	1.92%	2.02%	1.81%	1.92%
History	N	4	4	8	5	3	8
	%	1.80%	1.63%	1.71%	2.02%	1.36%	1.71%
Arts	N	1	6	7	7	0	7
	%	0.45%	2.44%	1.50%	2.83%	0.00%	1.50%
Chemistry	N	6	0	6	4	2	6
	%	2.70%	0.00%	1.28%	1.62%	0.90%	1.28%
Physics	N	6	0	6	2	4	6
	%	2.70%	0.00%	1.28%	0.81%	1.81%	1.28%
Painting	N	5	0	5	2	3	5
	%	2.25%	0.00%	1.07%	0.81%	1.36%	1.07%
Geography	N	1	2	3	3	0	3
	%	0.45%	0.81%	0.64%	1.21%	0.00%	0.64%
Music	N	1	0	1	1	0	1
	%	0.45%	0.00%	0.21%	0.40%	0.00%	0.21%
Computer	N	0	1	1	0	1	1
	%	0.00%	0.41%	0.21%	0.00%	0.45%	0.21%
Total	N	222	246	468	247	221	468
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the closed-ended Question: Are science and technology important for our society? Table 19 shows that the majority of students approved that S&T are important for the welfare of our society, males and females.

Table 19. Students' Answers per Country and per Gender

		Lebanon	Oman	Total	Female	Male	Total
No	N	8	4	12	5	7	12
	%	4.10%	1.60%	2.60%	2.10%	3.20%	2.60%
Yes	N	189	252	441	228	213	441
	%	95.90%	98.40%	97.40%	97.90%	96.80%	97.40%
Total	N	197	256	453	233	220	453
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the Question: How science and technology are important for our society? In Table 20, students explain that science and technology help to invent, to discover new things (16.00%), few of them (5.40%) mention that S&T

can help in research. Only two female Omani students indicate that S&T can save energy.

Table 20. Students' Answers about the Importance of Science and Technology per Country and per Gender

		Lebanon	Oman	Total	Female	Male	Total
Others: it is helpful.	N	34	44	78	41	37	78
	%	26.00%	27.00%	26.50%	25.20%	28.20%	26.50%
It is important for society	N	36	15	51	27	24	51
	%	27.50%	9.20%	17.30%	16.60%	18.30%	17.30%
It helps to invent, to discover new things	N	17	30	47	32	15	47
	%	13.00%	18.40%	16.00%	19.60%	11.50%	16.00%
It develops our country	N	5	22	27	14	13	27
	%	3.80%	13.50%	9.20%	8.60%	9.90%	9.20%
It facilitates communication between people	N	13	10	23	9	14	23
	%	9.90%	6.10%	7.80%	5.50%	10.70%	7.80%
It develops the world	N	6	13	19	12	7	19
	%	4.60%	8.00%	6.50%	7.40%	5.30%	6.50%
It helps in research	N	7	9	16	10	6	16
	%	5.30%	5.50%	5.40%	6.10%	4.60%	5.40%
It is important in education	N	1	7	8	2	6	8
	%	0.80%	4.30%	2.70%	1.20%	4.60%	2.70%
It is easy to use	N	3	1	4	3	1	4
	%	2.30%	0.60%	1.40%	1.80%	0.80%	1.40%
It helps us to be smart	N	0	4	4	4	0	4
	%	0.00%	2.50%	1.40%	2.50%	0.00%	1.40%
It saves energy	N	0	2	2	2	0	2
	%	0.00%	1.20%	0.70%	1.20%	0.00%	0.70%
Total	N	131	163	294	163	131	294
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the Question: What would you like to be in the future? More than half of the student sample chooses to have a career in science, for males and females too. Table 21 reports that Omani students prefer to have a career in science more than their Lebanese counterparts, and female students (52.60%) declared they like science as a future job more than males (51.80%).

Table 21. Students' Future Careers in Science per Country and per Gender

		Lebanon	Oman	Total	Female	Male	Total
Career in science	N	111	133	244	130	114	244
	%	50.70%	53.60%	52.20%	52.60%	51.80%	52.20%
Career not in science	N	81	71	152	58	94	152
	%	37.00%	28.60%	32.50%	23.50%	42.70%	32.50%
Not clear	N	27	44	71	59	12	71
	%	12.30%	17.70%	15.20%	23.90%	5.50%	15.20%
Total	N	219	248	467	247	220	467
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the closed-ended Question: I would like to become a scientist. Table 22 highlights that students, Omani and Lebanese students, females and male like to be scientists in the future; (70.90%) of Omani students and (51.00%) Lebanese students, (62.10%) of male students of the sample like to become scientists.

Table 22. Students' Answers related to Science per Country and per Gender

		Lebanon	Oman	Total	Female	Male	Total
No	N	119	82	201	102	99	201
	%	49.00%	29.10%	38.30%	38.60%	37.90%	38.30%
Yes	N	124	200	324	162	162	324
	%	51.00%	70.90%	61.70%	61.40%	62.10%	61.70%
Total	N	243	282	525	264	261	525
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Tables 23 and 24 depict details regarding students' answers. Students' answers in Table 23 present low percentages; for instance, only (2.30%) Omani females wrote that science is boring, (4.50%) Omani students said that they do not like to be famous, while (30.60%) Lebanese students declared that they do not love science. Females of the total sample admit that they do not have the qualifications (4%) and they do not like to study (7%), while (26.30%) of males acknowledge that they do not like to study.

Table 23. Students' Answers per Country and per Gender

No, because:		Lebanon	Oman	Total	Female	Male	Total
I do not love science	N	15	11	26	14	12	26
	%	30.60%	28.20%	29.50%	28.00%	31.60%	29.50%
I like another job	N	13	11	24	15	9	24
	%	26.50%	28.20%	27.30%	30.00%	23.70%	27.30%
I do not like to study	N	11	6	17	7	10	17
	%	22.40%	15.40%	19.30%	14.00%	26.30%	19.30%
Others: I do not like scientists, I do not like to be a scientist	N	5	4	9	2	0	2
	%	10.20%	10.30%	10.20%	4.00%	0.00%	2.30%
I do not have the qualifications	N	3	2	5	4	1	5
	%	6.10%	5.10%	5.70%	8.00%	2.60%	5.70%
I do not like to be famous	N	0	4	4	2	2	4
	%	0.00%	10.30%	4.50%	4.00%	5.30%	4.50%
It is boring	N	1	1	2	2	0	2
	%	2.00%	2.60%	2.30%	4.00%	0.00%	2.30%
Science is not my favorite subject	N	1	0	1	1	0	1
	%	2.00%	0.00%	1.10%	2.00%	0.00%	1.10%
Total	N	49	39	88	50	38	88
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 24 reveals why students love science; students love to discover and invent (34.70%), to help the world, their countries and societies (20.90%). But (19.70%) of Lebanese students tend to think about fame, the same is for the males of the sample (21.30%).

Table 24. Lebanese and Omani Students' Answers per Country and per Gender

Yes, because:		Lebanon	Oman	Total	Female	Male	Total
To discover, to invent	N	23	45	68	47	21	68
	%	30.30%	37.50%	34.70%	40.50%	26.30%	34.70%
To help my country, the society, the world	N	5	36	41	21	20	41
	%	6.60%	30.00%	20.90%	18.10%	25.00%	20.90%
I like to be famous	N	15	19	34	17	17	34
	%	19.70%	15.80%	17.30%	14.70%	21.30%	17.30%
Others: to teach people, I am smart	N	14	9	23	15	8	23
	%	18.40%	7.50%	11.70%	12.90%	10.00%	11.70%
I love science	N	12	6	18	9	9	18
	%	15.80%	5.00%	9.20%	7.80%	11.30%	9.20%
It is important	N	3	3	6	3	3	6
	%	3.90%	2.50%	3.10%	2.60%	3.80%	3.10%
It makes me feel happy	N	2	2	4	3	1	4
	%	2.60%	1.70%	2.00%	2.60%	1.30%	2.00%
It is my favorite subject	N	2	0	2	1	1	2
	%	2.60%	0.00%	1.00%	0.90%	1.30%	1.00%
Total	N	76	120	196	116	80	196
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

To the open-ended Question: I would like to get a job in technology. Table 25 presents students' answers; (61.70%) of students agreed to work in technology in the future, (62.50%) of them are males. Finally, Omani students choose to work in technology more than their Lebanese peers.

Table 25. Students' Answers related to Technology per Country and per Gender

Option		Lebanon	Oman	Total	Female	Male	Total
No	N	112	84	196	100	96	196
	%	47.70%	30.30%	38.30%	39.10%	37.50%	38.30%
Yes	N	123	193	316	156	160	316
	%	52.30%	69.70%	61.70%	60.90%	62.50%	61.70%
Total	N	235	277	512	256	256	512
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 26 gives more details why students do not take technology as a future job: (39.20%) of students do not love technology, where a substantial number of the Lebanese students (44.40%) dislike technology more than the Omani ones (34.90%). Moreover, (14%) of Omani students believed that technology is hard compared to (2.80%) of the Lebanese ones. On the other hand, (44.40%) male students do not love technology in comparison to (36.50%) of the females. In Table 27, only (2.40%) of the students believe that technology facilitates work,

(30.00%) of the Lebanese sample love technology, while (30.30%) of Omani students like to get a job in technology in order to help their country, the society and the world. As for gender, (23.40%) of males love technology and (26.10%) of females want the help of technology, to improve their country, the society and the world.

Table 26. Students' Answers per Country and per Gender

No, because:		Lebanon	Oman	Total	Female	Male	Total
I do not love technology	N	16	15	31	19	12	31
	%	44.40%	34.90%	39.20%	36.50%	44.40%	39.20%
I like another job	N	7	9	16	9	7	16
	%	19.40%	20.90%	20.30%	17.30%	25.90%	20.30%
Others: I do not like to be a scientist, my future job does not require technology	N	7	5	12	8	4	12
	%	19.40%	11.60%	15.20%	15.40%	14.80%	15.20%
I do not know, understand technology	N	2	6	8	6	2	8
	%	5.60%	14.00%	10.10%	11.50%	7.40%	10.10%
It is hard	N	1	6	7	6	1	7
	%	2.80%	14.00%	8.90%	11.50%	3.70%	8.90%
I like to become a teacher	N	1	0	1	1	0	1
	%	2.80%	0.00%	1.30%	1.90%	0.00%	1.30%
It's boring, it is waste of time	N	1	2	3	2	1	3
	%	2.80%	4.70%	3.80%	3.80%	3.70%	3.80%
I love children more than technology	N	1	0	1	1	0	1
	%	2.80%	0.00%	1.30%	1.90%	0.00%	1.30%
Total	N	36	43	79	52	27	79
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 27. Students' Answers per Country and per Gender

Yes, because:		Lebanon	Oman	Total	Female	Male	Total
To help my country, the society, the world	N	6	30	36	24	12	36
	%	8.60%	30.30%	21.30%	26.10%	15.60%	21.30%
I love technology	N	21	12	33	15	18	33
	%	30.00%	12.10%	19.50%	16.30%	23.40%	19.50%
Others: to make money	N	8	22	30	17	13	30
	%	11.40%	22.20%	17.80%	18.50%	16.90%	17.80%
It is important	N	15	13	28	15	13	28
	%	21.40%	13.10%	16.60%	16.30%	16.90%	16.60%
to discover, to invent	N	5	13	18	9	9	18
	%	7.10%	13.10%	10.70%	9.80%	11.70%	10.70%
It is enjoyable, easy, funny	N	10	6	16	10	6	16
	%	14.30%	6.10%	9.50%	10.90%	7.80%	9.50%
It facilitates work	N	1	3	4	2	2	4
	%	1.40%	3.00%	2.40%	2.20%	2.60%	2.40%
I like to be famous	N	4	0	4	0	4	4
	%	5.70%	0.00%	2.40%	0.00%	5.20%	2.40%
Total	N	70	99	169	92	77	169
	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Results related to Research Question 3: Who are Lebanese and Omani students' Favorite Scientists? Are There Common Scientists for the Two Countries?

To the Question: Who is your favorite scientist? Table 28 depicts students' best scientist.

Table 28. The Favorite Scientists of the Lebanese and Omani Students (N=571)

Specialty in Science	Students' favorite scientist		Lebanon	Oman	Total	Total
Navigation	Ahmad Bin Majid	N	0	11	11	11
		%	0.00%	7.10%	3.24%	3.24%
Space	Niel Armstrong	N	3	0	3	4
		%	1.62%	0.00%	0.88%	1.17%
	Helen Sharman	N	1	0	1	
		%	0.54%	0.00%	0.29%	
Medicine and Surgeon	Ibn Sina (Avicenna)	N	0	10	10	
		%	0.00%	6.45%	2.94%	
	Al Razi	N	1	0	1	15
		%	0.54%	0.00%	0.29%	4.41%
	Micheal Dabaghy	N	4	0	4	
		%	2.16%	0.00%	1.18%	
Natural Science and Genetics	Pasteur	N	2	0	2	6
		%	1.08%	0.00%	0.59%	1.76%
	Carolus Linnaeus	N	0	1	1	
		%	0.00%	0.65%	0.29%	
	Mendel	N	1	2	3	
		%	0.54%	1.29%	0.88%	
Mathematician	Khawarizmi	N	3	0	3	123
						36.18%
		%	1.62%	0.00%	0.88%	
	Kelvin	N	0	4	4	
		%	0.00%	2.58%	1.18%	
	Newton	N	34	82	116	
		%	18.38%	52.90%	34.12%	
Electricity and Engineering	Edison	N	9	12	21	32
		%	4.86%	7.74%	6.18%	
	Hassan Kamil El Sabbah	N	10	0	10	
		%	5.41%	0.00%	2.94%	9.41%
	Rammal Hassan Rammal	N	1	0	1	
		%	0.54%	0.00%	0.29%	
Nuclear, physical and chemical Science	Einstein	N	100	19	119	125
		%	54.05%	12.26%	35.00%	
	Nobel	N	5	0	5	36.76%
		%	2.70%	0.00%	1.47%	
	Ahmad Zwel	N	1	0	1	
		%	0.54%	0.00%	0.29%	
Western Philosopher	Robert Hook	N	0	3	3	3
		%	0.00%	1.94%	0.88%	0.88%
Muslim Scholar and Philologist	Jaber Bin Zayd	N	0	1	1	10
		%	0.00%	0.65%	0.29%	
	Ahmad Farahidi	N	0	3	3	2.93%
		%	0.00%	1.94%	0.88%	
	Ahmad Al Khalili	N	0	6	6	
		%	0.00%	3.87%	1.76%	
Painter	Picasso	N	1	0	1	6
		%	0.54%	0.00%	0.29%	
	Piet Mondrian	N	5	0	5	1.76%
		%	2.70%	0.00%	1.47%	
School teacher	My teacher	N	2	0	2	2
		%	1.08%	0.00%	0.59%	0.59%
Others	Sherlock Holmes	N	1	0	1	3
		%	0.54%	0.00%	0.29%	
	My sister	N	1	0	1	
		%	0.54%	0.00%	0.29%	0.88%
	I do not know	N	0	1	1	
		%	0.00%	0.65%	0.29%	
Total			185	155	340	340
			54.41%	45.59%	100.00%	100.00%

Einstein was the most popular scientist among students, especially the Lebanese ones. Omani students mentioned well-known Muslim Human Sciences scholars (Bin Zayd, Farahidi) and navigator (Bin Majid) from their countries, while, Lebanese students named famous Lebanese physicians (Michael Dabaghy) and inventors (Hassan Kamel Sabbah). It was clear that the scientists named by Lebanese and Omani students were mostly from their country or from the western civilization (Appendix C).

 Students did not mention scientists from Asian ethnicity, or contemporary Arab scientists. Although they drew a chemist working alone in the lab, they did not mention names of well-known chemists. In addition, one Lebanese student mentioned contemporary western scientist (Helen Sharman), and 6 students mentioned famous painters (Picasso and Mondrian). Overall, students of the sample have a positive view about scientists, but they reported about only one female scientist.

Results related to Research Question 4: What are Lebanese and Omani Sources of their Scientists?

To the statement: indicate the source (s) of your drawing, Lebanese and Omani students rated the television as the first source of their scientist (29.03%), followed by the internet (27.52%). The science textbook (23.22%) and the least medium that affected their mental image were the stories (9.89%) (see Table 29 and Table 30).

Table 29. Frequency and Percentages of the Students' Drawing Sources per Country and Gender

Source of Student Image about Scientist		Country		Total	Lebanon		Total	Oman		Total
		Lebanon	Oman		Female	Male		Female	Male	
TV	N	76	59	135	34	42	76	18	41	59
	%	33.20%	25.00%	29.03%	29.10%	37.50%		15.80%	33.60%	
Internet	N	81	47	128	37	44	81	24	23	47
	%	35.40%	19.90%	27.52%	31.60%	39.30%		21.10%	18.90%	
Stories	N	11	35	46	3	8	11	17	18	35
	%	4.80%	14.80%	9.89%	2.60%	7.10%		14.90%	14.80%	
Teacher	N	42	37	79	26	16	42	22	15	37
	%	18.30%	15.70%	16.98%	22.20%	14.30%		19.30%	12.30%	
Science Textbook	N	49	59	108	22	27	49	32	27	59
	%	21.40%	25.00%	23.22%	18.80%	24.10%		28.10%	22.10%	
Cartoons	N	55	53	108	31	24	55	37	16	53
	%	24.00%	22.50%	23.22%	26.50%	21.40%		32.50%	13.10%	
Movies	N	37	32	69	17	20	37	16	16	32
	%	16.20%	13.60%	14.83%	14.50%	17.90%		14.00%	13.10%	
Total		229 49.25%	236 50.75%	465 100.00%	117	112	229	114	114	122

Table 30. Frequency and Percentages of the Students' Drawing Sources as a Function of Country and Gender

Indicators of Scientist Image		Students		Total	Teachers		Total
		Lebanon	Oman		Lebanon	Oman	
Male gender only	N	182	180	362	4	7	11
	%	74.00%	81.80%	77.68%	30.80%	53.80%	42.3%
Caucasian only	N	96	53	149	7	3	10
	%	39.00%	24.10%	31.97%	53.80%	23.10%	38.46%
Clothing	N	81	42	123	3	3	6
	%	32.90%	19.10%	26.39%	23.10%	23.10%	23.07%
Scientist's facial expression	N	95	40	135	5	2	7
	%	38.60%	18.20%	28.6%	38.50%	15.40%	26.92%
Scientist working indoors	N	122	89	211	9	9	18
	%	49.60%	40.50%	45.27%	69.20%	69.20%	69.23%
Symbols of research displayed	N	105	78	183	11	9	20
	%	42.70%	35.50%	39.27%	84.60%	69.20%	76.92%
Symbols of knowledge	N	54	63	117	5	6	11
	%	22.00%	28.60%	25.1%	38.50%	46.20%	42.3%
Technology represented	N	54	31	85	3	5	8
	%	22.00%	14.10%	18.24%	23.10%	38.50%	30.77%
Relevant captions	N	14	4	18	2	3	5
	%	5.70%	1.80%	3.86%	15.40%	23.10%	19.23%
Mythic stereotypes	N	105	42	147	4	5	9
	%	42.70%	19.10%	31.54%	30.80%	38.50%	34.61%
Indications of danger	N	7	0	7	2	0	2
	%	2.80%	0.00%	1.5%	15.40%	0.00%	7.69%
Total		246	220	466	13	13	26

Overall, the social and visual art media are the most influencing for both Lebanese and Omani students' views about the scientist. On the other hand, Omani students tend to be impressed the least by movies (13.60%), and the most impressed by their science textbooks (25%), and TV (25%), unlike Lebanese students who are influenced by the internet (35.40%), TV (33.20%), cartoons (24%) and the science textbooks (21.40%). Appendix D shows a wide spectrum of Lebanese and Omani students' drawings of the scientist across the grades (Grade 4 till 9).

Research Question 5: Do Lebanese and Omani Science Teachers Influence their Students' Perceptions about Science and Scientists?

In Table 31, data show that students, as their teachers drew a male scientist (77.70%) working indoors (45.30%) and doing experiments (39.30%), with no indications of danger (1.50%) and little use of technology (18.20%).

Table 31. Frequency and Percentages of Stereotypes in Students' Drawings as a Function of Country

Indicators		Student (N$_{Drawings}$=466)	Lebanon and Oman Teacher (N$_{Drawings}$=26)
Male gender only	N	362	11
	%	77.70%	42.30%
Caucasian only	N	149	10
	%	32.00%	38.50%
Clothing	N	123	6
	%	26.40%	23.10%
Scientist's facial expression	N	135	7
	%	29.00%	26.90%
Scientist working indoors	N	211	18
	%	45.30%	69.20%
Symbols of research displayed	N	183	20
	%	39.30%	76.90%
Symbols of knowledge	N	117	11
	%	25.10%	42.30%
Technology represented	N	85	8
	%	18.20%	30.80%
Relevant captions	N	18	5
	%	3.90%	19.20%
Mythic stereotypes	N	147	9
	%	31.50%	34.60%
Indications of danger	N	7	2
	%	1.50%	7.70%
Total		1537	107

To the open-ended Question: What are the qualities of a scientist? As present in Table 32, almost all students (98.09%) have positive perceptions related to scientists, as teachers (98.81%).

Table 32. The Qualities of the Scientist of the Lebanese and Omani Teachers (N=26) and Students (N=571)

Qualities Scientist		Students	Sample Teachers
Positive qualities	N	924	83
	%	98.09%	98.81%
Negative qualities	N	18	1
	%	1.91%	1.19%
Total	N	942	84
	%	100.00%	100.00%

To the Question: What kinds of things do you think this scientist does on a typical working day? Table 33 illustrates that 74.87% of students highlight the thinking and science process skills compared to 50% of teachers. Both teachers and students advocate the investigative nature of the scientist work. Moreover, students' answers are more varied than teachers; students of both countries emphasized the nature of science skills (38.46%), the social and private life of the scientist (25.64%) and (2.3%) of students mention about space, computers and robots. Finally, only (1.47%) of teachers mentioned the teaching of scientists, compared to (8.71%) of students.

Table 33. Teachers and Students 'Answers related to Scientist Typical Working Day

Scientist activities	Teachers		Students	
	Frequency	%	Frequency	%
Mental work (and scientific method) like, observing, planning, reading, writing, learn, communication, publishing, search in internet	34	50.00%	292	74.87%
Imagine, create, testing new things	-	-	150	38.46%
Experiment, working in the lab, collect data	15	22.06%	128	32.82%
Leisure, sociable and private time like playing, drawing, shopping, visiting his relatives, praying.	6	8.82%	100	25.64%
Help people, the poor, the society	6	8.82%	13	3.33%
Discover and invent	3	4.41%	67	17.17%
Operate, prescribe medicine.	3	4.41%	13	3.33%
Teaching, help students, correct	1	1.47%	34	8.71%
Space	-	-	5	1.28%
Use computers, invent robots	-	-	4	1.02%
Total	68	100.00%	390	100.00%

Conclusions

The aim of this study was 1) to know about Lebanese and Omani science teachers' views of science and scientists and 2)) to know in-depth about cycle 2 and 3 Lebanese and Omani students' perceptions regarding science, scientists and their willingness to choose future careers in science and/or technology. Students presented 24 famous and prominent scientists mentioned 335 times by the Lebanese and Omani students, contemporary and from the past, from different disciplines and from the Arab and western civilization. But Lebanese students do not have common contemporary or past Arab scientists as their Omani peers; that scientists are mainly from the western culture. Data revealed that Einstein was the most popular idol among the sample of the study.

For the Lebanese sample, the mentioned scientists by students are present in the national science textbooks, that is applied in schools since 1997 and no major revisions were made up till now. The Lebanese science curriculum shows science as an old domain and not linked to students' daily life and needs. In fact, in 2002,

BouJaoude analyzed the Lebanese curriculum in terms of the four aspects of scientific literacy (Chiapetta et al., 1991). He found that the Lebanese curriculum emphasizes *the knowledge of science*, *the investigative nature of science*, and *the interactions of science technology and society*, but neglects *science as a way of knowing*. İt means that, the Lebanese curriculum does not include the work of scientists, with no indication of their life, their inventions, the history of their inventions, and scientists' contributions to the welfare of humanity. In addition, students are acquainted to science and scientists from the western cultures and mainly they were male scientists (Yacoubian et al. 2017). As for Lebanese students, this is also true for Lebanese in-service teachers (Abd-El-Khalick & Boujaoude, 2003; Ayoubi, El Takach & Rawas, 2017; Ayoubi & BouJaoude, 2006) who hold a behavioristic approach in teaching. Normally, they have to attend training programs held at the Faculty of Education at the Lebanese University and sponsored by the Ministry of Education and Higher Education (MEHE), in order to improve their PCK and in particular their NOS' perceptions and teaching practices.

Overall, students share with teachers, positive views regarding science and scientists. In fact, teachers used humanistic and professional values to the scientist (honest, smart, accurate), while students emphasized on the physical appearance and the social and private life of the scientist. In addition, the data indicated that, students as their teachers drew a male scientist working indoors and doing experiments, with no indications of danger and little use of technology. The internet and TV are the most influencing sources for both Lebanese and Omani students' views about the scientist. Besides social and visual art media, Lebanese and Omani students tend to be influenced by science textbooks. For instance, Lebanese students' answers about their favorite scientist and its source displayed clearly the outdated Lebanese science curriculum.

It is clear that students believed that when the scientist is doing experiment in a lab, he needs less technology. They do not realize that technology can help in knowledge and research production. On the one hand, Omani and Lebanese students, females and males like to be scientists in the future; (70.90%) of Omani students and (51%) Lebanese ones, and (62.10%) of male students of the sample like to become scientists. On the other hand, (61.70%) of students agreed to work in technology in the future, (62.50%) of them are males. Remarkably, Omani students choose to work in technology more than their Lebanese peers. Although, (11.50%) of females believe that technology is hard but (60.90%) of females want to work in technology in the future. To sum up, the concept of technology is still shy for teachers and students. For the Omani sample, Al Shabibi & Silvennoinen (2018) described the actual situation in Omani schooling and the challenges for teacher professional development. The researchers found that the main concern is the low level of learning outcomes in Omani schools; a low performance of Omani boys is due to fact that teachers, especially male teachers, do not have a strong professional identity and commitment to teaching. Moreover, the Ministry of education has a policy aim to raise the average level of outcomes, on one hand, and to ensure that good learning outcomes are evenly distributed between genders, schools and regions, on the other hand.

Lastly, Lebanese and Omani students do not have much in common related to science and scientists; this is obvious from the names of the scientists advanced by students of both countries. Also, although Lebanon and Oman are two Arab countries, but they have differences concerning science, especially that the language of instruction for science and mathematics in Lebanon is English or French, while in Oman it is Arabic. Findings

obtained in this study are limited to a few schools in Beirut and the South of Lebanon and in one Province in Eastern Oman.

Recommendations

DAST is a valuable tool for collecting students' understanding regarding science, technology and scientists. It is advised for teachers to use it as a teaching tool to diagnose their students' prior ideas about science in a classroom setting, who come to class with various social and cultural backgrounds. Also, DAST is very informative for curriculum developers that have for task to keep science textbooks on the tracks of the 21st century science and skills. Finally, DAST is a joyful tool for students themselves, regardless of their age, even for university students, because they enjoy drawing and discussing their image in class. By this way, they can profit a lot for making science and the scientist close to their lives.

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References

Abd-El-Khalick, F., & Boujaoude, S. (2003). Lebanese students' views of the nature of science. *Mediterranean Journal of Educational Studies, 8*(1), 61-79.

Al Mabsali, K. (in Arabic) (2015). The Blessed Omani Renaissance and the Epic of Education, Al Watan Newspaper (November 28). Available at: http://alwatan.com/details/87454, Retrieved: 10/9/2019.

Al Shabibi, A & Silvennoinen, H. (2018).Challenges in Education System Affecting Teacher Professional Development in Oman, *Athens Journal of Education,* Volume 5, Issue 3, pp. 261-282. https://doi.org/10.30958/aje.5-3-3.

Annual Report on Education in the Sultanate of Oman (in Arabic) (2018). Education Council.

Ayoubi, Z., & BouJaoude, S. (2006). A profile of pre-college chemistry teaching in Beirut. *Eurasia Journal of Mathematics, Science and Technology Education, 2*(3), 2006.

Ayoubi, Z., El Takach, S. & Rawas, M. (2017). Improving the pedagogical content knowledge (PCK) among cycle 3 in-service chemistry teachers attending the training program at the faculty of education, Lebanese University. *Journal of Education in Science, Environment and Health (JESEH), 3*(2), 196-212. DOI:10.21891/jeseh.326753.

BouJaoude, S. (2002). Balance of scientific literacy themes in science curricula: the case of Lebanon, *International Journal of Science Education*. Volume 24, Issue 2, 139-155.

Celik,S., & Bayrakçeken, S. (2006). *The effect of a 'Science, Technology and Society' course on prospective teachers' conceptions of the nature of science*, Research, Science & Technological Education, Vol. 24, No. 2, , pp. 255–27.

Center for Educational Research and Development (CERD) (1997). www.http:// www.crdp.org

Center for Educational Research and Development (CERD) (1997). General objectives of the curricula and their details. Beirut, Lebanon.

Chambers, D. W. (1983). Stereotypic images of the scientist: The Draw-Scientist Test. *Science Education,* 67(2), 255–265.

Chiapetta, E., Fillman, D. & Sethna, G. (1991). *Procedures for conducting content analysis of science textbooks*. University of Houston, Department of Curriculum and Instruction, Houston.

El Takach, S. & Yacoubian, H.A. (2020). Science teachers' and their students' perceptions of science and scientists. *International Journal of Education in Mathematics, Science and Technology (IJEMST), (IJEMST), 8*(1), 65-75.

El Takach, S. (2018). How Do Early Childhood Education Pre-service Teachers view Science and Scientists? The Eurasia Proceedings of Educational and Social Science, 9, 104-119. Retrieved from http://dergipark.org/epess/issue/38900/457749

Finson, K. D., Beaver, J. B., & Cramond, B. L. (1995). Development of and field-test of a checklist for the draw-a-scientist test. *School Science and Mathematics, 95*(4), 195–205.

Ministry of Education (2017), Agreement for the Development of an Integrated System of Science and Mathematics Curricula (in Arabic). Available at: https://home.moe.gov.om/topics/1/show/4856, retrieved 10/9/2019.

Ministry of Information (in Arabic) (2019). Profile of the Sultanate of Oman, available at: https://www.omaninfo.omRetrieved: 9/9/2019.

Ministry of Foreign Affairs (in Arabic) (2019). General information about the Sultanate of Oman, available at: https://www.mofa.gov.om/?page_id=9296, retrieved date: 10/9/2019.

Overview of School Education in the Sultanate of Oman (in Arabic) (2019). Education Council, available at: https://www.educouncil.gov.om/page.php?scrollto=start&id=15, Retrieved: 9/9/2019.

Sinno, S. & El Takach, S. (2020). The efficacy and relevancy of the language courses in the preparation of elementary science and mathematics prospective teachers. *International Journal of Research in Education and Science (IJRES), 6*(1), 179-201.

Sjøberg, S. & Schreiner, C. (2006). How do students perceive science and technology? *Science in School,* Issue 1: Spring 2006. Retrieved March 3, 2012, from: www.scienceinschool.org.

Sjøberg, S. (2000). *Science and Scientists: The SAS-study. Cross-cultural evidence and perspectives on pupils' interests, experiences and perceptions*. Department of Teacher Education and School Development. University of Oslo.

Skaf, A. & Habib, Z. (2008, 2011). Lebanon: In Ina V.S. Mullis, Michael O. Martin, Joh F. Olson, Dbra R. Berger, Dana Milne, and Gabrielle M. Stanco ed., TIMSS 2007 Encyclopedia: A Guide to Mathematics and Science Education Around the World, Volume 2, Boston: TIMSS & PIRLS International Study Center.

Stokes, J (2009). *Encyclopedia of the Peoples of Africa and the Middle East: L to Z*. Infobase Publishing. p. 406. ISBN 978-0-8160-7158-6. Retrieved 10 August 2019.

Türkmen, H. (2008). Turkish Primary Students' Perceptions about Scientist and What Factors Affecting the Image of the Scientists, *Eurasia Journal of Mathematics, Science & Technology Education*, 4(1), 55-61.

World Bank (2006) Lebanon Quarterly Update, First Quarter 2006, Beirut: The World Bank. http://siteresources.worldbank.org/INTLEBANON/News%20and%20Events/20883669/Q1-2006.pdf

UNDP (2014). Human Development reports. (http://hdr.undp.org/en/countries/profiles/LBN

UNDESA (2017). United Nations Department of Economic and Social Affairs, Population Division World Population Prospects: The 2017 Revision. https://*ESA.UN.org* Retrieved 12 August 2019.

UNESCO-IBE (2011). World Data on Education VII Ed. 2010/11. Lebanon. Geneva: UNESCO-IBE.

UNESCO-IBE. (2006). Lebanon: early Childhood care and education programme . Retrieved 15 December 2018. https://unesdoc.unesco.org/ark:/48223/pf0000148027

Yacoubian, H., Al-Khatib, L & Mardirossian, T. (2017). Analysis of the Image of Scientists Portrayed in the Lebanese National Science Textbooks. Sci & Educ (2017) 26:513–528, DOI 10.1007/s11191-017-9908-0.

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Appendix A. Teacher Questionnaire

DAST
(Draw-A-Scientist Task)

I am: Male ☐   Female ☐

1. In the box below, draw your mental image about a scientist at work.

2. Describe in few words, what your scientist is doing.

3. Give 3 adjectives of your scientist.

4. What is your scientist doing in a typical working day? Name 3 activities.

Appendix B. Student Questionnaire

Draw-A-Scientist

Date : …………………………

I am a boy ☐   I am a girl ☐

I am …….. years old

I am in class ………………….. My school is …………………………………..

1. Close your eyes and imagine a scientist at work. In the space below, draw what you imagined.

2. Describe what the scientist is doing in the picture.

3. Indicate with a (X) the source of your scientist you drew in the picture above:

Television		Internet		Stories	
Teacher		Science textbook		Others: Such as	
Cartoons		Movies			

4. What kinds of things do you think this scientist does on a typical working day? List at least three things:

5. What are the qualities of a scientist? State 3 adjectives:

6. Who is your favorite scientist? Why?

7. What would you like to be in the future? Why?

8. In your opinion, are Science and Technology important for our society? Yes/ No?

   How are Science and Technology important for our society?

9. What is your favorite school subject? Why?

10. I would like to be a scientist: No ☐   Yes ☐

    Because:

11. I would like to get a job in technology: No ☐   Yes ☐

    Because:

12. This is what I would like to tell you:

Appendix C. List of Scientists named by Lebanese and Omani Students

Scientist
Ahmad Al Khalili: The Grand Mufti of the Sultanate of Oman (1942-)
Ahmad Bin Majid: Great Arabian navigator and cartographer from Oman (1421-1500)
Ahmad Farahidi: Muslim philologist and lexicographer from Oman (718-791)
Ahmad Zwel: Egyptian chemist and a 1999 Nobel prize laureate (1946-2016)
Al Razi: Pesian polymath and philosopher (854-925)
Carolus Linnaeus: Swedish botanist (1707-1778)
Edison: American inventor in fields such as electric power, sound recording and motion pictures (1847-1931)
Einstein: German theoretical physicist (1879-1955)
Hassan Kamil El Sabbah: Lebanese electrical engineer (1894-1935)
Helen Sharman: British chemist and the first space cosmonaut (1963-)
Ibn Sina (Avicenna): Persian polymath, physician and astronomer (980-1037)
Jaber Bin Zayd: Muslim theologian from Oman (641-711)
Khawarizmi: Persian mathematician, astronomer and geographer (781-850)
Kelvin: English mathematician (1824-1907)
Mendel: Austrian botanist and father of the modern science genetics (1822-1884)
Micheal Dabaghy: Lebanese-American cardiac surgeon (1908-2008)
Newton: English mathematician (1643-1727)
Niel Armstrong: American astronaut (1930-2012)
Nobel: Swedish chemist (1833-1896)
Pasteur: French biologist (1895-1854)
Picasso: Spanish painter (1881-1973)
Piet Mondrian: Dutch painter (1951-1991)
Rammal Hassan Rammal: Lebanese physicist (1951-1991)
Robert Hook: English philosopher (1835-1703)
Sherlock Holmes: A fictional private detective created by British author Doyle

Appendix D. Students' Drawings of the Scientist across the Grades (Grade 4 till 9)
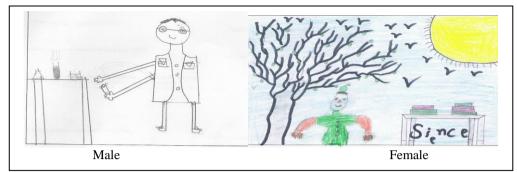

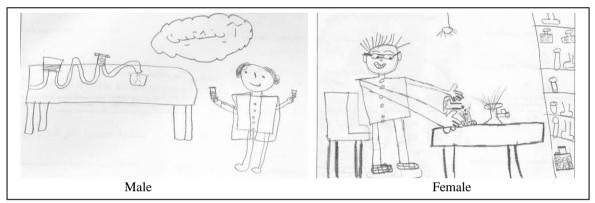Figure 1. Some DAST- Lebanese Students from Grade 4

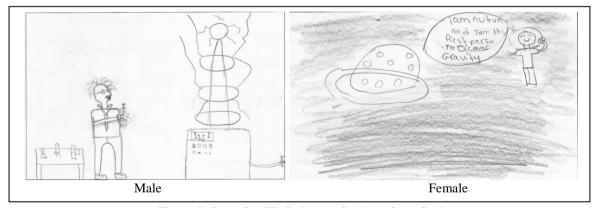Figure 2. Some DAST- Lebanese Students from Grade 5

Figure 3. Some DAST- Lebanese Students from Grade 6

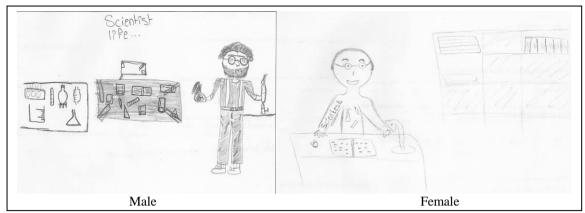Figure 4. Some DAST- Lebanese Students from Grade 7

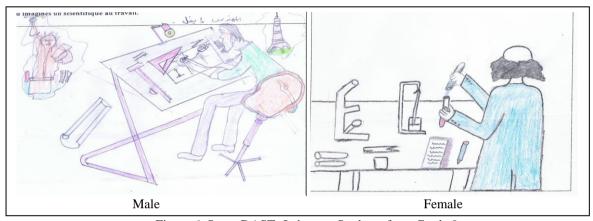Figure 5. Some DAST- Lebanese Students from Grade 8

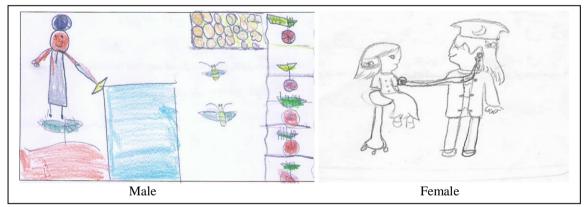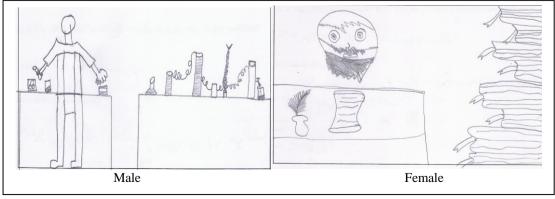Figure 6. Some DAST- Lebanese Students from Grade 9

Figure 7. Some DAST- Omani Students from Grade 4

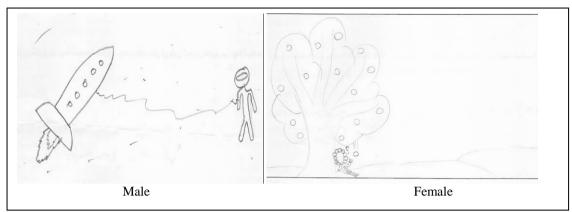Figure 8. Some DAST- Omani Students from Grade 5

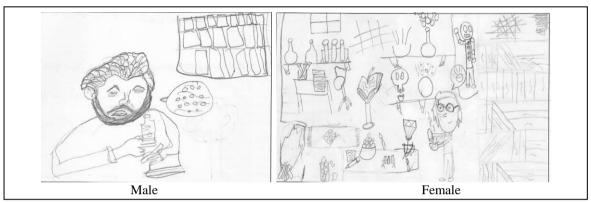Figure 9. Some DAST- Omani Students from Grade 6

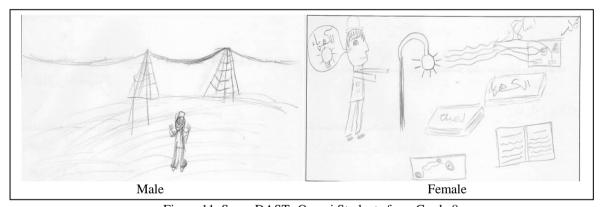Figure 10. Some DAST- Omani Students from Grade 7

Figure 11. Some DAST- Omani Students from Grade 8

Figure 12. Some DAST- Omani Students from Grade 9