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Investigation into Omani Secondary School Students' Perceptions of Scientists and Their Work

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The purpose of this study was to investigate Omani 12th grade students' perceptions about scientists and their work and accordingly propose some recommendations in order to encourage new generations to choose science and engineering-oriented specialisations in higher education. A 37-item questionnaire was designed to determine these perceptions and to find out if there are any differences in perception between males and females. The questionnaire was administered to 943 randomly selected students from ten schools in four Educational Governorates in the Sultanate of Oman, of which 411 were male and 532 female. The findings indicated that the four main resources used by Omani students to get information about scientists and their work are, the media, books, the internet, and the content of the school curriculum. The majority of students have clear perceptions of scientists' work, but are less clear about scientists' relationship with the society.

Keywords: Perceptions, scientists, secondary school students, specialisations, higher education

INTRODUCTION

We live in a rapidly changing society, where scientists of different religions, genders, and races endeavour to invent and discover in order to make human life easier and more comfortable. In order to encourage our new generations to choose science and engineering-oriented specialisations in higher education and become like these scientists, there is a need first to investigate their perceptions or images about the scientists and their work. Studies of students' perceptions of scientists are on-going, as the work of scientists continues and new issues and products related to the process of science appear every day.

The study by Mead and Metraux is a foundational piece of research in the area of students' perceptions of scientists. In their study, high school students describe the scientist as "a man who wears a white coat and works in a laboratory. He is elderly and middle aged and wears glasses…he often has a beard….he is surrounded by equipment, test tubes, Bunsen burners, flasks and bottles,…he writes neatly in black notebooks,….his work may be dangerous…he is always reading a book" (Mead & Metraux, 1957: 386-387). The results of the Mason *et al*. (1991) study with high school students showed that many pictures drawn by students showed scientists engaged in violent activities; while the rest showed scientists as being eccentric in their physical appearance. In their study with primary children, Huber & Burton (1995: 196) found that children's drawings included "funny hair, weird smile, wild eyes, facial hair, robotic features and scars". Similar results were found by (Fort &Varney, 1989; Chambers, 1983; Schibeci & Sorenson, 1983) in their studies. These inaccurate views of scientists are widely held by students from elementary through secondary school (Barman, 1996; Chambers, 1983).

This stereotype of scientists has persisted for many years (Türkmen, 2008; Painter *et al*., 2006), with negative connotations (Palmer, 1997). Samaras, Bonoti & Christidou (2012) point out that student perceive scientists in relation to their views of scientific knowledge and practice, and their attitude to science, as well as to their personal, professional, and social aspirations. For example students may think that scientists work alone to discover the scientific phenomena or that their life is isolated from the life of other people in the society. Parsons (1997) and Sumrall (1995) find that people's perceptions of scientists relate to their self-image and concept of self.

Some studies (Palmer, 1997; Yvonne, 2002) showed that students' perceptions of scientists can affect their attitude to science in a negative way. For this reason, science teachers play a key role in promoting scientists and encouraging a positive impression on students regarding scientists and their work (Benli, Dokme & Sarikaya, 2011). For instance, and as Sheffield (1997) points out, if students have a deeply rooted image of scientists as strange-looking, they are not likely to choose to be scientists in the future. Schibeci & Sorensen (1983) find that children's negative stereotypical image of scientists translates into a negative image of science. For example, students may think that science is very difficult subject that requires from people who are working in it to be isolated from people and spend most of their time and life in the laboratory. They may also view scientists as being quite different from people working in other jobs.

In the move to become a more scientifically literate society, there are many activities and initiatives in Omani. The first initiative is to give more scholarships to students opting to specialise in science and engineering in higher education, to cope with the requirements of the Oman Economy Vision (Oman 2020), which relies on the science and engineering sectors. The second initiative is the establishment of the Omani Research Council in 2005, which adds more value to the role of science in society. One of the major aims of the Council is to encourage Omani youth to develop a positive attitude towards science and encourage them to take up a career in science and engineering. The Council has conducted many scientific activities in schools, such as

adopting what they call "creativity incubators" where the Council supports students in their scientific projects. This may influence students' perceptions about scientists and their work. As Painter *et al*. (2006) notes, children are influenced by images they see around them. Therefore, it is worthwhile to investigate Oman secondary school students' views about scientists and their work in order to get right picture and then propose some recommendations.

RESEARCH QUESTIONS

This study is the only one conducted in the Omani context, which aims at investigating the perceptions of secondary school students of scientists and their work. In this study, we explore the following three research questions:

1. From what sources do secondary school students get their information about scientists and their work?

2. What are secondary school students' perceptions of scientists and their work?

3. Are there any gender differences in secondary school students' perceptions of scientists and their work?

METHOD

The Participants

The participants were 943 secondary school students (411 males and 532 females) selected randomly from ten schools in four Educational Region Authorities in the Sultanate of Oman. These regions are quite similar and students were taught the same science curriculum. The students were in their final year of public education and ready to move to higher education, which is more specialised. Consequently, if students have right perceptions of scientists at school, this may affect their choice to take scientific and engineering degrees in higher education.

Instrument

In order to investigate how scientists are perceived by students, there are different methods and instruments that can be used such as drawings, interviews, and questionnaires. The most frequently used instrument is the Draw a Scientists Test (DAST), developed by Chambers (1983). Finson *et al.*, (1995) further developed this instrument by formulating a checklist to score students' images in a reliable and efficient format and abbreviating it to (DAST-C). In this instrument, we ask the participants to reveal their images of scientists by drawing them. There has been some criticism directed at the use of this instrument, highlighted by some educators such as Symington & Spurling (1990), who note that, because students have no purpose for the drawing, the results reflect their knowledge of public stereotypes of scientists rather than their own views of scientists. Another criticism from Maoldomhnaigh & Mhaolain (1990), who find that changing the wording in the directions given to students in the DAST-C instrument alters the type of drawings produced.

In this study, we use a questionnaire to elicit secondary school students' perceptions of scientists and their work (Perceptions of Scientists and their Work Questionnaire (PSWQ)), because it allows us to survey a large number of students as well as being easy to score and manipulate the data. The first draft of the questionnaire consisted of 43 items, divided into four categories (domains), the sources of information about scientists, the relationship between scientists and society, views about scientists' work and, scientists' implementation of ethics during their work. We chose these domains after reviewing many research studies (Türkmen, 2008; Farland-Smith, 2006; Painter, *et al*., 2006; Palmer, 1997) that investigate the perceptions and attitudes of the participants towards scientists and their work. The inventory is validated by seven assistant and associate professors in science and science education from Sultan Qaboos University. The judges were asked to assess the items in terms of clarity, suitability for the purpose of the study, and the appropriateness of the classification. Due to the judges' comments and suggestions, 6 items were omitted, rephrased, and merged.

The final version of the PSWQ is composed of 37 items relevant to scientists and their work, divided into four categories, as follows:

1. The sources of information about scientists

2. Views about scientists' work

3. Scientists' relationship to society

4. Guiding principles for the scientists work

The reliability of the PSWQ was assessed by using internal consistency through the Cronbach's Alpha reliability coefficient. The reliability value for the overall PSWQ was 0.85 and for its domains ranged between 0.78 - 0.86 (Table 1). These values indicate that the PSWQ is consistent and reliable to collect data for this study.

Table 1: No. of items and reliability value for each domain

Domain	*No. of items*	*Reliability Value*
The sources of information about scientists	6	0.78
Views about scientists' work	13	0.84
Scientists' relationship to society	8	0.80
Guiding principles for the scientists work	10	0.86

For the first category (the source of information about scientists), students were asked to determine to what extent they rely on the given sources to get information about scientists. The three-point system was used, which is: (3) always, (2) sometimes, (1) rarely. For the remaining three categories, students were asked to indicate the degree to which they agreed, uncertain, or disagreed using a three-point Likert scale. The given value was (3) for agree, (2) for uncertain, and (1) for disagree. The participants were instructed to specify their gender, as we require this variable to answer the third question in the study.

RESULTS

Results of Research Question 1

In order to determine the most and least popular sources of information that Omani secondary school students use to get information about scientists, the percentages of students' frequencies for each resource in the three categories were calculated and presented in Table 2.

Table 2: Percentage of each source of information about scientists

Source	*Always %*	*Sometimes %*	*Never %*
Content of School Curriculum	27.0	46.1	8.6
Teachers talk about scientists in class	19.3	38.9	22.4
Reading about scientists in books and on the internet	26.9	37.3	17.0
Knowing about scientists from the media	28.8	33.2	20.1
Writing papers or doing research projects about scientists	10.7	29.5	42.1
Participating in a field trip related to scientists	9.7	24.1	53.6

The results in Table 2 show that 27% always use the school curriculum content as the main source of information about scientists, 46.1% of the students sometimes use this source, and only 8.6% never use it. Regarding the second source (teacher talking about scientists in class), it is clear from Table 2, 38.9% of the students sometimes use this source to get information, while 22.4% never use it. Media plays a vital role as a source of information, with 28.8% of the sample always using it as a resource, 33.2% using it sometimes, and 20.1% never using it. In addition, the information in Table 2 shows that students rarely write papers or do research projects about scientists and their work, as only 10.7% always use this type of resource to get information about scientists, with 29.5% sometimes use it and 42.1% never. The same applies for the final source - students participating in a field trip related to scientists – with more than half of the sample (53.6%) never use this source and only 9.7% of the sample always use it.

Results of Research Question 2

In order to determine Omani secondary school students' perceptions of scientists and their work, the percentages of students who agree and disagree for each domain were calculated and presented in Tables 3-5.

Views about Scientists' Work Domain

In Table 3 shows the percentage of students who agree/disagree for each item in the views about scientists' work domain.

Table 3: The percentage of each item in "views about scientists' work" domain:

No.	*Item*	*Agree %*	*Disagree %*
8	Scientists are working to discover new things	73.1	5.7
7	Scientists can implement research to increase scientific knowledge	69.9	2.4
9	Scientists can implement applied and developmental research in order to develop new technologies	65.9	5.4
10	Scientists are working to solve the problems arising from the applications of science	56.6	9.0

13	Scientists use their imagination and creativity in scientific research	54.8	11.9
14	Scientists exchange ideas and scientific consensus among themselves	53.1	8.7
19	Scientists follow up the accuracy and honesty in their scientific research	47.3	12.0
11	Scientists choose problems that they want to search freely	42.0	14.7
15	Scientists' work is always risky	33.4	17.5
17	Scientists' work only occurs in scientific research centres and laboratories	30.6	26.3
16	Scientists' work is limited to teaching students in universities or colleges	25.3	40.1
18	Scientists follow one scientific method to discover scientific knowledge	16.5	38.8
12	Scientific research is limited to scientists of the developed countries only	15.5	55.2

Notes: We have arranged items in descending order of the two categories of response (agree and disagree). We did not include percentage of students who chose "uncertain" option because these students were not sure about their perceptions so we cannot rely on them. The no. in the table corresponds to those in the original questionnaire.

It can be seen from Table 3 that the item number 8 "scientists are working to discover new things" came first in order of high percentage of agreement in this domain (73.1%). The second item in order of high percentage of agreement in this domain is item number 7 "scientists can implement research to increase scientific knowledge" with 69.9% of agreement. The third item in order of high percentage of agreement in this domain is item number 9 "scientists can implement applied and developmental research in order to develop new technologies" with 69.5% of agreement.

The two items which have low percentages of agreement in this domain is item number 12, "scientific research is limited to scientists of the developed countries only" with only 15.5% of agreement and item number 18 "scientists follow one scientific method to discover scientific knowledge" with only 16.5% of agreement. The results of these two items indicate that Omani secondary school students are forming proper perceptions about scientists in the developing and developed countries and the way they work to discover scientific knowledge.

Scientists' Relationship to Society Domain

Table 4 shows the percentages of students who agree/disagree for each item in scientists' relationship to society domain.

Table 4: Percentage of each item in "scientists' relationship to society" domain:

No.	*Item*	*Agree %*	*Disagree%*
27	Any scientist can stand for scientific awards, regardless of religious, ethnic, and social difference	45.5	14.1
21	Society's institutions provide material and moral support to scientists	43.8	13.7
23	Scientists are interested in the social and ethical impact of their discoveries	41.2	13.9
24	Scientists illustrate aspects of any problem and its impact on society	41.1	9.2
22	Scientists can be punished if they commit errors or cause harm to society	38.8	13.9
20	Scientists can be described as people who are isolated from the rest of society	29.7	27.2
26	Scientists avoid discussing controversial social issues and concentrate on their own research	22.6	22.2
25	Scientists do their research without any material or moral support from society	16.8	30.5

The results in Table 4 reveal that many Omani secondary school students appreciate the work of scientists and agree that they can stand for scientific awards, regardless of their religious, ethnic, and social differences. According to the sample, 45.5% of students

believe that scientists deserve to receive national and international awards for their work and inventions that make human life easier, faster, and more comfortable. Item number 21 "society's institutions provide material and moral support to scientists" came second in order of high percentage of students' agreement (43.8%) in this domain. 43.8% of the study sample perceive that scientists cannot do their work effectively without support from institutions like universities and research centres.

The two items of low percentage of agreement in this domain are item 25 and 26. In item 25 "scientists do their research without any material or moral support from society" 16.8% of students agree and 30.6% disagree. Only 30% of the sample disagrees with the content of the item. More than half of the sample size (53.2%) has no clear picture how society can support scientists to conduct research that help develop the country. In item 26 "scientists stay away from discussing controversial social issues and concentrate on their own research" there is almost equal numbers of students who agree/disagree.

Guiding Principles for the Scientists' Work Domain

Table 5 shows the percentage of students who agree/disagree to each item in the guiding principles for the scientists' domain.

Table 5: Percentage of each item in "guiding principles for the scientist' work" domain.

No.	*Item*	*Agree %*	*Disagree %*
28	Scientists are warned that it is necessary to reduce experimental errors	67.8	9.3
30	Scientists are awarded based on the quality of the science research they conducted	59.6	10.1
32	Scientists must not be biased in the interpretation of the results of scientific experiments for their own interests	58.8	14.4
31	Scientists can convey others' ideas with documents	53.7	14.7
29	Scientists are responsible for the damage resulting from the application of their discoveries	53.1	12.6
35	Scientists are awarded based on the number of their research publications	33.5	24.4
34	Scientists have complete freedom to conduct their research without laws to control their work	30.2	42.4
33	Scientists follow laws while conducting scientific research to reduce the chances of scientific creativity	29.6	28.1
36	Scientists are not responsible for the errors that result from their experiments	20.0	50.4
37	Scientists publish the results of their experiments without having to repeat them again in different conditions	17.5	36.6

It can be seen from the results in Table 5 that the item number 28 "scientists are warned that, it is necessary to reduce experimental errors" has the highest percentage of agreement in this domain (67.8%). More than half of the sample size is aware how important it is for scientists to take precautions while conducting experiments to reduce errors. The second item in order of high percentage in this domain is item number 30 "scientists are awarded based on the quality of the science research they conducted" with 59.6% of agreement. Almost 60% of the sample agreed that the criteria for awarding scientists should be based on the quality of the research work they produced and not based on their nationality, colour, race, or religion. This is very important in

encouraging students to choose science-oriented specialisations, as we award and appreciate for proficiency in such work regardless of difference.

The two items with low percentages of agreement in this domain are items number 36 and 37. In item number 36 "scientists are not responsible for the errors that result from their experiments" 20% of the research sample agree and 50.4% disagree. Half of the sample supports the view that scientists have responsibility for errors resulting from experiments they conduct. The second item of low percentage of agreement is item number 36 "scientists publish the results of their experiments without having to repeat them again in different conditions" with only 17.5% of agreement and 36.6% of disagreement.

Results of Research Question 3

In order to establish if there are any differences between secondary school students' perceptions of scientists and their work due to gender, chi-square was used and the percentages were broken down between each gender for each item in each domain (Table 6).

Table 6: Items with significant differences only between male and female students

No.	*Item*	*Agree %*		*Disagree %*		*p*
		male	*female*	*male*	*female*	
Views about Scientists' Work						
7	Scientists' work is limited to teaching students in universities or colleges	26.0	24.9	35.0	44.1	**
13	Scientific research is limited to scientists in the developed countries only	19.4	12.5	48.8	60.2	***
14	Scientists use their imagination and creativity in scientific research	49.0	59.3	14.6	9.9	***
19	Scientists' work is always risky	37.9	29.9	15.3	19.3	**
11	Scientists can implement research to increase scientific knowledge	64.1	74.4	3.4	1.7	*
15	Scientists can implement applied and developmental research in order to develop new technologies	60.9	69.7	5.3	5.4	*
12	Scientists follow one scientific method to discover scientific knowledge	17.7	15.5	31.3	44.5	***
Scientists' Relationship to Society						
27	Any scientist can stand for scientific awards, regardless of religious, ethnic, and social differences.	39.8	49.9	14.8	13.6	**
26	Scientists can be described as people who are isolated from the rest of society	33.0	27.1	22.6	30.8	*
Guiding Principles for the Scientists' Work						
28	Scientists are responsible for the damage resulting from the application of their discoveries	46.6	58.1	13.3	12.0	**
30	Scientists have complete freedom to conduct their research without laws to control their work	34.5	26.9	39.3	44.9	*
31	Scientists are awarded based on their scientific efficiency	53.9	63.9	11.2	9.3	**
35	Scientists are not responsible for the errors that result from their experiments	23.5	17.2	42.2	56.6	***

34	Scientists are warned that it is necessary to reduce experimental errors	62.6	71.8	12.1	7.1	**
33	Scientists must not be biased in the interpretation of the results of scientific experiments for their own interests	52.9	63.4	14.8	14.0	**
36	Scientists can convey others' ideas with documents	49.0	57.4	15.8	13.8	*

Note: *p* values are shown only where there are statistically significant differences in the distribution of the responses for gender using chi-square (*** $p<0.001$, ** $p<0.01$, * $p<0.05$).

As it can be seen from Table 6 that there are significant differences between male and female students' perceptions for some items about scientists and their work. In the "views about scientists' work" domain, there is a significant difference between males and females perceptions of scientists and their work in items 7, 11, 12, 13, 14, 15 and 19. For item 7 for example, more male students agreed (26%) compared to females (24.9%). 44.1% of female students are against scientists working only at university or college and they see scientists' work going beyond normal laboratory work and in the field to discover things and solve society's problems. For item number 13, again more female students (60.2%) than male students (48.8%) disagree that scientific research is limited to scientists in the developed countries only, agreeing that scientists from developing countries can also do scientific research as well as scientists from developed countries.

In the second domain, which is scientists' relationship to society, there are two items where there are significant differences between male and female students. These are items number 27 and number 26. For item number 27 for example, more female students (49.9%) agree that any scientist can stand for scientific awards, regardless of religious, ethnic, and social differences compared to male students (39.8%).

In the third domain, which is guiding principles for the scientists' work, there are seven items with significantly different results between male and female students. These are items 28, 30, 31, 33, 34, 35, and 36. For item number 28, for example, more female students (58.1%) agree that scientists are responsible for the damage resulting from the application of their discoveries compared to male students (44.6%). Female students give scientists more responsibility for their work compared to male students. It is the same for item number 30, where more male students (34.5%) agree that scientists have complete freedom to conduct their research without laws to control their work compared to female students (26.9%).

DISCUSSION

The main sources that Omani secondary school students use to get information about scientists and their work are the media, books, the internet, and the content of the school curriculum. Reading about scientists from other sources, such as the internet and books, and using media are two important sources that help increase knowledge about scientists and their work. Oktay & Eryurt (2012) assure this and state that in and out of school, students encounter different images of scientists (e.g. documentary films, science fiction, books/movies, and textbooks). In order for students to get right perceptions about

scientists and their work, teachers and the curriculum developers should direct students to appropriate books, journals, websites, and TV programmes (Türkmen, 2008). For example, when teachers teach in physics about objects in motion, they may ask students to read and write a short report about Isaac Newton and his contribution to establishing the Motion Laws by reviewing some articles in scientific journals or magazines. If the content of the science curriculum does not include sufficient information about scientists, and how they work, then we cannot expect students to possess good knowledge and form the right and positive perceptions. Türkmen (2008) asserts that science teachers and textbooks help to shape the minds of young students about who a scientist is and what he does. The content of Omani science curriculum should include some information about scientists and their contribution to developing scientific theories to help students form right and positive perceptions of scientists and their work. The content of these curricula should not only present scientists as those people who conduct scientific research to increase the scientific knowledge but also conduct it to improve previous inventions and discoveries and make them more effective and easy to use.

The relationship between scientists and society may not be clear to some Omani secondary students as it is evident from the results of the current study. Therefore, the educationalists (teachers and curriculum developers) in Oman need to show students that there are many ways in which society can support scientists. Oktay & Eryurt (2012) argue that teaching about scientific development, the construction of scientific knowledge and scientists as leading actors of science is very important for students to develop positive attitudes towards science. Science teachers should teach students that science is a human endeavour enterprise and that it cannot be successful without the support it gets from people in the society. In Oman, scientists and the people working on science projects can get support to conduct their scientific research from the big petroleum and gas companies, the Research Council and governmental and private universities and colleges. However, scientists also need moral support for their work from society. So, there is a need for great effort from the Omani government to emphasise the role of scientists and scientific works in developing Omani society. It is clear from previous researches that society's social and cultural aspects affects scientists' work (Schwartz, Lederman & Crawford, 2004, Boulter, 1999). As McComas (2004) points out, what research we perform and what research we discourage or prohibit, we understand best by considering human forces such as history, religion, culture, and social priorities. However, there is one important point that should be bore in mind, although scientists should get support from society physically and morally to conduct research, they should also be questioned and be responsible for mistakes in their experiments.

The content of the science curriculum should state explicitly the effort that scientists from different cultures and genders make. In addition, science teachers need to discuss this with their students so that students will form better and right perceptions of scientists from developing and developed countries (Ashrif, 1998). Moreover, there is a need for more attention from science teachers when teaching science via scientific activities. Clark (1998) argues that, in order to understand the nature of science and scientists' work, students must actively engage in science teaching through scientific

activities. Teachers should place students in small research teams responsible for developing experiments to investigate a particular question. According to Clark (1998), students must make important decisions concerning the experimental set-up, collection of relevant data, its interpretation, and judgements regarding the veracity of their work. That scientists follow one scientific method to discover scientific knowledge is one myth that students have about the nature of science, and science teachers need to tackle it in their teaching (McComas, Clough & Almazroa, 1998). McComas (2004) argues that there is no single systematic scientific method by which we all do science. He states that although common features in the practice of science, like logical reasoning and careful data collection, are all part of good science, there is no universal set of steps that begins with "defining the problem," extends to "forming a hypothesis," then "testing the hypothesis," and finishes with "making conclusions" and "reporting results."

The same applies to the "guiding principles for the scientists' work" domain, where the content deals with the ethics that scientists should follow when doing scientific work. Students do not realize these ethics or guidelines because teachers do not teach them to students explicitly or practice with them during science activities and experiments. The Omani curriculum, unfortunately, does not give teachers and students that much opportunity to explore ethical issues related to scientists' work. In addition, science teachers may worry that when discussing such issues, they might lose control of the classroom due to conflict and debate that may occur between students especially when touching religious issues. Omani Science teachers should practice these ethics and gaudiness as much as they can when they or their students conduct or demonstrate experiments inside the classroom or laboratory.

The differences in perceptions between male and female students in some items which mostly favour female students could be explained that, generally speaking, Omani female science teachers perform better in their teaching compared to male teachers. These are supported by some previous researches such as Ambusaidi & Al-Rashidi (2012) and Al-Harthi, (2011). According to the results of these studies, female teachers have better preparations and conducting of teaching. They do more practical works and creative teaching of science compared to the male teachers. In addition, the results of students in their final grade (grade 12), and in some international studies such as TIMSS, showed that Omani female students get better scores than Omani male students (Ministry of Education, 2011).

IMPLICATION AND RECOMENNDATIONS

To encourage new generations to choose science and engineering-oriented specialisations in higher education, they need to form right perceptions of science and scientists at school. In order to achieve this, there are two key players, the science curriculum and science teachers. For the science curriculum, the content in all grades should pay attention to scientists and their work by presenting it in attractive ways. They should use many approaches and methods to deliver the content more attractively such as presenting the life and work of scientists in story form or as a case study, as well as paying attention to the history and nature of science. For example, when the curriculum

deals with the concept of “Force”, this can be done through Newton’s story and how he discovered the 'force".

Science teachers have a crucial role to play in encouraging students to choose science subjects at school and university. Teachers should use appropriate teaching methods, such as inquiry, discovery, and role playing and use these approaches, give students the opportunity to think and work like scientists. Scherz & Oren (2006) argue that the traditional instruction of school science fails to introduce students to scientific environments in the real world or to the professionals who work there. In this case, and as Türkmen (2008) points out, the contemporary teaching of science at school tends to be active and hands-on, and teaches children a great deal about their world. Science teachers should work inside the classroom as scientists, and by doing so; they would be more able to guide students in pursuing their own research and science projects (McComas, Clough & AlMazroa, 1998) and give them the opportunity to encounter the same conceptual difficulties that confront great scientists (Ebenezer & Haggerty, 1999). Students' perceptions of science and scientists will then reflect these changes. In addition, teaching needs indicative ideas, which involve critical reading of media texts, or viewing science-related films that students reflect on and compare science as presented in the media with their own ideas (Reis & Galvao, 2004).

In addition, science teachers should give students the opportunity to discuss science with real scientists in their working environments at university or research institutes (Scherz & Oren, 2006). Students should be provided with opportunities for outdoor teaching or site visits in order to give them the chance to meet scientists and work with them in the places where they conduct experiments and carry out scientific research in universities and research centres. Farland-Smith (2006) points out that when we expose students to adult professional scientists, they develop a better understanding of science and the role of scientists. In this case, science teacher could arrange a visit to some nearby universities like in Oman Sultan Qaboos University, where students can meet scientists in their working place

The Omani schools should activate what was called "Science Clubs" in each school. The purpose of establishing these clubs by the Ministry of Education is to encourage students to practice scientific activities and research not necessarily related to their school science curriculum. Many activities can be implemented by students in these clubs such as designing scientific models, conducting experiments and planning and designing mini science projects. Finally, more studies are needed to explore other factors affecting Omani students' perceptions of scientists, such as their attitudes towards science and their achievements in science. Moreover, there is a need to explore the image of scientists in Omani media, Omani society and among higher education students.

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Turkish Abstract

Bilim İnsanları ve Yaptıkları İşler Konusunda Ummanlı İlköğretim Öğrencilerinin Algıları

Bu çalışmanın amacı Ummanlı 12. sınıf öğrencilerinin bilim insanları ve yaptıkları işler konusundaki algılarını belirlemek ve buna göre yeni nesle yüksek öğretimde bilim ve mühendisliğe yönelik uzmanlıkları teşvik etmek için bazı öneriler sunmaktır. Bu algıyı ölçmek için 37 soruluk bir anket hazırlanmış ve kadın ve erkek katılımcılar arasında farkın olup olmadığı bulunmaya çalışılmıştır. Umman Sultanlığı'ndaki dört Eğitim Valiliği'nden on okuldaki öğrencilerden rastgele seçilen 943 (erkek n=411, kadın n=532) öğrenciye anket uygulanmıştır. Bulgular Ummanlı öğrenciler tarafından bilim insanları ve işleri konusunda bilgi almak için kullanılan dört ana kaynağın medya, kitaplar, internet ve okul müfredat içerikleri olduğunu göstermiştir. Öğrencilerin büyük çoğunluğu bilim insanlarının işleri konusunda net algılara sahipken, bilim insanlarının toplumla olan ilişkileri konusunda daha az net oldukları saptanmıştır.

Anahtar Kelimeler: Algı, Bilim insanı, İlköğretim okulu öğrencisi, Uzmanlaşma, Yüksek öğretim

French Abstract

Enquête dans les Perceptions d'Étudiants de Collège d'Enseignement Général Omanaises de Scientitis et Leur Travail

Le but de cette étude était d'examiner les perceptions des étudiants de terminale omanaises des scientifiques et leur travail et proposer en conséquence quelques recommandations pour encourager de nouvelles générations à choisir la science et des spécialisations axées sur ingénierie dans l'enseignement supérieur. Un questionnaire à 37 articles a été conçu pour déterminer ces perceptions et découvrir s'il y a des différences de la perception entre des mâles et des femelles). Le questionnaire a été administré à 943 étudiants aléatoirement choisis de dix écoles dans quatre Gouvernorats Éducatifs dans le Sultanat de l'Oman, dont 411 étaient masculin et 532 femelle. Les découvertes ont indiqué que les quatre ressources principales utilisées par des étudiants omanais pour obtenir des informations sur des scientifiques et leur travail sont, les médias, des livres, Internet et le contenu du programme d'études scolaire. La majorité d'étudiants a les perceptions claires du travail des scientifiques, mais est moins claire de la relation des scientifiques avec la société.

Mots-clés: Perceptions, Scientifiques, Étudiants de Collège d'Enseignement Général, Spécialisations, Enseignement Supérieur

Arabic Abstract

العنوان: التحقيق في إدراكات الطلاب العمانيين في المدارس الثانوية حول العلماء و أعمالهم.

كان الهدف من هذه الدراسة هو التحقيق في إدراكات الطلاب العمانيين في الصف ال 12 حول العلماء و أعمالهم و إقتراح بعض االتوصيات بناءا على ذلك في سبيل تشجيع الأجيال الجديدة في إختيار العلوم و تخصصات الهندسة في التعليم العالي. تم تصميم إستبيان من 37 بند لتحديد هذه الإدراكات و التوصل إلى ما إذا كان هناك إختلافات في افدراك بين الذكور و الإناث. تم تقديم الإستبيان إلى 943 طالب تم إختيارهم بشكل عشوائي من 10 مدارس في 4 محفظات تعليمية في سلطنة عمان,411 من بين المشاركين كانوا ذكورا و 532 إناثاً. بينت النتائج إلى وجود 4 مصادر رئيسية مستخدمة من قبل الطلاب العمانيين في الحصول على المعلومات حول العلماء و أعمالهم ,وهي؛وسائل الإعلام,الكتب,الإنترنت,و محتوى المنهج المدرسي. يملك أغلبية الطلاب إدراكات واضحة بأعمال العلماء,و لكنهم أقل علم بعلاقة العلماء بالمجتمع.

كلمات مهمة: الإدراك,علماء,طلاب المرحلة الثانوية,تخصصات,التعليم العالي.