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Public engagement: Talking science to laypersons as perceived by postgraduate students in Jordan

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Abstract

Aim: This research sought to understand how and why postgraduate students in Jordan viewed the importance of involving non-laypersons in their research.
Method: Twelve hundred-eight graduate students from Yarmouk University were randomly chosen for this study. Twenty-four items were taken from a questionnaire with a Likert scale of 1-5.
Findings: Respondents agreed that communicating with and involving the public was important and that doing so would benefit their everyday lives and the proper application of technology. In the end, scientists need to be able to convey their findings to the general public.
Implications/Novel Contribution: Communication facilitates the spread of information and its subsequent application. How cooperation can be encouraged is explored in detail in the report. The findings will aid non-laypersons in training and communication.

Keywords: Public Engagement, Talking Science, Laypersons

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INTRODUCTION

In ancient history, scientists relied solely on logic and reason; they were forbidden to engage in experimental work. Scientists endured hardships and difficulties; many were imprisoned or even killed for their work. Thomas Bacon (1561-1622) first raised the issue of the relevance of scientific research to everyday life. During his time working for the king, he used his position of authority and was bold enough to openly discuss the king's direct involvement in some matters. Science literally came from the scientists' elbows. "Science" means "knowledge and process." What we call "knowledge" in the field of science refers to ideas like "concepts," "facts," "laws," "principles," and "theories," while "process" refers to abilities like "observing," "predicting," "defining," and so on. Since technology results from scientific research, technological advancements also advance scientific understanding.

Rather than attempting to destroy or degrade human life, science should seek to enhance it, protect it, and alter it somehow. Some risks to human safety may arise as a result of science's rapid pace of progress. It's possible that if more regular people had been involved in scientific research and development, fewer people would have been hurt by the results. As a result, we cannot conclude that scientific progress has enhanced human existence.

The scientific method and its practical applications are "of, by, and for" humanity (Bakuwa, 2014; Limjuco, Jr, Loguinsa, Elmer, & Noval, 2017). People need to have a certain level of scientific literacy even if they don't plan on becoming scientists. People must be taught how to make decisions (Merz, Fischhoff, Mazur, & Fischbeck, 1993). It's possible that our understanding is limited to speculation on some potential outcomes (e.g., amount of farm products, health costs). On the other hand, you may need some background information to grasp the reasoning behind the experts' projections (Achaleke, 2018; De Bruin & Bostrom, 2013; Kongmanus, 2016; Wijetunge, 2016). Informed citizens can keep up with developments in scientific innovations thanks to the public's access to scientific literature and findings (Lupia, 2013; Reyna, 2012).

Because of this, people will always be the primary consumers and creators of scientific knowledge and

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technology (technology). In the distant past, scientists and their experts, such as engineers and technologists, were responsible for developing science, while society benefited from their work. It's crucial for everyone, but the average person has a hard time wrapping their head around (concepts, scientific facts, theories) and the actual methodology employed by scientists.

Background of the Study

Most of the general public needs a better grasp of what scientists actually do and how their findings apply to everyday life. Scientists owe it to the public to explain the relevance and value of their work. Scientists must hone this skill, as they omit technical details to summarise years of work in just a few sentences. As a result, the purpose of this research was to shed light on the reasons for and strategies for communicating with laypersons from the perspective of Jordanian graduate students.

Study Objectives

This study aimed at investigating the following questions:

a) Why do scientists interact with lay people and the public as perceived by postgraduate students?

b) How to communicate with lay people and the public as perceived by postgraduate students?

LITERATURE REVIEW

In 1995 Carl Sagan (1934-1996) as cited in Bakuwa (2014). Said that "We've arranged a global civilization in which the most crucial elementsprofoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces".

A study by the Pew Research Center (2015) in the USA showed that 87% of 3748 Americanbased scientists connected to the "AAAS" agreed with the statement that "Scientists should take an active role in public debates about the importance of science and technology." Only 13% supported the opposite statement that "Scientists should focus on establishing sound scientific facts and stay out of public policy debates."

American Association for the Advancement of Science (1993), Project 2061, and Science for All Americans: "The life enhancing potential of science and technology cannot be realized unless the public, in general comes to understand science, mathematics, and technology and to acquire scientific habits of mind; without a scientifically literate population, the outlook for a better world is not promising, but most Americans are not scientifically literate. The United States should be able to do better." Science is a vital way of representing the nature of science (Irwin & Wynne, 1996). The real argument for understanding science is clearly presented by the United Kingdoms The Royal Society of London (1985) also known as the Bodmer Reportwhich states that: "better public understanding of science can be a major element in promoting national prosperity, in raising the quality of public and private decision-making and in enriching the life of the individual. Improving the public understanding of science is an investment in the future, not a luxury to be indulged in if and when resources allow" (The Royal Society of London, 1985). Analysis and identifying are the few scientific results that people need to know among the scientific knowledge that it would be important to know (Löfstedt, Fischhoff, & Fischhoff, 2002; Von Winterfeldt, 2013). Scientists should start with the most valuable fact and then their benefits (Kahneman & Egan, 2011). Although one can formalize such analyses (Merz et al., 1993; Raiffa, 1968; Von Winterfeldt, 2013), in fact the matters that are important to scientists are also important to the public (Dietz, 2013; Lupia, 2013; Morgan & Henrion, 1990; Raiffa, 1968; Schwartz & Woloshin, 2013; Von Winterfeldt, 2013)

METHODOLOGY

Sample of the Study

(128) of the postgraduate students at Yarmouk University were selected and answered the questionnaire.

Instruments

A questionnaire was developed, it has 25 statements following 5 points-scale Likert scale, (strongly agree,

agree, neutral, disagree and strongly disagree), were divided into two main domains (Why to interact with laypersons and how to interact with the laypersons), validity and reliability were conducted using face and content validity, while Cronbach-α for internal consistency was calculated and it was (0.83).

RESULTS AND DISCUSSION

The results and discussion will be presented according to the sequence of the objectives as follows.

Findings and Discussion of Objective 1

Why scientists should interact with lay people and the public as perceived by postgraduate students?

Table 1: Means and standard deviations of postgraduate students responses on why to engage laypersons with science

Domain	Statements	Means	Standard Deviations
Why to engage laypersons with science	I believe that science engagement with laypeople will improve their daily life	3.68	0.82
	I believe that science engagement with laypeople will help them to use technology easily	3.68	0.74
	I believe that science engagement with laypeople will help them solve problems they face in their daily life	3.73	0.74
	I believe that science engagement with laypeople will help them to understand the value of science	3.67	1.06
	I believe that science engagement with laypeople will help them use tools and equipment in their daily life	3.64	1.18
	I believe that science engagement with laypeople will help them communicate with their neighbors and friends	3.51	1.01
	I believe that science engagement with laypeople will help them change their values and attitudes towards science	3.51	1.02
	I believe that science engagement with laypeople will Improve their health	3.51	0.88
	I believe that science engagement with laypeople will Improve their critical thinking	3.47	0.95
	I believe that science engagement with laypeople will Improve their trust in new technology	3.45	0.99
	I believe that science engagement with laypeople will Improve their trust in natural phenomena	3.44	1.08
	I believe that science engagement with laypeople will Improve their trust in the new inventions	3.42	0.89
	Total	3.56	1.03

*Highest value 5.0

As shown in Table1 the means of postgraduate responses came between 3.86 and 3.42, out of 5 or 73.6%-69.0% and overall percentage of 71.2%. Lay persons should be able to understand the basics of science to make correct

decisions. Because science communication seeks to inform decision making, it must listen to the people, to identify the problems that its members faceand, the information they need. While science education begins by hearing to scientists and learning the facts that they wish to present, Klahr (2013). One of the examples of the negative consequences of poor communication between scientists and the laypersons is the issue of climate change (Somerville, 2012). Some studies (Irwin & Wynne, 1996; Wynne, 1989, 1991, 1996) have demonstrated knowledge that complements that of science experts. For example, Wynne (1989), in his study of the relationship between the Ministry of Agriculture and Fisheries (MAF) and Cumbrian sheep farmers after the Chernobyl disaster, found that sheep farmers knew more about the effect of radioactivity on their local environment and sheep farming than scientists. Wynne (1989), Wynne (1991) argues that scientists should not show that they knew everything, and concentrating on the layperson ignorance of science, but that they should learn from the public, culture, and peoples experience. In Jordan as an example some farmers have better knowledge about olive trees than some agriculture engineers, as they deal with these trees as their babies, from sawing them till they grow up. It is clear that it is important to engage laypersons with science as it is important in their daily life, using and trust in technology, and help them to in problem solving.

Findings and Discussion of Objective 2

How to communicate with lay people and the public as perceived by postgraduate students?

Table 2 shows that the perception of postgraduate students ranges from 3.45 to 2.95 out of 5, with an average percentage of 64.8%. Communication to a lay person audience is difficult. Scientists should know how to communicate. Meanwhile communication is not an easy process especially with lay people. Some scientific ideas are too complicated so to present and communicate with laypersons becomes too difficult. Real communication skills need extensive training and practice in order to communicate to lay people. It is clear as perceived by postgraduate scientists should use different strategies and ways to communicate with laypersons as follows:

a) Simplify (break down the concept): It is a real mistake when scientists breakdown the concept to he layperson and oversimplify it. Also the overestimation of their knowledge can leave them confused and form misconceptions among them.

b) Follow the funnel model: This means to start from a broad concept then go down to narrow concept. This way you will increase the layperson attention to the subject you are going to describe. Finally make the conclusion of your results.

c) Storytelling: Storytelling in science is the best way for layperson attention to science subjects. Analogies or metaphors will allow a layperson to engage with your scientific ideas.

d) Use friends/family and your neighbors to your advantage: practice your spiel on family members or friends and take their feedback. Give your attention to what they face difficulty to understand and try to tailor your story according to their knowledge. Alternatively, sometimes you need to use text and drawings to explain some scientific ideas.

g) Speaking to the media: Scientists must speak with the media and the key points to remember:

Be confident, because you are at the high knowledgeable person. Say no if you are not sure of the scientific concept. Reflect on what you want (or do not want) to be on record days, months or years later, and use that as a filter.

h) Social media can be tricky, but on balance it is good for science communication, as long as you are able to deal with.

i) Dont turn your nose up at laypersons who choose to take their knowledge beyond journals or conferences. Current and future challenges: As much as we understand the current and future challenges associated with our changing lives, it is a struggle for many laypeople to see beyond simple scientific concept which affecting their daily life. The science communicator must keep this in mind and find ways to relate the message to the core values of the layperson.

Table 2: Means and standard deviations of postgraduate students responses on how to engage laypersons with science

Domain	Statements	Means	Standard Deviations
How to engage lay-person with science	I believe that scientist should use simple and clear words	3.45	0.83
	I believe that scientist should use their students and assistants to interact with laypeople	3.44	0.96
	I believe that scientist should Be close and build good relations with laypersons	3.43	1.29
	I believe that scientist should not go deeply in scientific explanations	3.4	1.12
	I believe that scientist should Use social media to explain scientific concepts	3.25	1.03
	I believe that scientist should Use newspapers and media to explain scientific concepts	3.2	1.17
	I believe that scientist should Use lectures and seminars	3.2	1.05
	I believe that scientist should dialogues and metaphors	3.19	1.02
	I believe that scientist should Cooperate with other scientists all over the world	3.17	1.07
	I believe that scientist should Use journals and stories	3.13	1.00
	I believe that scientist should use Science fictions	3.11	1.18
	I believe that scientist should use Conferences and symposiums	2.95	1.16
	Total	3.24	1.16

*Highest value 5.0

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

Communications are useful if they reach people with the information they need and they can use. This requires collaboration between scientists with subject matter knowledge to communicate and scientists with expertise in communication processesalong with laypersons. Such collaboration affords the sciences the best chance to tell their stories It is clear that there is no doubt about the importance of communicating with laypersons, and communicating with them is not an easy it needs experience and special skills of communication in addition of using different strategies, methods in communicating with them. Companies should play an effective role in social responsibility. Train scientists in how to communicate with laypeople. Universities and colleges should also train scientists on how to communicate with laypeople.

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