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A cultural on informal science education in the State of Kuwait and Scotland

Talal Alajmi

Overview

Much has been written from a governmental and an academic perspective about the nature of science education. The purpose of this work is to provide a comparative study of the Kuwaiti and British, specifically Scottish education systems with regards to the teaching of science, and in particular in the use of informal methods of science education. This study will examine the nature and landscapes of formal and informal science education in each country in addition to, how it is engaged amongst pupils aged between 9-12. In recent years, investment in science and overall science literacy is increasingly regarded as vital for the overall performance of society, perceiving it as an extremely beneficial aspect of life (Roberts, 2007). As such, governments have been focusing on science education at all levels (Bell et al., 2004). In this respect, the research will attempt to shed light on informal science education, which primarily refers to science outside of the classroom and in settings such as museums, zoos or other locations (Bell et al., 2009). Much of the literature relating to the nature of science within informal settings holds the consensus that it is a major benefit in supplementing, rather than replacing formal science teaching (Jeffs and Smith, 1999). Teaching science in informal settings has the ability to engage young students, and allow them to engage with science in a more interactive manner. Informal science education is increasingly being regarded as a useful tool for educators and therefore, something that is a significant area of interest for teachers and individuals involved in informal education (Guest, 2003). There have been a number of studies that have already provided some level of comparison between Kuwait and the UK one of which is Nashif (1985), which provided a deep level study of comparing the educational development of the two states. Furthermore, Kuwait is certainly a regional leader in terms of its academic and educational policy (Nashif, 1985), often leading on issues of inclusivity and on teaching those with development needs (Weber, 2012). Kuwait and Scotland have also been identified in recent cooperation in an attempt to improve healthcare awareness through education and technology (Dasman Diabetes Institute, 2010). In essence, Kuwait has invested a great deal of money into science education, therefore, it potentially provides an excellent example for a comparative study with other scientifically advanced nations.

Within this research, there are three key research questions to be studied throughout the course of this work:

i) What are the landscapes of informal science education in Kuwait and Scotland?

This is a key question in terms of understanding the way that different informal education situations emerge in different nations and cultures. The nature of informal education involves a wide range of scenarios, involving educational institutions, government, public, non-profit organisations and others. Therefore, it is significant to draw upon these scenarios of informal science education, which will ultimately reveal the perspective and applications of informal

science education in both countries.

ii) How do primary school pupils, ages 9-12, and their teachers in Kuwait City view and engage in informal science education compared with the UK, with the emphasis on Scotland?

This fundamentally focuses on the issue of children's interest in science education in general and in particular informal science learning. This section will rely on data collected from Kuwait, and will compare it with surveys and secondary information collected from within the UK.

iii) How do organizations and individuals involved in informal science education in Kuwait view informal science education compared with Scotland?

Again, this will be something explored in greater detail via the interviews, and will focus on the use and role of informal science education in each country. Interviewees included employees from various institutions from Kuwait and Scotland. The selected employees are involved in informal science education in some way, either through their workplace or as informal science practitioners. From Scotland, the selected sample included the Edinburgh International Science Festival (EISF) www.sciencefestival.co.uk, the Scottish Centre for Regenerative Medicine (SCRM) www.crm.ed.ac.uk, the Centre for Ecology & Hydrology (CEH) www.ceh.ac.uk and the Royal Observatory, Edinburgh (ROE) www.roe.ac.uk. From Kuwait, respondents were employees currently working at the Kuwait Institute for Scientific Research (KISR) www.kisr.edu.kw, the Dasman Diabetes Institute (DDI) www.dasmaninstitute.org and the Scientific Center, Kuwait (TSCK) www.tsck.org.kw. It is also fair to mention that Kuwait has a limited number of resources on informal science education. As such, it seemed necessary to allocate a great deal of the resources towards learning about the Kuwaiti landscape. This proved to be extremely useful in shaping the approach to this study, and the fact that these tended towards interviews, will aid in making broader assumptions as well as giving alternative perspectives on the subject.

Defining and researching informal science education

Much of the literature relating to the nature of science within informal settings holds the consensus that it is a major benefit in supplementing, rather than replacing formal science teaching (Jeffs and Smith, 1999). Teaching science in informal settings has the ability to engage young students, and allow them to engage with science in a more interactive manner.

As a term, it is perhaps used more than it is understood (Blyth, 1988), therefore, hard to characterize. It is fair to say that informal science education do not share the same characteristics of the conventional occupations in life, for example; architect, nursing or accountancy, all these have defined qualified bodies that illustrate the tasks and qualifications of the profession (Richardson, 2003). However, this is not the matter in informal science education as this type of work is usually undertaken by different domains that include an array of practitioners (Helms, St. John and Smith, 2008).

Hofstein and Rosenfeld (1996) did much research into how and why informal learning was beneficial to the overall teaching of science. They defined informal learning as

'voluntary', 'nonassessed' and 'learner-led', which often were catalyzed by interactive experiences (Hoftsein and Rosenfeld, 1996). The voluntary and learner-led aspects of informal learning are absolutely critical in shaping the rationale behind its success as it highlights many of the key aspects of informal learning, in particularly in museums and science centers, where individuals are truly voluntary and are there by choice.

There are a number of determining factors that shape the success or failure of informal science education as a means of teaching, and one of the most important aspect of these is the role of the teacher. It is essential to provide some level of framework throughout the lesson. A key aspect of informal learning comes from the fact that it depends upon the ability of teachers to harness it. Even though informal learning is learner-led, ironically, it must be planned and guided (Richardson, 2001). This suggests that informal learning is not always dependent on the presence of an environment outside a formal setting, but also the presence of an individual who is best able to shape the learning in that environment.

There is a sense that informal science education is something that is far more dependent upon the overall abilities of the educator, and the more personalized the teacher is able to make the experience, the more likely the student will benefit from it (Farmery, 2002). This is something that highlights the fact that the benefits of informal science education come primarily in situations where the culture tends more towards independence and individualism where education is based on different perspectives and expressions, rather than a one-directional view of 'how to do' things (Ho, Holmes and Cooper, 2004). This may suggest that there are cultural elements to informal science education and that these may prevent it from becoming accepted worldwide. As such, there is much that can be explored as to the difference in cultural applications, and particularly how informal science education can be applied in

different situations. Where there exist cultural differences, there is a real sense that informal science education will differ.

Therefore, there is a chance that informal science education will be met with obstacles and challenges, particularly from those outside of the traditional western culture, where science subjects usually consists of classroom based learning and memorizing of equations and formulas (Qubain, 1966).

As a result, an array of research has gone into how to foster a sense of international cooperation over best practice within science education (Bass and Kahle, 1996). The UK and other European nations, for example, have successfully led the path in creating a sense of cooperation on science education (Ackers and Gill, 2009), on the basis that this will benefit society in future cooperation. However, efforts at a global consensus have been unable to spread to be fully international (Prang-Gsthol, 2010), and particularly the states of the non-western world that have been unwilling or unable to contribute fully to this discourse.

Different approaches in informal science education, or any education in that respect, will be distinct in different cultures (Sjoberg and Schreiner, 2005). Culture is determined with what has worked in the past for society; these might include beliefs, values, norms and ideologies (Vinken, Soeters and Ester, 2004).

When comparing the UK and Kuwait, a key aspect of why science is regarded as being increasingly crucial within the nation's policy is that it has the capacity to considerably increase the skills of workers within a state (Farmery, 2002). The Kuwaiti model of education has been discussed as being perhaps the most successful example in the Middle East, and certainly, Kuwait has been extremely willing and able to use the economy to fill gaps in educational policies (Hanafi, 2005). Kuwait presently has an economy that boasts a number of skilled workers, however, Kuwait is obligated to seek assistance from foreign workers to utilize their expertise in the development of science education in the country (Ministry of

Planning & Center for Research and Studies on Kuwait, 1995). Although this shows the lack of Kuwaitis in the field of education, it is critical in aiding the development of an effective science curriculum in the country.

Kuwait differs culturally from many of the countries surrounding it as it is viewed extremely pro-western and on the issue of science education, Kuwait falls between the two cultures (Salame, 1994). Kuwait has consistently taken its education model from the West which has brought it a number of benefits, both, economically and culturally.

Methodology

Questionnaires were administered to primary school teachers and students in school, as well as face-to-face interviews with individuals involved in informal science education. All the questions presented in the students survey refer to attitudes and perceptions about informal science education. This required somewhat of a Likert style (Likert, 1932), where attitudes are measured by 'strongly agree', 'agree' or 'strongly disagree', 'disagree.' In addition, to maximise the results, semantic differential questions (Osgood, Suci and Tannenbaum, 1957) were also incorporated in the questionnaire, which allows the children the opportunity to express their feelings along a scale of two opposite attributes, for example, (fun/boring) and (easy/hard). Based on that, students were allowed to express a range of attitudes through the questionnaire regarding informal science education.

The questionnaire that were administered to the teachers included both genders working at state primary schools. However, the teachers questionnaire were framed differently from that of the students. This was a multiple-choice format which aimed to identify the applicability of informal science education and how it is engaged in Kuwaiti classrooms, as well as attitudes. Multiple choice responses were created to attempt to maximise the number of respondents, and to ensure that any results gleaned were easily comparable (Oppenheim, 1992). The interviews with individuals involved in informal science education were slightly different. Rather than being based on closed questions, with a multiple-choice response, these questions were open and relied on the respondent being able to elucidate his or her thoughts on the subject.

Interviews were semi-structured as this would examine the intended topics as well as allowing the respondent to express themselves without restraints (Kvale, 1996). This section would perhaps be the hardest to analyse as interviewees are freely able to express their thoughts; therefore they may veer off the intended subject. Nevertheless, it seemed necessary given the fact it has the capacity not only to clarify the issue, but also to identify new ones (Brace, 2008).

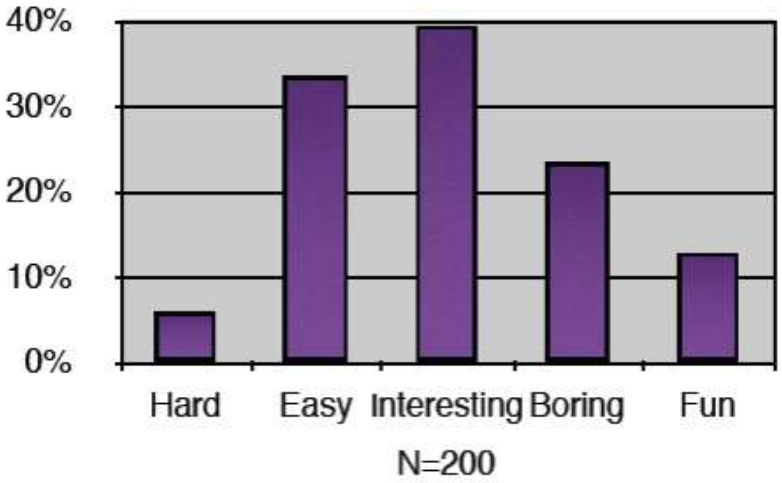
Table.1:
Student responses:

Question Q		Edinnburgh (N (%) (N=22)			Kuwwait (N=2 (%) =200)		
		Yes	No	I Don't Know	Yes	No	I Don't Know
Do you like Science?		77	5	18	83	11	6
Is Science important in our lives?		73	5	22	92	4	4
Do you only learn Science in school?		23	18	54	21	74	5
Do you Like...	Science subjects	100	0	0	80	20	0
	Learning science in the classroom	100	0	0	74	26	0
	Learning science outside the classroom	64	14	0	73	27	0
	Going on a school trip to a science center	100	0	0	89	11	0
	Talking to a scientist	37	45	0	81	18	0
Have you ever been on a science trip?		100	0	0	79	21	0
Do you learn Science on school trips?		37	42	0	46	47	0
Do you have visitors in your class?		42	37	0	48	52	0
Do you learn science with visitors in your class?		5	73	0	12	87	0

The initial responses were perhaps one of the most expected results revealed (Table.1) as the vast majority of the primary-age children felt that science was an important part of modern life (Sjober and Shreiner, 2010). As such, Kuwait revealed 92% agreeing on this as well as the Edinburgh sample with 73%. What this shows is that even at this early developmental stage, there was a real sense that young children appreciate the value of Science. Although there is not the range of data available about the Edinburgh schools in this research, there is much work on the subject that can be drawn through reports within the UK.

In the 2010 ROSE project, however, it was identified that there was disfavor in 'school science' in Scotland when compared with other countries (Sjober and Shreiner, 2010). By contrast, 74% of the Kuwaiti sample liked learning science in the classroom, and when asked 'why?', the majority perceived it as interesting (Fig.1). However, there was a low number in the 'fun' category, which suggests that, despite their interest in school science, most students did not agree that it was 'fun' which perhaps lacks in that element.

Fig. 1 Kuwaiti students' attitudes on 'learning science in the classroom'



What was also clear about the results, was the fact that for many primary children, they preferred travelling outside the school premises, rather than remaining within the confinements of the classroom. This was evident in both samples, the majority of the children stated that it they liked going on school trips. However, in the case of the Kuwaiti respondents, only 46% felt that they learned Science on school trips, another low number was revealed from Edinburgh with 37% (Table 1). There is a sense that many of the children were not aware that school trips were educational which could suggest that the students do not benefit from outside of the classroom learning. However, what is more likely is that students are not aware that they are learning (Wellcome Trust, 2011). This perhaps suggests that, regardless of the location where informal science learning takes place, it must be guided to a certain extent, to maximise its benefits for students in that environment (DeSena and Falk, 2010).

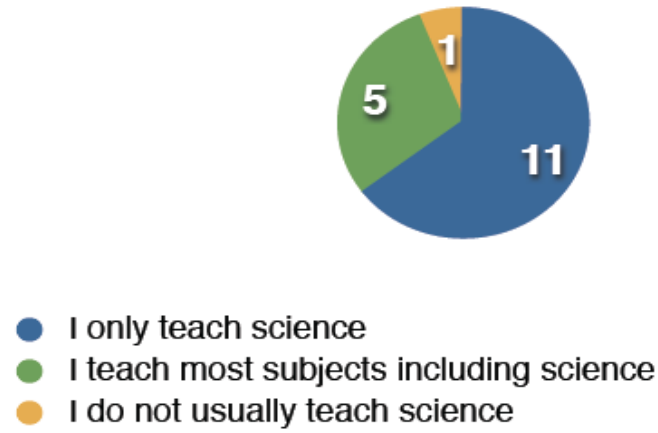
Within the questionnaire, perhaps one of the most interesting replies appeared when students were asked 'what do you want to be when you grow up?'. In Kuwait, the vast majority responded with a science career. Over 50% stated 'engineer (oil sector)' and 'doctors', the remainder of the children replied with 'policeman' or 'teacher'. However, the Edinburgh sample revealed a remarkably different set of responds, even though small, it is interesting to notice the diverse gap between the two. Surprisingly, not one from Edinburgh responded with a similar career to Kuwait, some of the responses included; dancer, photographer, optician, hairdresser, fashion designer, writer and others. However, this is

perhaps expected from the Edinburgh sample as the Rose Project (2010) also noted within its findings, that there was a lack of ambition towards science careers in Scotland (Sjober and Shreiner, 2010). Perhaps the predicament in this case as Sjober and Shreiner clarifies, the fact that 'the more developed the country, the less interest for science' (Sjober and Shreiner, 2010), a statement that perhaps best describes the lack of choice in science careers from the Edinburgh results. It is perhaps fair to say that this statement also applies when children were asked if they liked talking to scientists, the majority that affirmed this were students from Kuwait with 81%. On the other hand, the Edinburgh sample showed very little interest.

Teacher responses:

The first inquiry of the questionnaire was particularly interesting, the intention was to identify the role of Kuwaiti primary teachers in science education. The results here revealed that eleven primary teachers that taught science only teach science (Fig.2), this is something significant to note as on the other hand, primary teachers in the UK teach all subjects including science. It is clear that, in Kuwait, there is a sense of independence in the formal scope of science education as the results revealed the majority of teachers dedicating their career to primary science education. Individuals willing to teach primary science in Kuwait require a completed secondary school degree and a four year academic degree in general science education, this is then followed by a placement at various state primary schools during the school year. For a formal education career, this perhaps is an ideal approach for teaching primary science, as teachers are experienced and committed to the subject would potentially increase the standards of scientific knowledge of students at an early age (Harlen et al., 1995). Teachers competence and knowledge in science is a crucial aspect in teaching the subject (Harlen, 2008).

Figure 2. What is your role in teaching science?



One of the significant results regarding informal science education in Kuwait comes from the fact that it is very rare for students to leave the classroom and travel to alternative learning environments (Fig. 3). However, when school trips do occur, over 10 teachers admitted that they never travel to neither scientific centres or museums! (Fig.4, Fig.5). Similarly, visits to the zoo, aquarium and natural history museums were also (Fig.6, Fig,7). Evidently, this diminishes the capacity for informal science education as science centres allow for students to learn in environments other than that of the school setting (Bell et al., 2009). However, this is perhaps common within schools, as teachers state, trips consume much of the class time and would distract pupils from the core objective of the subject. To a certain extent, school trips carry a number of implications. For example, discipline, safety procedures, parents consents, etc. (QA Research, 2008). Although the same concerns are similar regarding school trips between Kuwait and Scotland, there is a real sense that from the UK in general,

teachers emphasise on learning science outside the classroom and specifically in science museums (QA Research, 2008). Science museums in the UK are always thriving to simplify science through interactive experiences and other techniques to young pupils (Travers and Glaister, 2004), therefore would be extremely beneficial for the overall objective of informal science education.

Fig: 3 School trips in general

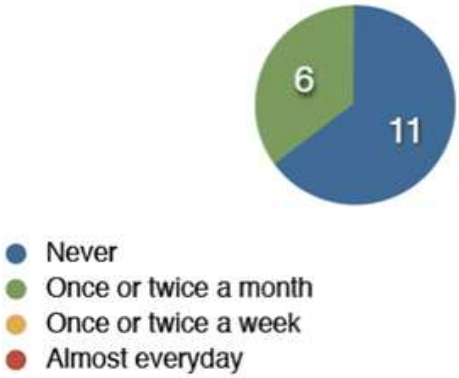


Figure 4. Visits to scientific centres

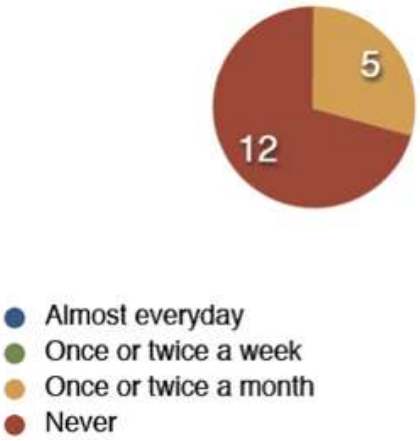


Figure 5. Visits to science museums

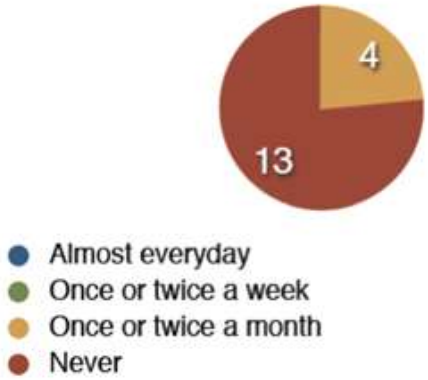


Figure 6. Visits to the zoo or aquarium

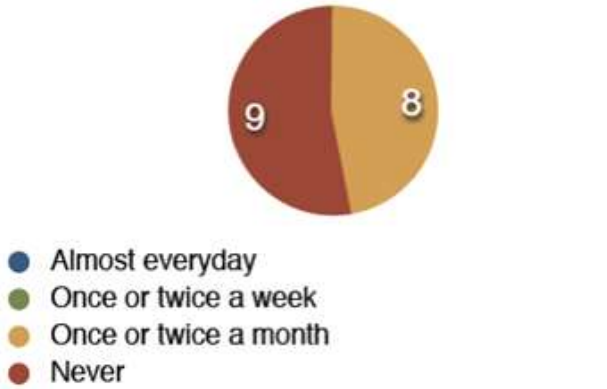
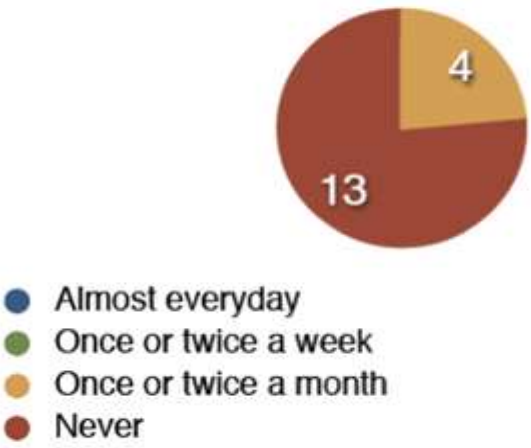
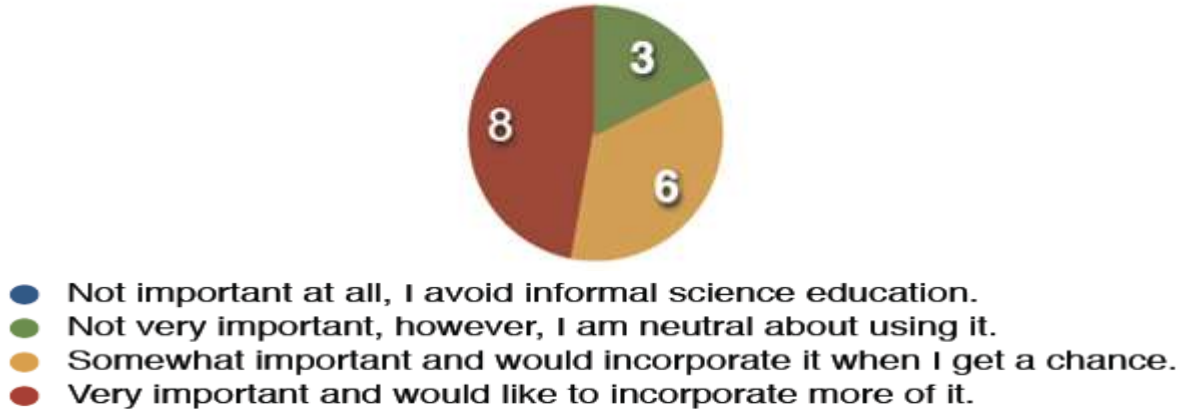


Figure 7. Visits to natural history museums



Overall, most teachers in Kuwait agreed on the importance of informal science education. As results reveal in (Fig. 8), informal science education is somewhat important, and teachers are willing to incorporate either 'more of it' or 'whenever they get a chance'. There was no indication from the results that teachers avoid informal science teaching. In Scotland, there is no trace that teachers differ in their views, UK educators realise the importance of informal science and incorporate it to 'improve engagement with science education' and to 'make science more relevant and applicable to everyday life' (Lloyd et al., 2012).

Figure. 8: Informal science education is...



Interviews:

From a different angle, the issues that were raised in conducting the interviews were perhaps interesting as a result. Kuwait's styles of informal science education were mostly organised around rigid styles, such as lectures and conferences. Fenichel and Schweingruber (2010) describes this sort of engagement as 'dull' and may not be sufficient in generating interest in the subject (Fenichel and Schweingruber, 2010). Critically in Kuwait, the public belief in the benefits of informal science, as well as the impact of bureaucracy on popular engagement of science is weak, unless they have a particular interest in engineering, or are already relatively adept as scientists (Hanafi, 2005). Clearly in Kuwait, it is far more tailored towards those who already show an interest in science.

By contrast, the Scottish interviewees stated that it is very much based on drawing people into science. However, it is also mentioned from Scotland that individuals tend to shy away from science due to it complex nature, which ultimately makes the engagement more challenging. To counter this, organisations such as the EISF and the SCRM develop a variety of science engagement activities which are concerned more with opening access to science to many people as possible by broadening the rate of participation (MacGregor, 2003). This is a key difference in what is understood and meant by informal education from the interviewees and is something that suggests a fundamentally different purpose in the way it is approached. A significant part of the Scottish approach to informal science education is the idea that there must be 'recreational learning', this comes from the fact that students must lead some part of the lesson. However, this has not transferred to be the case in Kuwait, and this prevents the cultural aspects of informal science education from developing.

Conclusion:

Overall, there is a clear attempt that Kuwait is fostering an effective primary science education system, although, it still lacks in engaging in the informal aspects of it. Where the failure to engage occurs is that too much of the 'informal' aspects of science education are approached only to benefit a specific vocational target (Ziman, 1980). That is to say that the Kuwaiti system is utilising science education as a means of motivating more people to work in industries that are most beneficial for the country's economy. This is counterproductive for informal science education and perhaps hinders the enjoyment of science for children, thereby, fails to engage with popularising science (Hofstein and Rosenfeld, 1996). By contrast, in Scotland, there is little sense that science has a direct vocational application, and broadly, Scotland gears itself towards promoting science to make good scientists, not good workers.

In addition, the vast majority of the work of groups such as the Edinburgh International Science Festival is contingent upon expanding science as far as possible, and to inspire more Scottish students to realise that science is of interest to them (Bryce, 2007). In Scotland, the activities undertaken at the science festivals involved attempting to make science fun and interesting, in that they are able to communicate science effectively without making the student feel like they are learning (Bryce, 2007).

This is hugely significant in increasing the benefits that the student receive from informal learning. Although, there were issues that were raised concerning funding, specifically in Scotland, there is much work from the Wellcome Trust (2012) that are attempting to understand the drives of funding institutions and how best to maximise it to benefit the landscapes of informal science education.

Certainly, there is much to be drawn from the data collected and literature, to the extent that the differences, regarding informal science education between Kuwait and Scotland, are traced down to cultural divergence. It is clear that, in each country, the manner of how informal science teaching and learning are approached varies, Kuwait is a country far more rigidly hierarchical than in the UK with regards to informal science teaching. In Scotland, the model of learning seems far more likely to encourage students to participate and engage with science. Therefore, it is fair to say that informal science education in the UK is broad and bottom-up (Lloyd et al., 2012). By contrast, in Kuwait it is narrow, and top-down.

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