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The Impact of Beliefs and Challenges Faced, on the Reported Practice of Private School Science Teachers in Abu Dhabi

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ABSTRACT

Private international schools in Abu Dhabi, UAE, are diverse in curriculum, methods and ethos. They all recruit internationally (and often Western) trained teachers. It could be assumed that these teachers bring with them beliefs about current 'best practices' from their native countries and that these methodologies are implemented into Abu Dhabi's schools. This study used a mixed-methods survey design to investigate the reported beliefs and practices in science education, an area that primary teachers are often hesitant to approach, to identify how much impact beliefs have on reported practice, often despite impeding barriers and challenges. It was found that in many areas the reported beliefs and practices of Abu Dhabi's private school teachers correlate. Where practice does not correlate with beliefs, language barriers and a lack of time, space and resources were identified as the leading reasons. Targeted professional development, support from school management and greater parental involvement are identified as strategies for reducing discrepancies between beliefs and practices.

Keywords: Science Education; Belief Systems; Challenges Primary Teaching; UAE.

INTRODUCTION

The Emirate of Abu Dhabi is one of seven emirates that constitute the United Arab Emirates (UAE). It is the capital of the UAE and is the largest by population of the seven emirates. In mid-2012, the population of Abu Dhabi Emirate was estimated to be 2,334,563 people, of which almost 80% were non-nationals (Statistics Centre – Abu Dhabi, 2013). The UAE has encouraged the establishment of private schools and has seen a surge in such institutes particularly over the last two decades, in part due to the dependence on foreign labour (McKinnon, Barza & Moussa-Inaty, 2013). Approximately 265 public schools provide a free education for the emirate's national students, while non-national students are educated in a diverse variety of private international schools (approximately 185 schools). National students have the option of attending the fee-paying schools and currently make up about 25% of the private school student population (Abu Dhabi Education Council, 2014).

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All schools in the emirate are under the authority of the Abu Dhabi Education Council (ADEC). Private schools must abide by the Council's governing rules and guidelines and are subject to regular evaluation by ADEC. However, they may operate using any approved curriculum they choose, including those from Britain, Canada, Australia, India, Pakistan and the United States of America.

The teaching faculty in Abu Dhabi's private schools are predominately non-nationals with teaching qualifications earned from their native country's education systems, meaning in theory, these teachers should bring with them 'best practices' from supposedly developed countries which have well-established education systems.

Science Education in Abu Dhabi Private Schools

As private schools use a variety of curricula and language of instruction, and serve a variety of communities, each system may place a different emphasis on science indicating that science education in the emirate may vary greatly. The Abu Dhabi Education Council's New School Model Teacher Guide emphasises inquiry based learning, in which students are "*…encouraged to explore their learning actively through creativity and problem solving, [and are] engaged in purposeful practice as they move towards independence*" (ADEC New School Model Teacher Guide, 2013, p. 8). Private schools are not bound by these definitions, however they have been used as a common basis to form the theoretical framework from which we derived our research tool.

Theoretical Framework – The Impact of Teachers' Beliefs and the Challenges They Face

Since private schooling in Abu Dhabi is so heterogeneous, it is difficult to isolate a common model of what constitutes best practice in primary science education in the emirate. Ornstein (1985) suggests that "*…it is difficult to define or agree upon generalizations of successful teaching*" (p. 176), but asserts that teachers can make a positive difference on student performance.

Academic research has shown that teachers' beliefs exist as a system, and that core beliefs are resistant to change (Fives & Buehl, 2012, as cited in Kılınç, et. al., 2014). Furthermore, Ornstein (1986) believes that one of the biggest issues with defining best teaching practice is that people are handicapped by their own biases and beliefs about what constitutes good teaching. This is particularly important in the area of primary science education as many researchers have documented the hesitancy of teachers to teach science (*e.g.* Appleton, 2008; Tytler, 2007; Mulholland & Wallace, 1996), with the reluctance often attributed to the perceived importance (or lack of) that teachers assign to science, their own science anxiety and low self-efficacy with respect to teaching science (*e.g.* Walan & Rundgren, 2014; Fleer, 2009; Harlen, 1997). Bandura (1997) endorses the viewpoint that teachers' beliefs are a very strong predictor of actual behaviour, and Lederman (2007) found teachers' practices to be directly related to their perceptions and beliefs about science. This idea of a high correlation between beliefs and practice, that teachers' instructional decisions are closely related to beliefs about how students learn best, is commonly held in literature both recent and less contemporary, (*e.g.* Seung, Park & Narayan, 2011; Keys & Kang, 2000; Richardson, 1996; Haney, Czerniak & Lumpe, 1996). Recent research has also found that, for the majority of students, engagement with and interest in science, has been largely formed by the time they reach 14 years of age (*e.g.* Lindahl, 2007; The Royal Society, 2006). Fitzgerald, Dawson and Hackling (2013) found that effective primary school science teachers "*…create a learning environment that stimulates and supports student interest*" (p. 982). Therefore, the role of primary school science teachers is critical.

Mahmoud (2009) suggests that the relationships between beliefs and practices are very complex, due to the fact that beliefs are dependent upon the context in which they exist. Ernest (1988) also suggests that the contextual factors such as curriculum, the schooling systems and others' expectations also impact the practice of teaching, elements which may sometimes be outside of teachers' control.

Concerns about a lack of time and space to deliver science; the need for, and the (lack of) ability to use, technical equipment; and the complex nature of science-based content for primary-aged students have been cited by teachers as challenges to teaching science (Appleton, 2002). Teachers of a science curriculum during the reform of the education system in Kuwait identified a set of internal barriers such as the time allocated to teach science, teaching resources, workload, students' behaviour, the level of the content and poor professional development (Al Shammeri, 2013). Similar challenges were perceived by primary science teachers in Turkish schools (Sengul, Cetin & Gur, 2008). The findings of a study conducted by Al Ghamdi and Al Salouli (2012) pinpoint inadequate physical space, lack of resources and professional development, and not enough instructional time as perceived barriers that impede teaching science in public and private schools in Al Dammam in the Kingdom of Saudi Arabia. The language of instruction in primary schools has long been debated with scholars believing that use of students' first language is better in the first years of schooling (Sua & Raman, 2007). Conteh (2003) argues that language is an important component required to develop teacher-student relationships which are necessary in the process of learning. The student population of Abu Dhabi's private schools is often very multi-cultural and consequently it is not possible for each students' first language to be the language of instruction for science. This creates challenges for teachers and may act as a barrier to learning. Todd (1983) presents an educational definition of mother tongue language where he defines it as a tool through which students learn faster than through an unfamiliar language. Undesirable outcomes of learning through a second weaker language were highlighted by different scholars. Minority students in the USA and the United Kingdom have low attainment and face difficulties in understanding concepts due to their low levels of English language (Jeffcoate, 1984; Baker, 1993; Thomas & Collier, 2002). Sua and Raman (2007) conclude that students who do not have enough language skills cannot work to their full potential and their academic achievement will be impacted.

Therefore, the purpose of this study is to determine the beliefs of Abu Dhabi private school teachers' regarding how students best learn science and whether or not this aligns with their reported practice. The study also seeks to uncover the barriers and challenges faced by these teachers' in order to shed light on why practices and beliefs may not correspond.

The conceptual framework that was developed from the relevant literature in terms of levels of confidence, challenges faced and the perceptions and beliefs of primary school teachers informed our research questions and the development of the data collection tool.

The research questions are as follows:

1. How do the private school teachers' beliefs about science learning correlate with their reported practice?
2. What are the main challenges faced by teachers when teaching science in Abu Dhabi private international schools?

METHODOLOGY

a) Data Collection Tool and Participants

This study followed a case study research design that utilised an online survey questionnaire. This survey was emailed to 13 private primary schools in the Emirate of Abu Dhabi where English is the medium of instruction. In the email forwarded to the participants, the researchers explained the purpose of the study and emphasized that participation is anonymous and voluntary. 66 teachers responded to the survey.

The survey consisted of a variety of items under 3 main themes; barriers and challenges faced, teachers' beliefs about how children learn, and (reported) actual teaching practice. Example items included: 'The physical space in which I teach science is adequate' (barriers and challenges faced); 'Students learn science more effectively when they work in groups and share ideas' (teachers' beliefs about how children learn); and, 'I actively involve students in hands–on activities and investigations' (teaching practice). Participants responded using a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree) and were given the opportunity to write general or explanatory comments at the end of each section, if they wished - 17 comments were recorded.. Teachers were asked to self-report on their practices in the classroom for later correlation with their beliefs on how students best learn science. Teachers were also asked about the barriers and challenges they face when teaching science. It was expected that the answers to these questions would help identify possible reasons for a lack of correlation of beliefs and practice (if applicable), or enlighten us on the obstacles teachers were overcoming in order to teach according to their beliefs. The survey also asked teachers to rank the importance of the English, maths and science subjects to indicate teachers' beliefs about the relative importance of science.

b) Data analysis

The survey questionnaire consisted of four-point Likert scale items and qualitative items that were developed from and linked to the reviewed literature. The questionnaire was piloted with five teachers to get feedback and make necessary changes; however, their responses were not included in the collected data and they were asked not take the survey again. To assure that using the same instrument in different situations will give the same results, reliability test was performed (Field, 2013). The reliability test was run on the 8 items that are exploring teachers' beliefs about how students best learn Science, the 14 items that are exploring the practice of Abu Dhabi's private school teachers and the 7 items that are investigating the barriers and Challenges to teaching Science. Each of the items had an acceptable value of Cronbach's alpha which is greater than 0.7 (Sekaran, 2003).

The results of the survey were tabulated to show percentages of answers along the Likert scale and to highlight discrepancies between teachers' beliefs about how students' best learn science, and how they actually teach science. Significant discrepancies were analysed against responses to 'barriers and challenges faced' items to identify possible causes. Where participants recorded additional optional comments, these were used to further describe the beliefs, practices and barriers faced, and were coded as such under the three themes.

FINDINGS and DISCUSSION

The private school teachers in this study overwhelmingly agreed with the 'best practice' statements in the survey (see Table 1). Over 90% of all participants responded positively to each of the items and 98% of participants agreed or strongly agreed that students learn science best when they work in groups and share ideas, discover scientific facts by exploring and observing by themselves rather than when they read it, and when they are given

time to think before answering questions in class and time to reflect on their learning. This certainly aligns with the inquiry emphasis endorsed by the Abu Dhabi Education Council. The only teacher who disagreed with all statements, added this comment:

> *All these statements depend on a particular student's learning style. Some work better in groups and pairs, others learn more through self-exploration. This is why it is important to differentiate learning settings.*

Similar to Fleer (2009) who found that experienced early-childhood educators doubted the value and place of science learning, over 70% of participants ranked science third (least important) when comparing the English, mathematics and science subjects, and only 3% ranked it as most important. This in itself does not denote that teachers believe science to be unimportant, simply that it is not as important as English and mathematics. This belief may affect the time and effort dedicated to teaching science.

Table 1: *Abu Dhabi's private school teachers' beliefs about how students best learn Science*

Answer Options	Strongly Disagree %	Disagree %	Agree %	Strongly Agree %
Students learn science more effectively when they work in groups and share ideas.	0	1.5	51	47.5
Students understand science best when they discuss concepts with their partners.	0	6	52.5	42.5
Students' interest in learning science increases when they pose their own questions and discover the answers by themselves.	0	6	38.5	55.5
Students remember a scientific fact when they discover it by exploring and observing by themselves rather than when they read it.	0	1.5	27.5	71
Students remember a scientific fact when they discover it by exploring and observing by themselves rather than when they hear about it from their teacher.	1.5	1.5	44.5	52.5
Students broaden their scientific inquiry skills by communicating, sharing and reviewing each other's results.	0	6	36	58
Students understand scientific concepts better when they are given time to think before answering questions in class and time to reflect on their learning.	0	1.5	32.5	66
Students develop a deeper understanding of scientific concepts when they regularly record their findings in a science journal.	0	11	48.5	40.5

Table 2: *Self-reported practice of Abu Dhabi's private school teachers*

Answer Options	Never/ Rarely %	Sometimes %	Often %	Always %
I allow my students to explore and discover science concepts on their own with minimal teacher input.	6	45.5	36.5	12
I involve students in class debates and discussions.	1.5	13.5	33.5	51.5
I actively involve students in hands–on activities and investigations.	0	24	45.5	30.5
I provide opportunities for students to work in pairs or very small groups	0	4.5	38	57.5
I incorporate scientific inquiry skills in my science classes.	1.5	18	39.5	41
I encourage collaborative learning among my students	0	7.5	41	51.5
I use ICT tools in my science class.	12	33.5	35	19.5
I arrange library lessons and field trips connected to the science topics	23.5	40.5	26.5	9.5
I relate science concepts studied in class to our daily life and to the real world.	1.5	8	49	41.5
I create differentiated resources to support student learning in science	1.5	27.5	40	31
I create differentiated activities and experiments to support student learning in science	3	33	37.5	26.5
I use different science assessment tools, not only projects and exams.	4.5	29	36.5	30
I demonstrate practical work to my students first before they begin the work.	3	22.5	41	33.5
I help my students to make connections between science, maths and English.	0	15	39.5	45.5

The reported practices of these teachers revealed that teachers are employing the strategies they believe help students to learn science at least sometimes in most cases (see Table 2). This corresponds with other research (e.g. Seung, Park and Narayan, 2011; Lederman, 2007: Keys and Kang, 2000; Bandura, 1997; Richardson, 1996; Haney, Czerniak and Lumpe, 1996) that suggests teachers' practices are closely related to their beliefs about how students learn best. Some anomalies were noticed however. For example 6% of teachers surveyed never allowed their students to explore and discover science concepts on their own and 45.5% only sometimes provided opportunities for students to do this. This is comparable with the research of Brickhouse and Bodner (1992) whose research subject believed science learning should be exploratory in nature however the majority of his teaching was formal and structured. Teachers were also less likely to arrange library lessons and field trips connected to the science topics, and comments supplied by teachers explained that these things were often outside their control:

> *Fieldtrips are planned out by coordinators and administration with excessive concerns placed on cost, rather than on the life-experiences for students.*

Table 3: *Barriers and Challenges to teaching Science in Abu Dhabi Private Schools*

Answer Options	Strongly Disagree	Disagree	Agree	Strongly Agree
I find English language a barrier that affects students' understanding of scientific concepts	3	24	42.5	30.5
I have sufficient resources to teach science practically	23.5	34.5	31	11
The physical space in which I teach science is adequate	16.5	36.5	41	6
I find it hard to manage students' behaviour while teaching science in an active way	30.5	48.5	15	6
I receive professional development on the planning and teaching of science	33.5	35	24	7.5
Parents support adequately by working with their children at home to link with their learning of science at school	21.5	40	34	4.5
Due to time constraints I find it hard to cover the science curriculum adequately	9	29	36.5	25.5

A number of barriers and challenges in the teaching of science were identified by the surveyed private schools teachers (see Table 3). Using English language as a medium of instruction was identified as one of the challenges that the teachers are facing. 73% of the surveyed science teachers agreed or strongly agreed that students' grasp of scientific concepts is influenced by using the medium of English to teach Science. Those findings correspond with Alvarez's (1991) findings that showed that the majority of students in schools in Philippines need to be taught scientific concepts through their native language and that only the high ability students can cope with the second language. Howei (2001) echoes this by stating that students face problems in understanding and responding to various types of science questions including open-ended questions when they are taught through a second language. One teacher commented:

> *Some Arabic science lessons are needed to support the English.*

This is illustrative of other similar comments. This might be helpful as a number of research studies that took place in different contexts have shown that students' achievement is improved when the mother tongue language is incorporated in a bilingual instructional strategy (Cummins, 2007). Despite this, almost 85% of participants reported that they often or always involve students in science debates and discussions.

Time constraints are also perceived by 62% of the surveyed teachers as a challenge that impedes teaching science. This resonates with Al Ghamdi and Al Salouli's (2012) study

which shows that teachers in private and public primary schools in the Kingdom of Saudi Arabia perceive time as an internal barrier in teaching science. It seems that the active teaching approach that the teachers are adopting has brought about this challenge. 80% of our participants stated that they teach inquiry skills in their science classes and 76% incorporate hands-on activities and actively involves students in investigations. Using a student-centred teaching approach like the inquiry-based approach that involves investigations and hands-on experiments is time consuming (Alexander, 2000). One of the teachers commented:

> *Administration/Ministry of Education/Abu Dhabi Education Council should understand that science is a core subject and allow more time in the timetable for it.*

47% of the participants reported that they do not have enough physical space that enables them to teach science and 42% of them assert that they do not have enough materials and resources. This could be the reason behind nearly a quarter of teachers surveyed only sometimes including hands-on activities and investigations in their classes, despite the vast majority agreeing that this was best for students. The teachers explained:

> *It would be great if private schools had science labs set up to help promote and encourage students about science education. Also it would mean more space to carry out investigations as I see science as investigations, experiments.*
> *We need more scientific resources or even a junior lab for every student to be able to work using his/her own hands and not wait for others.*
> *We need better facilities!*

The lack of, or insufficient professional development was perceived as an obstacle by almost a third of the surveyed teachers. When they were asked to make suggestions on how to optimize science teaching they expressed their sentiments as follows:

> *We need more teacher training and planning guidance.*
> *Providing the opportunity for teachers to attend professional development courses relating to the teaching of Science and the implementation of the new science curriculum.*

The challenges identified above are in accordance with the findings of Al Shammeri's (2013) and Sengul, Cetin and Gur's (2008) studies.

Inadequate parental involvement emerged as a challenge, a challenge that was not alluded to in the studies mentioned above. Over 38% of the participants expressed their concern about the support that parents give to their children in learning science and they said that parents are not working with the school and teachers to support their kids' learning. This contradicts Agbatogun (2009) who argues that parents whose children attend private schools are more engaged with their kids' schooling due to the fact they pay tuition fees. Different research studies have shown that students' achievement is positively affected when parents are actively involved in the learning process of their kids (Henderson & Berla, 1997; Houtenwille & Conway, 2008). Other studies also researched the effects of parental involvement on the achievement of students in science and the findings have shown that the relationship between the two variables is a positive one (Olatoye & Ogunkola, 2008; Olatoye & Olajumoke, 2009).

CONCLUSION and RECOMMENDATIONS

This study was conducted to identify the beliefs of primary science teachers in private schools in Abu Dhabi and the challenges that they perceive in teaching science. The teachers surveyed reported beliefs that align with current 'best practice' and with the Abu Dhabi

Education Council's viewpoint on science education and, wherever they had control, were endeavoring to include these strategies in their teaching. This was not true for exploratory type learning, however. Almost all teachers surveyed agreed or strongly agreed this was how students learned best, yet just less than half of the teachers provided these types of activities for students often or always. This finding contradicts both previous educational psychological theories and recent research that held the viewpoint that teachers' beliefs are a very strong predictor of actual behavior (Bandura, 1997), and found teachers' practices to be directly related to their perceptions and beliefs about science (Lederman, 2007).

Our findings pinpointed a number of perceived obstacles that the teachers were facing that affect the way they teach science which may go some way to explaining the aforementioned inconsistency. Identifying these professed challenges has important implications for school principals and heads of departments who might need to revise some of their policies and strategies to address the teachers' concerns. The majority of teachers reported that using English language impeded them from teaching effectively. However, in private schools in Abu Dhabi, there is a diverse student population and English is the only common language through which science curriculum could be delivered, changing the language of instruction is not an option. It might be useful to review studies on teaching science using a second language in multicultural classrooms in other contexts to explore solutions that were suggested and conduct an action research project to check their applicability and practicality. Moreover, schools should evaluate and assess their scheduling issues especially the time allocated for teaching science as this was perceived as a barrier. Another issue that emerged is the physical space and materials and this shows the importance of collaboration between corporate departments in schools and teachers as it is the teacher who knows exactly what resources and facilities are needed for proper delivery of the curriculum. In addition, teachers expressed their concern about the inadequacy of professional development activities that they are provided with. It is recommended that school administrators and heads of departments should consider providing teachers with both in-house and external professional development opportunities. Parental involvement was also highlighted as a challenge that the teachers perceive and this issue should be explored carefully by school administrators to open more parent-school communication channels. Schools should organize workshops to guide the parents on how to be involved with their children's curricular activities.

Teachers in this study ranked science least important (out of English, mathematics and science) which may affect the time devoted to science in class. Therefore, any time spent on science needs to be quality, 'best practice' teaching and learning. In order to develop the scientists of tomorrow, students must be interested in and engaged with science, and primary education has a huge impact on this. Therefore, administrators and policy-makers must support teachers in the best practice of science education.

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