



EMIRATI SCIENCE TEACHERS' BELIEFS, SELF-CONFIDENCE, CHALLENGES FACED, AND THEIR REPORTED PRACTICE

Melissa McMinn

Emirates College for Advanced Education, Abu Dhabi, United Arab Emirates

mmcminn@ecae.ac.ae

Martina Dickson

Emirates College for Advanced Education, Abu Dhabi, United Arab Emirates

mdickson@ecae.ac.ae

Hanadi Kadbey

Emirates College for Advanced Education, Abu Dhabi, United Arab Emirates

hkadbey@ecae.ac.ae

ABSTRACT

Amidst an ambitious education reform agenda, Abu Dhabi, United Arab Emirates, has pledged that 90% of the education sector be Emirati by 2030. The reforms aims to move away from traditional style teaching and learning and towards a student-centred, hands-on, inquiry approach, a vastly different approach to the one which current Emirati teachers experienced themselves as students. This study investigates the beliefs about how students best learn science and the actual teaching practice of nine Emirati teachers in Abu Dhabi's elementary public schools. Items pertaining to teachers' self-confidence, and the barriers and challenges they face in teaching science were also analysed to further explain any correlations, or lack thereof, between beliefs and practice. The findings suggest that while a lack of confidence and other barriers and challenges do impede on ideal teaching practice, many teachers self-report attempting to teach according to their beliefs nonetheless.

Key Words: Emirati Science Teachers' Beliefs, Self-Confidence

CONTEXT

In 2006, the Abu Dhabi Education Council began an ambitious reform programme to improve the quality of education in government-run public schools, which predominantly serve Emirati students. A new science curriculum was adapted from the Australian New South Wales curriculum, which was implemented gradually into public schools with the support of Education Advisors. This outcomes-based curriculum was markedly different to the previous curriculum, which was heavily centred on a prescribed textbook. The role of the Education Advisors was to not only to support teachers implementing the curriculum, but also to provide professional development for existing teachers to improve pedagogy, moving them away from the traditional, teacher-centred styles that were predominant in the UAE and most Arab states at the time (Shaw, Badri&Hukul, 1995; United Nations Development Programme and KSA, 2003 as cited in Alghamdi& Al-Salouli, 2012) and towards a student-centred, hands-on, inquiry approach. In 2010, the New School Model (NSM) was launched in Grades 1-3 in all public schools. As part of this stage in the reform, Science, along with Maths and English, was to be taught through the medium of English by English medium teachers (EMTs). While several initiatives prior to the NSM had piloted programmes in which Science be taught in English (e.g. SAMIE: Science and Maths in English), this was the first time for it to be mandated across all public schools (Dickson & Kadbey, 2014). Each year since 2010, the NSM has rolled out into the subsequent grade, and at the time of writing is deployed in Grades 1-7.

The NSM and the new science curriculum places an emphasis on critical thinking and requires teachers to develop and implement student-centred strategies, inquiry-based learning and exploratory approaches. This is in stark contrast to the way Emirati teachers learned Science in schools themselves.



The reform also impacted teacher education in the emirate with a dedicated teachers' college being established in 2007 offering a Bachelor of Education at no cost to Emirati students, and other established universities also offering education programmes. Currently, the vast majority of EMTs have been recruited from overseas (e.g. USA, UK, Australia, New Zealand), however the Abu Dhabi 2030 Vision aims to have 90 percent Emiratis in the education sector by 2030 (Constantinou, 2009; as cited in Sharif, Hossan& McMinn, 2014).

LITERATURE REVIEW – TEACHING PRACTICE AND CONFIDENCE IN SCIENCE

Emirati teachers' are not an anomaly when it comes to being required to teach in a pedagogically different way than they were taught themselves. Many authors (e.g. Al Ghamdi& Al-Salouli, 2012; Garbett, 2003; Kelly, 2000; Elliot, 2000) have commented that the school science experience of most pre- and in-service primary and early childhood teachers was a passive, teacher-centred collection of facts. If student-centred, hands-on and inquiry approaches are not modelled effectively to teachers during their professional education, it is likely to affect their confidence in using such approaches in their own teaching. Temiz and Topcu (2013) assert it is necessary to provide pre-service teachers '...with constant opportunities to practice with respect to constructivism' (p. 1439).

Despite a plethora of writings about pre- and primary school teachers' hesitancy to teach science and recommendations made to rectify this (e.g. Appleton, 2008; Mulholland & Wallace, 1996; Tytler, 2007), little improvement has been noted in this area (Fleer, 2009). Appleton (2002) claims that in Australia, science is often missed from the curriculum, and when it is included, the teaching strategies used are not consistent with contemporary science programmes. Aside from, or perhaps due to, teachers' own experiences with science education, this hesitation has often been attributed to a lack of confidence regarding the teachers' own science abilities (e.g. Walan&Rundgren, 2014; Fleer, 2009; Watters and Ginns, 1996). Walan and Rundgren (2014) found that one contributing factor provided by early childhood teachers to explain why they excluded science were their own science anxiety and low self-efficacy with respect to teaching science.

A teacher's subject knowledge impacts on their ability to make science ideas and understandings accessible to young learners. A lack of subject knowledge could cause teachers to want or require a controllable environment. A study of teachers of older students showed that the less the teacher knows about science concepts the more often learning experiences are teacher-centred (Carlsen, 1991). Garbett (2003) also noted that "[T]he less competent the teacher is, the more difficult it is for them to follow the child's lead and explore topics by asking the right questions, initiating the appropriate activities or directing the line of inquiry with confidence" (p. 468-9).

Teachers of differing science content knowledge may also lack confidence in their abilities to implement effective science programmes for children. Bandura (1993) asserts that there is a difference between possessing knowledge and skills and being able to use them well. That means that the practice of teachers with the same knowledge and skills may differ depending on their self-efficacy. Watters and Ginns (1996) claim that to positively change self efficacy, "...teachers need to have experienced success, vicarious experiences, or be exposed to effective and powerful persuasive arguments" (p. 66).

Alternatively, teachers who are cognizant of 'best practice' may face insurmountable barriers or challenges, real or perceived, to teach the way they would ideally like. No research is required to substantiate the impediments to teaching practice, be it organizational obstacles, lack of resources, lack of support from administration or parents, classroom management, or the language of instruction.



The personal beliefs of teachers about how students best learn science are also known to have an effect on how teachers plan and implement science programmes. Teachers' pedagogies and practices are not always aligned with each other as shown by Brickhouse and Bodner (1992), whose research subject's beliefs and actions around science teaching were contradictory.

Many articles discuss the beliefs teachers hold about the importance or relevance of science (e.g. van Aalderen-Smeets, van der Molen and Asma, 2012), but scant research examining what teachers believe about how students best learn science exists.

This investigation aims to determine how the three aforementioned elements (1- theoretical pedagogy, 2- barriers and challenges and 3- confidence) influence the actual teaching practice of Emirati teachers in Abu Dhabi.

METHODOLOGY

Surveys were constructed using surveymonkey™ and emailed to principals at 60 public, cycle 1 (grade 1-5) schools in Abu Dhabi, with the request that they forward the survey to their science teachers. The survey items were developed from and linked to the reviewed literature. Out of a total of 248 respondents, only 9 who completed the survey identified themselves as Emirati. It is this smaller group that is the focus of this paper. Due to the feminization of cycle 1 education, all participants are female, and all had less than 10 years of teaching experience. This is due to the fact that before 2009, science was taught through the medium of Arabic by science specialist teachers who have since been replaced by the EMTs. Native Arabic speakers are required to have an IELTS score of 6.5 to be employed in Abu Dhabi's public schools as an English-medium teacher, as such the survey was conducted through the medium of English.

The survey consisted of a variety of questions relating to the teaching of science. For this paper we will focus on the responses to particular questions under 4 themes; self-confidence, barriers and challenges faced, teachers' beliefs about how children learn, and actual teaching practice. Participants responded using a 4-point Likert scale and were given the opportunity to write comments at the end of each section, if they wished. Teachers were asked about their practices in the classroom to see how closely aligned their reported practices were with their beliefs on how students best learn science. Teachers were also asked about their own confidence in teaching science and about the barriers and challenges they perceive. These questions were asked as it was hoped the answers would shed some light on reasons *why* if beliefs and practice did not correlate, or enlighten us on the obstacles teachers were overcoming in order to teach according to their beliefs.

The main guiding research question was:

How do Emirati teachers' self-confidence, science teaching beliefs, and perceptions of barriers and challenges they face, impact on their science teaching practice?

Participants have been assigned pseudonym names for discussion purposes.

RESULTS AND DISCUSSION

Exploratory, Collaborative and Hands-on Learning

In terms of providing hands-on opportunities for learning science, the reported confidence levels of the participants correlated well with the actual teaching practice. That is, the four teachers who claimed to



always use hands-on activities in their lessons and one who often did, rated themselves as confident or extremely confident. It is interesting to note that three of these five teachers agreed or strongly agreed that they found it hard to manage students’ behaviour while teaching science in an active way, yet appear to be forging ahead anyway. Two teachers, Dalal and Mariam, who stated they are confident, only sometimes include hands-on learning. These teachers also agreed that managing behaviour is difficult for them, which may go some way to explain this, however does seem to contradict the confidence rating. It could mean that they feel confident in *planning* hands-on activities, but are less confident about the *implementation* of them, or they could be facing behaviour management issues with the specific class they are currently teaching.

The other two participants’, Ibtisam and Zainab, both feel unconfident and only sometimes provide opportunities for their students to be involved in hands-on learning. While Ibtisam agreed that managing behaviour was a challenge, Zainab disagreed, indicating that her level of confidence has more impact on her teaching practice than the student behaviour barrier in this instance.

Table 1: Science teaching practice

	I incorporate scientific inquiry skills in my science classes.	I provide opportunities for students to work in pairs or very small groups	I encourage collaborative learning among my students	I actively involve students in hands-on activities and investigations.	I allow my students to explore and discover science concepts on their own with minimal teacher input.
Alia	3	4	4	4	1
Basma	3	2	3	3	2
Dalal	2	1	2	2	3
Fatima	2	4	4	4	3
Ibtisam	3	3	3	2	2
Mariam	2	No response	4	2	1
Nahla	3	4	4	4	3
Raheema	3	4	4	4	3
Zainab	1	3	2	2	2

1 = never/rarely; 2 = sometimes; 3 = often; 4 = always

The survey also asked participants whether they believed students remember a scientific fact when they discover it by exploring and observing by themselves rather than when they read it or hear about it from a teacher. All nine Emirati teachers agreed or strongly agreed that this was the case, yet only four often allowed their students to explore and discover science concepts on their own with minimal teacher input. This is significant as Fitzgerald, Dawson & Hackling (2012) found in their study that one crucial way to enhance science teaching and learning was to focus on inquiry, “...whereby students investigate, construct and test ideas and explanations about the natural world” (p. 985).

The most interesting responses in this data set were those of Alia and Mariam. Alia agreed that students remember a scientific fact better by exploring and observing it for themselves, and rated herself as extremely confident in both providing hands-on learning opportunities and utilizing a student-centred approach. She also disagreed that managing behaviour was a challenge for her. Yet, she rarely or never allows her students to explore and discover science concepts on their own. Mariam also rarely or never allows students to explore for themselves, despite also agreeing or strongly agreeing that students learn best this way, but she is not confident in providing a learning experience in science which is primarily student-centred and agrees that students’ behaviour is a challenge. This indicates that Mariam’s confidence and the barrier she perceives students’ behaviour to be have a greater impact on her teaching



practice than her beliefs about how students best learn science. Alia’s self-contradictory responses indicate there may be another reason for not including opportunities to exploring scientific concepts in her teaching, not covered by the questions in this survey.

Basma, Ibtisam and Zainab only sometimes allow students to explore science concepts independently regardless of the fact that they all agree or strongly agree that this is how students learn best. Both Basma and Ibtisam agree that behaviour management is an issue and both lack confidence in providing a student-centred science experience (Basma, not confident; Ibtisam, not at all confident). Zainab rated similarly to Basma and Ibtisam, yet disagreed that managing behaviour was a barrier, suggesting it was her lack of confidence that had the greatest impact on her teaching practice here. Dalal, Fatima, Nahla and Raheema often allow students to explore scientific concept for themselves. All are confident or extremely confident about providing student-centred learning except for Dalal who disagreed here, but interestingly only Fatima disagreed that student behaviour was a barrier, while the other three agreed or strongly agreed that this was the case. This denotes that the challenge Dalal, Nahla and Raheema face with managing behaviour is not enough to deter them from providing exploratory activities that require minimal teacher input for their students.

Table 2: Beliefs about how students learn science

	Students understand science best when they discuss concepts with their partners.	Students learn science more effectively when they work in groups and share ideas.	Students broaden their scientific inquiry skills by communicating, sharing and reviewing each other’s results.	Students remember a scientific fact when they discover it by exploring and observing by themselves rather than when they read it.	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.
Alia	4	4	2	3	3
Basma	3	3	3	4	4
Dalal	2	2	1	3	3
Fatima	4	4	4	4	4
Ibtisam	3	3	4	4	4
Mariam	4	3	4	4	3
Nahla	4	4	4	4	4
Raheema	3	4	4	4	4
Zainab	3	3	3	3	3

1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree

“A different skills set is needed in today’s scientists. We can no longer focus on a niche area. Collaboration is now the norm. We are all living in a connected world.” (Peacock, 2007, cited in Tytler, 2007).

With the exception of Dalal, all teachers agreed or strongly agreed that students understand science best when they discuss concepts with their partners and learn science more effectively when they work in groups and share ideas and results. Dalal disagreed with all three related learning beliefs statements and responded that she rarely or never provides opportunities for students to work in pairs or very small groups and only sometimes encourages collaborative learning among her students. Dalal lacks confidence in facilitating student-centred settings and agrees that managing student behaviour is a factor. On the other hand, Ibtisam often provides opportunities for small group work and collaboration, despite being not at all confident in student-centred learning and agreeing that behaviour management is an issue. As



discussed previously, a lack of confidence in teaching science, especially in a student-centred setting, could be attributed to a lack of scientific knowledge on the part of the teacher. Furthermore, a lack of effective modelling of student-centred instructional approaches during pre-service training could affect teacher sureness in implementing these approaches. The subject knowledge and training of these teachers is outside the scope of this study, however may explain the low confidence levels of these teachers. Further research is required in this area to clarify this relationship.

It is pleasing to see that on at least three occasions, teachers have overcome their own lack of confidence or the behaviour management barrier they face in order to teach in a hands-on, collaborative way. However, both students’ behaviour as a barrier to science teaching and learning and the teachers’ own lack of confidence clearly have an (almost equal) impact on the practice of several teachers in this study. Professional development sessions on effective behaviour management and on science inquiry teaching methods may help these teachers to overcome these challenges in order to teach the way they believe students learn best. If teachers are lacking in science ability, the inquiry training may need to be specific to topics currently taught in order to be readily utilised, at least in the short term, while some ongoing up-skilling in scientific content knowledge be undertaken.

For Dalal, who does not agree that students learn best through discussion and collaboration with peers, the above suggested professional development may help, but it is likely that she will need to observe the positive effects of such teaching methods for herself in order to change her beliefs and subsequently, practice.

Interestingly, all participants responded positively that the medium of English language is a barrier that affects students’ understanding of scientific concepts, with six of nine teachers strongly agreeing. Clearly this has implications for discussions during exploratory, hands-on and group work. As instruction in English is a mandated element of public schooling in Abu Dhabi, there is no easy solution to this challenge. Science, in itself, is a language, and to complicate things further, many words used in primary science education have different meanings in other contexts, for example; weight, force, solid and matter.

Van Laere, Aesaert, van Braak, (2014) found in their study of 1761 students in Belgium, those “...with a home language that is different from the language of instruction experience difficulties with science subjects” (p. 2772).

Despite strongly agreeing with all of the beliefs about learning items, Fatima, a grade 2 teacher, upholds the Belgian findings: “If the student cannot understand the language, s/he cannot do any of these statements”. We must assume that the language Fatima is referring to here is English. Fatima’s students’ first language will be Arabic, and although Fatima is herself bilingual, she indicates that language can be a significant barrier to learning science nonetheless.

Table 3: Science teaching confidence

	Teaching science inquiry skills	Providing a learning experience in science which is primarily student-centred	Providing hands-on opportunities for learning in science
Alia	4	4	4
Basma	2	2	3
Dalal	2	2	3
Fatima	1	3	3
Ibtisam	2	1	2



Mariam	2	2	3
Nahla	3	3	3
Raheema	4	4	4
Zainab	1	2	2

1 = not at all confident; 2 = unconfident; 3 = confident; 4 = extremely confident

Table 4: Barriers and challenges to teaching science

	I find it hard to manage students' behaviour while teaching science in an active way	I find English language a barrier that affects students' understanding of scientific concepts
Alia	2	3
Basma	3	3
Dalal	3	4
Fatima	2	4
Ibtisam	3	4
Mariam	3	4
Nahla	4	4
Raheema	3	4
Zainab	2	3

1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree

The Teaching of Inquiry Skills

The levels of confidence for teaching inquiry skills correlate well with the teaching practice of our Emirati teachers. That is, those that were not at all confident sometimes or rarely/never incorporated scientific inquiry skills in their science classes, and those that felt confident or extremely confident, included inquiry skills often in their teaching. No teachers, however, claimed to always incorporate inquiry skills in science classes. Interestingly, Basma and Ibtisam both claimed to be unconfident in teaching inquiry skills and yet often included them in their practice, and Fatima who professed to be not at all confident in this area, sometimes incorporated skills into her teaching. This indicates that these three teachers are striving to include inquiry skills despite their lack of confidence, placing an assumed importance on such skills.

In the comments section for barriers and challenges in the survey, Fatima wrote: “I suggest to have a teacher only teaching science so that she can put more attention on this important subject to our [sic] future of our learners.” This opinion may be a reflection of Fatima’s confidence (not at all confident in teaching inquiry skills) but seems to be not uncommon among primary school teachers. For example, in their study involving pre-service and in-service primary teachers in The Netherlands, Asma, van der Molen, & van Aalderen-Smeets (2011), found that many teachers expressed the importance of teaching science in primary schools, but did not necessarily see themselves as the ones to do it. Instead, like Fatima, they suggested specialist science teachers do this.

Dalal, a grade 3 teacher who only sometimes includes inquiry skills in her teaching, wrote: “Students in cycle 1 school [sic] have very basic skills to learn science so most skills are not suitable to their age like recording data or working in groups” - a statement which could be tempered with her self-admitted lack of confidence in teaching science skills.

**CONCLUSION**

It is positive to see that most of the teachers in this study hold predominantly ‘best practice’ beliefs about how students learn science. Many are endeavouring to teach according to these beliefs despite their own low confidence and the barriers or challenges, perceived or real, they face.

Hesitancy to teach science, or an unwillingness or inability to teach science in a student-centred, hands-on, exploratory way has often been linked with a lack of teacher confidence. However, positively, research has shown that when teachers gain greater confidence and self-efficacy through continuing professional development, they are able to go on to teach science in a more effective manner and are able to improve the attitudes of their students in this area (e.g. Osborne & Dillon, 2008; Osborne, Simon & Collins, 2003). This has implications for the future professional development of our Emirati teachers, more than half of whom claimed to be unconfident or not at all confident in at least 2 of the 3 survey items pertaining to confidence.

If teachers believe student behaviour will be hard to manage during hands-on, exploratory type activities, then may be less likely to include these in their practice. Professional development in this area is also likely to be beneficial for two-thirds of the teachers in this study.

The other surveyed barrier to teaching science, the English language, is less simple to rectify. The use of English as the only medium of instruction to teach science in ADEC government schools may need to be revisited. Research into the effect of the language of instruction on the performance of students is suggested.

In some instances beliefs and practice were paradoxical, and the lack of inclusion in practice did not correlate with a lack of confidence and or student behaviour management concerns. This signifies that other barriers or challenges are impeding teaching practice and it is likely that these are case-by-case issues that may be investigated and rectified in individual schools.

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