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The Use of Webquests in Developing Inquiry Based Learning: Views of Teachers and Students in Qatar

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***Abstract*—**This paper reports on an aspect of e-learning in developing inquiry-based learning (IBL). We present data on the views of teachers and students in Qatar following a professional development programme intended to help teachers implement IBL in their science and mathematics classrooms. Key to this programme was the use of WebQuests. Views of the teachers and students suggested that WebQuests helped students to develop technical skills, work collaboratively and become independent in their learning. The use of WebQuests also enabled a combination of digital and non-digital tools that helped students connect ideas and enhance their understanding of topics.

***Keywords*—**Digital technology, inquiry-based learning, mathematics and science education, professional development.

I. Introduction

AS with many other nations, the promotion of science, technology, engineering, and mathematics (STEM) is key to education in Qatar [1]. Despite this aim, students in Qatar are often disengaged and disinterested in science and mathematics [2]. These attitudes may be due to teaching in Qatar that has traditionally related to a transmissive teacher-directed model with an emphasis on acquisition of knowledge [3]. Research has suggested that IBL can encourage understanding and relevance and, hence, overcome such negative attitudes [4]-[6].

Our project aimed to implement and evaluate a PD programme that would support teachers in developing IBL in mathematics and science classrooms with grades 5 to 9 students. A key part of the implementation was to introduce teachers and their students to the use of WebQuests [7] as a practical didactic tool that would support research and inquiry through e-learning. WebQuests have been seen to inspire students to investigate and research answers to questions [8], [9], but their use in teaching in Qatari schools was relatively unknown. Our research interest was to evaluate how well such a tool could be used to develop IBL within the context of Qatari schools

II. Literature Review

The view of IBL adopted for this study relates to a way of thinking through the posing of real questions and investigation of tentative answers [10]. As such, IBL is a way of discovering knowledge through student-oriented approaches. IBL is seen as a *vehicle for learning* and the development of higher order thinking where students go beyond the acquisition of specific information and develop skills to analyse, apply and evaluate information [11].

The introduction of digital technology into schools continues to escalate, with many teachers eager to introduce them into their classrooms. Whilst they have the potential to change practices and learning experiences, a concern remains as to whether their use is pedagogically effective [12]. Nevertheless, a review of research into the incorporation of digital tools into teaching and learning practices has suggested several influences, including developing dialogue and argumentation and student-centred inquiry learning approaches [13].

WebQuests, originally developed by Bernie Dodge and Tom March at San Diego State University, relate to "an inquiry-orientated activity in which some or all of the information that learners interact with come(s) from resources on the internet" [7, p. 1]. The students are given a task to focus on in relation to their learning. Depending on their experience, the students are given a structured or open process to research the task with a focused set of possible websites. The structure of the process set out in WebQuests enables students to research answers to their questions. The students are required to closely examine the information accessed on the internet and to determine information and mis-information. The students apply criticality in making their thinking clear in the way that they use information from the sources to inform their own ideas about mathematics within an investigation [8], [9].

The focus in this project is on the use of WebQuests as a tool to integrate technology to scaffold an inquiry approach. Whilst the process of a WebQuest provides a practical tool to support teachers, we could not assume that the its introduction would necessarily be helpful in the context of Qatari classrooms. The integration of digital technologies is widespread in many nations, such as the UK, New Zealand and Australia, but their use is not so common in Arabic countries. As well as the concern about access to safe online materials, there is the added issue of the availability of online materials in Arabic. As such, introducing WebQuests into Qatari classrooms constitutes a new pedagogical context for both teachers and students who may be used to more traditional teaching approaches.

In this paper, we report on the teachers' and students' views following the introduction of WebQuests. We explore how the

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teachers and students perceived the use of WebQuests to promote a student-centred approach that might support student engagement and learning. We also consider if there were concerns or disadvantages in introducing WebQuests into the Qatari classrooms.

III. The Study

A. Context of the Study

The Curriculum Standards Office (CSO), which is he body responsible for developing national curriculum standards in key subject areas for school system in the State of Qatar, sets the national curriculum standards for kindergarten to grade 12 [14]. Despite these standards, schools and teachers have freedom to design their own curricula, instructional strategies and lesson plans. Real-world problem, critical thinking, inquiry, and reasoning are emphasized in the science curriculum [15]. In addition, the use of digital technology is promoted in both mathematics and science as powerful tools to promote learning and communication. It is common for science laboratory facilities to be available to students in both primary and preparatory schools. However, computing facilities are often concentrated in technology laboratories and there is little use of mobile or other digital technologies in other classrooms.

Schools in Qatar are separated by gender, and the education system is organised into pre-school (years 3 to 5), primary (grades 1 to 6), and secondary (preparatory grades 7 to 9, and general or technical secondary grades 10 to 12). In this project, we worked with students from primary schools (grade 5) and from secondary preparatory schools (grades 7 to 9). Instruction in these schools was in Arabic. Science and mathematics were taught separately by specialist teachers both in primary and preparatory grades.

The lifetime of the larger project was over three years. The first year involved eight teachers (four science teachers and four mathematics teachers) from four schools in a pilot introduction of the PD. The second year involved 16 teachers (eight science teachers) from eight schools. Eight PDSs (four specialists in mathematics and four specialists in science) worked with the teachers. During these two years, the PDSs presented initial workshops and provided in-class support at intervals across two school terms. The third year of the project involved the voluntary establishment of schools as learning centres for continued dissemination of practice.

The data focused on in this article are from the second year of the project when the major intervention took place. In this second year, the schools were predominantly girls' schools with two boys' science classes and two boys' mathematics classes. Students were predominantly Arabic, either Qatari or other Arabic nationalities, with a minority of students from Pakistani backgrounds (generally 10% to 20%). Each class had 20-25 students. Students received six to seven mathematics classes a week and four to five science classes a week. The 16 teachers had a range of teaching experiences from two years to twenty-two years. All the teachers had at least degree-level qualification, either in the subject area they were teaching or in education with a specialisation in the subject. In presenting the results, pseudonyms have been used to maintain anonymity.

B. Research Methods

The methodology of the larger three-year project was based on a transformational model of PD [16], where teachers make decisions in how to adapt pedagogical strategies in contexts that are relevant to their classrooms. A case study method was used, and a cross-case study analysis approach was taken using the principles of constant comparison technique [17]. In this paper, we report on the analysis of the sixteen teachers, eight science teachers and eight mathematics teachers, and their students involved in the second year of the project. The data consisted of interviews with the sixteen teachers, and focus group interviews with their students, grades 5 to 9, carried out at the end of the PD programme. Teachers were interviewed individually, and each student focus group had 5-6 students. Both the teacher and focus group interviews were carried out in Arabic. The interviewer took handwritten notes that were translated into English. Each interview lasted approximately 30 minutes. All the responses were kept anonymous and confidential.

IV. Results

A. Introduction of Webquests

Teachers found that introducing the WebQuests encouraged their students to think creatively and apply inquiry skills. The WebQuests provided a structure for student-centred learning. The students were encouraged to search in depth; to investigate, discover and evaluate different information to build the right concepts. The focus was on using information and transferring their knowledge to scientific methods and not just looking for answers.

Students learnt skills in relation to self-directed learning. They learnt to search and explore ideas by themselves, and to focus on their learning. Students built their own learning beyond the limits of the textbook and were not dependent on the teacher's explanation.

B. Students' Motivation and Engagement in Science and Mathematics

Many teachers indicated that their students were excited and motivated to learn. They became self-motivated, enjoyed learning and their confidence increased. The use of WebQuests enhanced students' responsibility in learning. Students became more engaged and asked many questions, even those who did not normally participate. One teacher explained that students were more enthusiastic toward mathematics, and another that students who did not like science became more excited and interested in the lessons.

At least some students in all the focus groups were positive about the WebQuest lessons. Using the computer was motivating, it caught their attention and helped them to focus much better on the lesson. One mathematics student commented, "After those lessons we believe that mathematics is one of our best subjects." Students indicated how they

gained confidence and that this helped them participate in the lessons. One student, who had previously felt anxious about participating in lessons, felt she could now answer her teacher. Students commented that the WebQuests encouraged them to study. They were motivated to seek for information even outside their classes. One science student commented, "I fulfil my dreams and work harder."

C. Student Learning

Many teachers felt that the enhanced engagement and independence contributed to student learning and the achievement of learning goals. Teachers commented that students met the learning objectives for the lesson and applied their learning to other situations. They were able to connect the lesson's objectives and conclude concepts by embedding ideas. Some teachers commented how the introduction of WebQuests helped low academic students achieve the learning objectives as they used a variety of resources and concluded concepts by themselves.

Teachers felt that their students developed high level questions and critical thinking by judging how accurate and relevant the information was. One teacher commented that the students did not accept knowledge without thinking and discussing with each other. Engaging in the WebQuests and exploratory talk helped the students to learn skills of communication and to explain their thinking. In addition, searching the internet improved reading skills and use of IT.

Students felt that they were achieving in their lessons. They were challenging themselves and were pushed to seek out information. They could understand better because the information was in front of them and they concluded the information by themselves. Students also referred to the variety of media that they worked with, and how searching for knowledge from multiple sources helped them to learn mathematics and science. Watching different videos helped them to organise their thoughts and make connections between lessons. They were able to replay or revisit websites when they needed to check their answers. Some students noted that the different resources provided a way to support different abilities and learning styles of students. One mathematics student compared WebQuest lesson to their more traditional classes, where they learnt only from a book. He commented that he was no longer bored in his lessons. Another student commented, "It gives me an idea about where mathematics is used, and it makes science and mathematics simpler."

Students also recognized how they were developing skills. They were required to read by themselves and to depend on themselves as learners. They were increasing their ability to self-learn and become more independent as they learnt to monitor and control themselves. They were learning how to employ technology and to make searches on the internet. They were building personalities that were capable of dialogue and discussion.

D. Teachers' Reflections on Their Experiences

Several teachers reflected on the introduction of WebQuests in relation to their own practice. Some teachers commented that they found the implementation easy for both the teacher and the student. They found that using WebQuests helped them to organise the inquiry process and introduce a new pedagogy. They could plan activities and choose appropriate resources. One teacher commented how she loved working with technology and stated that this reduced the effort for her teaching. Other teachers found that teaching this way provided a new way to discover students' abilities, to check students' understanding, and assure their achievement of the lesson objectives.

E. Teachers and Students' Concerns and Challenges

The two main challenges for many of the teachers were time management and reliability of the technology. Several teachers commented how the students needed more time in the lessons s to visit the resources, analyse the content and answer questions. Teachers also referred to the unreliability of the hardware and access to the internet and how these caused disruptions in their lessons. Some of the teachers of grade 5 students commented on the students' poor reading skills, although one of them explained how she circumvented this by using more videos. Other teachers commented on the students' poor skills in searching the internet or preparing a PowerPoint presentation and that some of their time was spent teaching these skills rather than the content of the lesson.

Whilst many of the teachers indicated that they felt the use of the WebQuests had enhanced the learning experience for their students, some teachers were less convinced the lessons had supported achievement and understanding of the content. Teachers felt that, as the pedagogy was still new, students were not able to confirm their knowledge or that shifting the responsibility of learning towards the students meant that they needed to check the students' understanding and repeat the lesson.

Whilst all the focus groups included some students who were positive about the WebQuest lessons, there were a few students in some focus groups who were not so satisfied. Some students described a lack of cooperation when they worked together at the computer. Others lacked confidence to share their ideas and were embarrassed if their answers were not correct. A few students stated that they preferred traditional teacher-oriented approaches with the teacher giving direct clear explanations to confirm their answers. A few students felt that they did not achieve in their learning as they only understood when the teacher explained the content.

V. Discussion and Conclusion

Both teachers and students referred Large to advantages in relation to acquiring skills and increased motivation. Whilst some teachers expressed concern about the time taken by the students to carry out the research, it seemed that this time was appreciated by the students, as it gave them the opportunity to access learning from different contexts and media. Several teachers and many students referred to enhanced learning from this experience. From teacher and student comments, it appeared that the searching and analyzing was supporting higher order thinking and hence enabling the pedagogy to

move towards a more student-centred approach. This finding concurs with previous research into IBL with digital technologies [11], [13]. However, some teachers indicated that the shift of responsibility towards the students may not have confirmed students' understanding or enhanced achievement. Some students also seemed uncomfortable with this shift in responsibility. These concerns may have related to a view of quality pedagogy and the need to help students to acquire the content set out in the national standards.

Several teachers and students also commented on the increased skills that the students were developing in using technology, in reading and in working independently. However, the lack of these skills was given as concerns by some teachers. As this project evaluated the early introduction of WebQuests, the lack of skills would still be apparent with some students. It would be beneficial to determine if the development of these skills through further use of WebQuests can overcome these teachers concerns. One issue in the context of these Qatari schools related to the provision of technology and the access to websites in Arabic. It seemed that some teachers felt the time taken to resolve problems with the technology or to resource appropriate websites was not commensurate with the potential learning. The creation of a bank of WebQuests with suitable resources could be one aim to support teachers.

Most of the comments from teachers and students indicated that the introduction of WebQuests as an example of digital technology has the potential to influence and develop student-centred inquiry learning approaches. However, the findings from this study also indicate that we cannot assume the introduction of digital technology will be seen as effective pedagogy by all teachers and students. Some of the reasons for the teachers' concerns were practical or related to the newness of the pedagogy; however, other concerns are related to teacher and student views of quality pedagogy. Whilst the motivational aspect of introducing WebQuests is clearly recognized, for a minority of teachers and students, the enhancement of learning and achievement is not so certain.

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