

Implementation Considerations of Emirate Student Teachers Regarding Online Math

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Abstract

This paper reports on an exploratory study concerning the integration of Information & Communications Technology (ICT) and Mathematics as it supports the effective implementation of outcome-based curriculum practice in the United Arab Emirates (UAE). It demonstrates a commitment among undergraduate students on an Initial Teacher Training (ITT) programme in Emirates College of Advanced Education (ECAE), in creating progressive curricular provision in ICT /Mathematics. In particular, attention is given to the development of pedagogical approach supporting innovative transformative, self-regulated student approach in preference to more traditional transmission style teaching forms in elementary schools in Abu Dhabi. This approach to immersion activity in student-engaged learning behaviors is believed to better deliver outcome-based approaches and so is directly in keeping with the principles of Abu Dhabi's New School Model (NSM) curriculum. As such the study outlines a consideration of how ICT may be best placed to support Math provision in forward thinking schools within the emirate and wider UAE elementary provision. Crucially, the study can also be seen to have evidenced a pragmatic style of integration of ICT and Math by offering an approach dealing with the proliferation of online Math resources that often leave students and practitioners in a quandary as to where to begin in terms of fostering self-regulated learning styles, how to monitor educational worth of websites and how to engage child learners in independent learning tasks online without losing rigor of curricular content.

ECAE in Abu Dhabi has been unusual in implementing a Vertically Integrated Project (VIP) as a unique approach to operationalizing the integration of Information and Communication Technology (ICT) and Mathematics in respect of helping its undergraduate students investigate the progressive pedagogical tenets inherent in the NSM curriculum. The approach was unique in two respects, firstly the VIP project operated outside that of the normal core undergraduate degree course offered at ECAE and as such afforded students with specific interests in the cognate areas of Mathematics and ICT the opportunity to work on a practical research task, both prior to and during, practicum experience in elementary schools. Secondly, the project class structure was deliberately designed to cut vertically across student year groups and to be supported by academic and research staff in a semi-formalized research team structure. This meant that individual project group constituencies ultimately consisted of groups of students and academics from a range of experiential backgrounds and as such did not mirror the traditional class environment of standard Mathematics core groups. The design of these project groups was informed by work conducted by Abler et al (2010) in the USA as to the benefits of the use of VIP to enhancement of students' professional skills acquisition and academic research output by faculty. It was also informed by research study on communities of practice, communities of enquiry and online collaborative practice towards elaborated enhancement of professional learning detailed by Hargreaves (2000), Christie et al (2007) and Wilson et al (2007) respectively.

Introduction

In the UAE for the past two decades or so, ICT has been viewed as the ultimate complimentary resource for the creative enhancement and transformation of content in most curricular areas. This has especially been the case in elementary schools, particularly in terms of the teaching of Science, Mathematics and English subjects. Internationally it has also often been seen as having a ubiquitous presence, with the potential to deliver a ‘magic bullet’ in terms of enhanced motivation of children and regenerative properties of content. However, studies would suggest that this position has been far less sustained than anticipated (Munro, 2008; Condie, 2003). Further study has also suggested that use of ICT by many practitioners may well be restrictive and follow a typical pattern of the use of word-processing for professional tasks and the limited use of educational software to support transmission modes of teaching. In short, although the technology available in schools is modern, the use to which it is put by many teachers lags somewhat behind the progressive transformational pedagogy known to facilitate deep learning in favor of more traditional transmission teaching styles where knowledge is treated as commodity (Williams et al 2008). Within the same report it was also suggested that newly qualified teachers were no more likely to exhibit what could be considered transformative pedagogical response to the use of ICT than their more experienced counterparts. This was mainly due to a lack of operational confidence in its use within the classroom, although they themselves were what resembled more what has since become more colloquially known as ‘technological natives’ than, ‘technological migrants’.

It is crucial to also acknowledge the developments and benefits in the use of ICT in UAE schools however. Personal experience of visiting elementary schools in the region by college staff involved in the study witness that there are undoubted pockets of commitment towards its use in the development of presentation and problem-solving skills in Mathematics, the redress of abstract concept in Science through the use of video and in the use of online content in supporting creativity within the Arts. A strategic and reflective approach by practitioners regarding ICT use to enhance learners’ understanding and creativity has been well established in places such as the UK for some time (HMIE, 2007). This kind of use of ICT may be held to resonate with pedagogies linked to constructivist or social constructivist theory and would seem to be becoming ever more established in elementary schools internationally. The benefits to such use and of the associated prerequisite for practitioners to consider the educational worth of online content in this vein, prior to, and following , content implementation with children has been well established in the literature (Loveless, 1995; Pritchard, 2004). The need for structured inputs within teacher training establishments in order to support early career teachers in recognizing the educational worthiness of content and approach will undoubtedly become recognized as UAE moves towards production of standardized frameworks for enhancements to published professional standard setting ITT courses in the near future. The NSM too would seem to reify such a position in its commitment towards outcome-based, transformative pedagogy and greater interdisciplinary learning in its elementary schools.

It has been known for some time that difficulty in achieving fully transformative and self-regulatory approaches in schools has been that the practitioners charged with their delivery themselves require deep immersion in the pedagogy within their own training (Butler & Winne, 1995). The student teacher task examined in this paper was designed to develop just such student teachers’ understanding of how learners may learn in a more independent,

self-regulated manner through the use of ICT scaffolding tools. Scaffolding of activity towards enhanced knowledge and skills acquisition, together with raised levels of academic confidence is well rehearsed in the literature (Brophy, 2002; Butler & Winne; Zimmermann 1998). The ultimate aim then, was to support the student teachers' own mediation and confidence towards their own learning by asking them to create software materials for use in practicum experience that would support learner autonomy in elementary Mathematics and simultaneously support self-regulated learning tasks for children. This exposed student teachers to much of the required experience necessary to promote transformative and self-regulatory in their own learning as well as developing progressive transformative pedagogy inherent in activity aimed at the children in their practicum class.

To this end ECAE established VIP project approach within a unique extra-curricular structure. The organizational task set to students was to form small project groups with constituencies drawn from across BEd (Hons) year groups. Together with this form of peer support, each group had regular meetings with faculty staff members with proven academic and research capabilities. In this way it was hoped that several different types of experience would come to bear upon the project activity, as well as setting in motion a sustainable element of succession management for future iterative cycles of the similar type of project design for student teachers as they progressed through their undergraduate course. The actual task for students was to create a Webquest feature for use in Math (and Science) within an elementary classroom setting. A Webquest is a familiar practitioner-generated software tool used in many elementary schools worldwide. It provides a basic intuitive user-interface contextualized around a common theme (in this case Math). This helps teachers direct and manage online access for children through use of on-screen text and icons connected to preselected website content relevant to the theme in question (e.g. counting on, fraction etc.). Text within the Webquest offers children prompts and assistance allowing them to work independently, at their own pace, and in a choice of domain of their own choosing. In effect this means that children learn in a differentiated style at a suitable ability level, and so emulates a prime requirement within self-regulatory learning activity. In much the same way, the freedom of choice within the Webquest allows children to move between comparative context domains and affords them the opportunity to consolidate and enhance prior learning in an engaging and self-regulated way. Both factors of self-regulation and transformative aspects are required for success in deeper learning supported in NSM's principled outcomes-based approach.

Throughout the process of Webquest design for children the ECAE students were required to use a website evaluation tool (adapted from Potter, 2002; Pritchard, 2004) to investigate and report upon targeted aspects of Math online content. This evaluation process required the students to access each website they used in their Webquest material for children and to record aspects of its purpose, authenticity, creativity, competence, accuracy, security, and implementation strategy. Students were expected to offer expanded comment on each evaluative component and to be mindful of elements related to authenticity of task for children, encouragement of inter-active approaches, differentiation and pedagogical style. The evaluation tool itself was provided for students (Collins & Paterson, 2009) and this supplied consistency of evaluative approach between groups.

Method

Design

The study was conducted in Semester 1 of Session 2013-14 with undergraduate students from across the BEd (Hons) Year 1- Year 4 cohorts. Given the voluntary and social aspect of student participation with in the VIP programme, no strict constituency rules were established for the ratio of content of year group representatives. It was stipulated to students though, that all groups should strive to contain membership from across cohorts. It should also be noted that it was felt from the start that BEd4 were particularly under-represented. It was believed that this was caused due to timing of the project coinciding with their preparation for final practicum experience and so their absence was perhaps understandable. Online or virtual collaboration of group members was permitted however, and there is anecdotal evidence that several students, including some in BEd 4, may have participated exclusively in this way.

The study was designed to specifically evaluate the component of the website evaluation tool which centered on subject 'implementation'. It particularly asked students to consider:

- How do online tasks match children's learning
- Will you have to augment online tasks suggested with external resources?
- How will you achieve this?
- Could your chosen site be used to enhance teaching and learning?
- Would you recommend any adaptations? (If so what would this be?)

Student teachers were asked to create their own Webquest design for use on practicum and submit this to faculty some 4-5 weeks later, together with record of evaluations of websites used within their product. During this time regular meetings were held with individual project groups, as well as with the entire VIP programme cohort on two further occasions. Faculty staff involved with scrutiny of the student teachers' written website evaluation responses used experience of these meetings, interactions with students, informal follow-up interview and written student responses as data. Immersion study on written and oral response was used to elicit common themes. Thematic determination was also informed by knowledge of previous research in this field and this provided important insight into international comparison of the ECAE student response (Collins et al 2010).

Instrument

The website evaluation tool for use in the creation of the Webquest products had been initially devised and adapted from advice by Potter (2002) and Pritchard (2004). The tool itself had been piloted and used extensively for over ten years in undergraduate and postgraduate ITT courses at the University of Strathclyde in the UK and had featured in several research studies (Collins & Paterson, 2009; Collins et al 2010). It was felt that the tool itself should be re-worded to facilitate second-language English speakers and minor changes were made to reflect cultural and linguistic norms (e.g. modification to American English spelling etc.). As Mathematics is taught in an English medium, at both further and elementary settings in the UAE, and the fact that students are actively recruited with

above average IELTS scores prior to commencing ECAE BEd(Hons) programme, it was felt that the level of English language within the tool was commensurate with their experience and offered little barrier to participation. Anecdotal information from student interview post-task would also seem to support this.

Participants

There was no formal requirement for ECAE students to participate in the VIP programme. It formed an extra-curricular activity and participation was wholly voluntary. Students were informed of this and that they could withdraw from participation at any time, without fear of penalty, as the programme carried no assessment credit in the BEd (Hons) course. Even with natural attrition, numbers attending project groups remained fairly stable from the first establishment of the four small project groups involved. As noted earlier, BEd 4 were felt to have been particularly underrepresented at project meetings, although, anecdotally at least, some seemed to have maintained virtual contact with peers. On the whole, numbers of physical participants in project groups stabilized at around twenty-nine (29) participants. Of these it was undoubtedly Year 3 participants who most actively co-ordinated groups, with returned data sets witnessing to overall BEd1 (13), BEd2 (7) and BEd3 (9) project group constituency numbers. Although membership was open to both genders, ultimately project groups were exclusively female in their membership. It should perhaps be noted, however, that the initial meeting of the VIP programme a small number of BEd1 and BEd2 males (4) attended the information session, took literature and website evaluation tools, but did not pursue participation in the VIP programme proper.

Findings

The initial phase of the study resulted in the collation of website evaluations submitted by all four small VIP groups. These provided insight into the student teachers' views of the potential use of available website provision in Mathematics. A subsequent database of the website evaluations submitted by students was collated. Responses were then considered and emergent themes were derived from immersion analysis. Justification of proposed themes was established via scrutiny of student written response as well as faculty staff recollection of observation and discussion with students. Subsequent comparison was then made to similar international study (Collins et al, 2010) to investigate the possibility of parallel themes. Response themes were subsequently grounded against established study and were further scrutinized for potential fit to pedagogical elements of the use of ICT by student teachers in the elementary classroom. Attrition in terms of useful fit was (probably unsurprisingly) minimal, and it was felt that this was most likely due to the utilization of the similarity between evaluation tools.

The study arrived at a total of some ten emergent themes through immersion analysis. Table 1 below summarises the key themes identified and the frequency with which these were prioritized as important features in online content for use in Math lessons.

Table 1: Emergent Themes	Frequency of Theme Occurrence within Collated Student Teacher Response	Percentage Occurrence within Collated Response
Impact on learning & teaching (e.g. used to introduce topic)	19	10.3
Developing research skills/ subject knowledge - teacher	9	4.9
Developing research skills/ subject knowledge - child	11	5.9
Supporting collaborative learning – child-child	25	13.5
Supporting collaborative learning – teacher-child	13	7.1
Supporting child independent learning	18	9.7
Affording opportunity for personalisation & choice	26	14.0
Engendering child motivation/engagement	26	14.0
Supporting active research/interactive learning	28	15.2
Requiring external resources by teacher	10	5.4

As stated, ten distinct themes were established. What is immediately clear from the student teacher responses is that websites with attributes which support active research and interactive approaches figure keenly in their determination of provision. A matched focus regarding their wish to prioritize websites which evidenced emphases on engendering child engagement and enjoyment, together with facilitating personalization and choice in their learning of Math is also evident. This is also closely mirrored through an intention to choose websites that encourage collaborative learning between peers. Far less motivation was given to websites that engendered the acquisition of knowledge through traditional text formats or reading tasks. Values pertinent to this type of site treating ‘knowledge as commodity’ were similar whether knowledge acquisition was to be derived from text by the teacher (4.9%) or children (5.9%). Similarities would seem to suggest that student teachers could perhaps empathize with their charges in terms of what was viewed as engaging content and perhaps refutes established viewpoints of practitioners as ‘digital migrants’. In short, this data may well herald conjecture of a generation of classroom teachers that recognize themselves as every bit ‘digital natives’ as the children they teach.

Using a lens of inferred pedagogical approaches (Collins et al; 2010) it is apparent that the student teachers could be seen to prioritize websites which engendered transformative, self-regulatory and non-transmission pedagogical behavior. This is particularly noticeable if notional distinction is made between themes that seem more representative of knowledge transmission and those themes which are representative of more progressive interactive teaching styles. Within the study the former may be seen to be represented by themes relevant to the prioritization of

knowledge acquisition as commodity and the use of ICT as a peripheral tool in Mathematics. The first three themes in Table 1 can be seen to collectively represent pedagogical consideration which pertain this transmission style in teaching. Taken collectively these represent 21.1% of the sample response. Conversely, the remaining themes can be said to represent categories more representative of the latter. These categories are far more typically associated with self-regulated and transformative styles of teaching and resonate well with constructivist or social constructivist forms. These areas taken collectively represent 78.9% of the collective considerations towards ICT/Mathematics provision within the Webquest product created by the student teachers at ECAE. This represents a ration of approximately 3:1 in favor of progressive cognitive considerations among the student groups when considering online Math provision for practicum.

Discussion

The study's findings seem to tentatively relate messages of the establishment of cognitive approaches and self-regulation in classrooms as espoused by Brophy (2002) and Butler & Winne (1995) by student teachers at ECAE when deriving the educational worth of ICT/Mathematics online content. It could be argued that the study offers partial insight into the benefits of the immersion of student teachers into self-regulatory and progressive forms of pedagogy in their training in order to reap benefits in subsequent provision in elementary schools sooner rather than later. This may tend towards claims of generalisability however, and the current study would therefore naturally distance itself from such claims. It seems at least plausible to postulate however, that participation in the small VIP programme may have had some positive impact on the student teachers' considerations of implementing similar self-regulatory and transformative pedagogical behaviors in the creation of their own provision regarding ICT/Math during practicum.

The ECAE students also compare very favorably internationally with their UK counterparts. A comparative table of pedagogical consideration paralleling data drawn from UAE and UK BEd(Hons) student teachers involved in a similar studies is displayed in Table 2

Table 2: Emergent Themes	Percentage Occurrence within Collated Response (UAE)	Percentage Occurrence within Collated Response (UK)
Impact on learning & teaching (e.g. used to introduce topic)	10.3	10.8
Developing research skills/ subject knowledge - teacher	4.9	6.8
Developing research skills/ subject knowledge - child	5.9	15.3
Supporting collaborative learning – child-child	13.5	9.9
Supporting collaborative learning – teacher-child	7.1	3.2
Supporting child independent learning	9.7	5.9
Affording opportunity for personalisation & choice	14.0	9.0

Engendering child motivation/engagement	14.0	19.8
Supporting active research/interactive learning	15.2	13.9
Requiring external resources by teacher	5.4	5.4

Initial reading of the comparison between the UK student teachers (from Collins et al, 2010) and those in the UAE both evidence both sets of student teachers clear commitment towards progressive pedagogical thought in their work. Both sets of student teachers share similar ratios of cognitive considerations pertinent to preference of self-regulatory and transformative pedagogical behaviors over that of outmoded transmission teaching styles. What is of particular note is that, although the online context between the UAE and UK students was discrete (ICT & Mathematics as opposed to ICT & Science), both sets of student teachers were studied at a time of huge curricular change from target-based to outcome-based curricula in both their respective countries. Both were also immersed in programmes that had a deliberate design towards the establishment of progressive pedagogy in future elementary schools provision by means of immersing student teachers in similar pedagogical constructs during lengthy periods of their own study. Both groups can also be seen to have shared a strong identity within the BEd3 year group, but whether this is significant or not remains to be seen.

What is evident from the data harvested in UAE is an initial indication that cognitive considerations surrounding the use of ICT & Mathematics provision which engender children's engagement and choice within a structured learning environment would seem to be preferable to the early career teachers studied. This, it could be debated, can only be of some benefit to the successful implementation by these future practitioners of outcomes-based curriculum of NSM. It is also hoped that findings from the study will engender reflection by others involved in ITT of the potential benefits of a VIP approach to student teacher training. The study would thoroughly recommend future expansive research in this area.

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