Assessing the Technology Skills in a Blended Learning Course

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Abstract:
Digital literacy is an indicator of students’ preparedness for blending learning in Mathematics Education. The main purpose of this study is to explore the pre-knowledge digital literacy skills of students enrolled for Mathematics Education in the Bachelor of Education degree at the School of Education at the Durban University of Technology and it is envisaged the digital pedagogy provides a platform for collaboration outside the lecture hall.
The 2016 cohort of students pursuing Mathematics Education was targeted as the population using a mix method approach to determine digital literacy factors that affect performance in an online environment. The qualitative method measured student assessment of an online test. The quantitative method was used to understand student’s readiness to use a Learning Management System.
For the quantitative method used Data from the Skills and Life Orientation module which measures digital literacy skills. The MCQ test from the Skills and Orientation module determines readiness to work in an online environment. In the qualitative method forty students were randomly selected from the Mathematics Education cohort to elicit their responses on mathematics in an online environment for teaching, learning and assessment.
The results indicated a diverse range and depth of pre-knowledge skills exhibited by the students. This indicates that the instructional material for the course be designed in accordance to the digital skills of the students.

INTRODUCTION
Information and Communications Technology (ICT) is increasing its penetration in all spheres of human activity all around the world. As such it has a significant role to play in education. Open and distance e-learning (ODeL) is characterised by virtual learning environments (VLE) and web technologies (Arinto 2013). The use of open educational resources (OER) and open source tools like blog sites, media sharing sites and web based applications and some of the features to support the learning.
Digital literacy is a prerequisite for the effective use of technology in a digitally driven learning environment. It encompasses more than just the use of software. It includes the ability to follow or read instructions from graphic interfaces (photo-visual literacy), being able to copy and paste (reproduction literacy), the construction of knowledge through non-linear navigation (lateral literacy) and evaluation of information (information literacy) (Eshet-Alkalai 2004). Students must be shown how to use communication technology associated with the learning management system (LMS) as part of their digital literacy preparation.
Students entering the University have a varied school experience in the use of digital tools for teaching, learning and assessment. It is necessary to evaluate the students’ digital literacy capabilities to determine their ability to learn mathematics in a digital learning environment.
The three key phases suggested by (Goodwill 2014) reconfigured in figure 1, shows a progression of the digital literacy skills student’s need to develop to work effectively in a digitally driven learning environment. Initially students will enter an exploratory phase learning how to manoeuvre and find their way in the digital classroom. The next phase is to zone in on foundational skill building. Students need to practice how to perform tasks required to be able to benefit from the digital delivery mode. The last phase is related to mastering skill to perform real world tasks like the ones suggested by the course facilitator.
UNESCO recognises the role of ICT in the way we live, communicate and learn. (Meleisea 2007). The biggest challenge is how we use technologies to promote interest and motivate learners and academics alike. Using ICT can contribute to equity issues, quality issues, training issues, professional development, improved educational management, governance and administration.
In the South African context, we can see that the Government is unable to keep abreast with the ICT challenges in the country. The Mail and Guardian reports: "South Africa’s ranking on the ITU ICT Development Index has slipped from 72nd in 2002, to 92nd in 2008.” (Fairweather 2013).

At the Durban University of Technology, a key priority for teaching, learning and assessment is based on its Strategic Plan. Internet access is available to all students and dedicated open access computer laboratories and well equipped. Both staff and students have access to IT support.

The broader picture in the country shows that around 10.9 percent of the households have access to internet (figure 2). Students rely on facilities at the University to perform online tasks.

Figure 2 Adapted from Internet at home statistics South Africa’s 2014 General household survey
The purpose of this study is to determine the state of readiness of students’ pre-existing digital literacy skills on performance in a Mathematics undergraduate course that uses a digital environment for teaching, learning and assessment.

**DIGITAL LITERACY**

Digital literacy refers to cognition strategies one would use in a digital environment. It goes beyond the physical use of computer software. In order to get a broader understanding of digital literacy it is necessary to explain terms that feature in a digital learning environment.

Skills identified by (Eshet-Alkalai 2004) essential to function in a digital environment include photo-visual literacy skills, the ability to “read” instructions from graphic interfaces, Reproduction Literacy, Lateral Literacy, Information Literacy, New Media Literacy, Visual Literacy, Branching Literacy and Socio-Emotional Literacy.

According to (Gilster and Glister 1997) digital literacy is the ability to understand information and evaluate and integrate it using multiple formats. Evaluation of information is necessary to place it in context and also give the user an idea of what is necessary or relevant to the task at hand.

The key factors for being able to learn concepts in a digital environment will be able to competent in using new formats. In order to present the world view in various perspectives (Jones 2006) the student need to develop skills to represent knowledge. These will include using the collaborative tools to enhance knowledge representation. Students can benefit from multiple representations and view the world of mathematics from different perspectives.

**Digital Literacy and Teacher Education in the South African Context.**

Central to the supply and demand of quality teachers and continuous professional develop is the integration of ICT into preservice teacher training, (UNESCO: 2015).

What are the benefits to trainee teachers of using ICT in undergraduate university courses? Are students’ able to function effectively without any inhibitions? Can these skills be integrated “smoothly” into undergraduate courses at the School of Education, Durban University of Technology? These are some of the challenges facing both instructors and students alike.

In an ICT environment student’s will have more opportunity to evaluate their own effort through collaboration or revising and reviewing lectures. Students that have a phobia for mathematics can ask questions with ease and get assistance through participation in a community of practice created in the VLE.

The smooth integration of skills depends on a good understanding the learning management system (LMS). Students must be given training and also encouraged to participate in collaborative tasks to encourage them to realise the potential of the online blend in their courses.

The White Paper on E-Education (Ravjee 2007) envisages a significant increase in the number of students that will be ICT capable over a ten-year period. This being the case it does not account for the digital divide in first year South African students at a University of Technology. Digital divide refers to capability in a digital environment. Access to ICT includes telephone, television, computers and the Internet.

(Barlow-Jones 2010) identified factors that prevent smooth ICT implementation in secondary schools. These include:

- Financial constraints
- Trained teaches for ICT implementation
- Connection both electricity and internet
- Socio economic factors
- Security, theft and vandalism
- Curriculum constraints
- Teacher pupil ratio
Infrastructure for dedicated computer laboratories
Community Engagement

These constraints have impeded ICT implementation and as a result secondary school students rely on sources outside school for any ICT intervention.

At the Durban University all undergraduate students studying towards the Bachelor of Education Degree do a course in Skills and Life Orientation which has a Computer Literacy component. The outline of the course in Annexure 1, gives the main areas of focus with respect to digital literacy skills.

THE RESEARCH PROBLEM:
Access to Information and Communication Technology (ICT) at secondary schools in South Africa is limited. Students entering a University of technology need to adapt to teaching, learning and assessment using a digital learning environment. Students experience challenges due to lack of exposure to ICT for teaching, learning and assessment at secondary school.

A significant percentage of the first year students studying MTMC 101 have had no access to ICT prior to their university experience. The percentage of households with internet access shows that only 10.9 percent have access. It is imperative that appropriate and adequate training be undertaken for these students to face the challenges of teaching, learning and assessment in an environment that is digitally driven. Research indicates that there is a digital literacy divide between the “haves” and “have nots.”

In this paper it is argue that students:
- May lack ability to succeed in courses at University that use ICT as a main resource.
- May be demotivated to study using ICT as a tool for teaching, learning and assessment.
- May need basic skills in the use of hardware, like the keyboard, mouse and digital literacy.

Theoretical Framework:
The Digital Literacy Framework (Goodwill 2014) consists of three key phases: Exposure and Exploration; Foundational Skill Building and 21st Century Skill Building.

The Exposure and Exploration phase focusses on learning to understand basic digital literacy concepts and vocabulary, exploring the hardware, devices and tools, software, programs, and apps. The Foundational Skill Building phase emphasises on building hard skills needed to use tech tools, completing isolated tasks using software, programs, and apps, building an awareness of online safety, privacy, and their digital footprint, using online services and resources and searching for and locating information and resources online.

The 21st Century Skill Building uses digital communication tools and software to complete real world tasks, collaboration using digital tools and software to complete real world tasks and creating original products and content using digital tools and software. The user also considers safety, privacy, appropriateness and digital footprint issues before using digital tools and making decisions online. Analysis and evaluation of information and resources found online critically to make decisions is also an additional skill and finally the use of resourcefulness and self-direction to complete real world tasks using digital tools and software.

Research Method:
Academic staff in Higher Education (HE) need to transform their teaching practices to support more future-orientated, digital, student-centered learning (Salmon and Wright 2014). The Carpe Diem Model (Armellini and Jones 2008) is used to characterise the technology. The first stage involved a meeting with the course facilitator to establish the specific needs of the course Skills and Life Orientation 1. The Department School Board was approached to rethink and approve plans for a blended learning course. The buy in from the School of Education is also supported by the Institutional Strategic Plan. The course facilitator is part of a team that was invited for training using the Learning Management System. The planning stage took a year and the course was put online. Currently the facilitator is in the review and evaluation stage of the model.
Students were given a face to face lecture based on computer basics which included terminology, computer technology, computer literacy, E-learning, Wi-Fi and the internet. The lecturer posted learning material for each of the topics at the Skills and Life Orientation I online classroom. Students were shown how to log in into the online classroom and were allowed to practice in the computer laboratory.

The students were then taken through the Discussion Board and were asked to post entries and reply to each other. The class was divided into groups of 6 to work online in groups to work autonomously outside the traditional lecture time.

The lecturer would monitor the discussion forum and make periodic announcements regarding new posts in the classroom.

The mixed method approach (Creswell 2013) is used concurrently to construct the data sets for the research.

The Hotspot test gives an indication of student expertise in the online setting but does not provide information on how the students feel about working in an online setting. It was necessary to gather qualitative data to gain more insight into the research investigation. Student perceptions will be an indicator of how the online environment will support the MTMC 101 course.

**METHODOLOGY**

**Population and Sampling:**
Data is drawn from approximately 170 students enrolled for Mathematics Education I (MTMC 101), undergraduate course in the Bachelor of Education Degree at the School of Education, Indumiso Campus, Pietermaritzburg at the Durban University of Technology.

**Data Collection Techniques:**
Data consisted of the marks for the Hotspot test for quantitative analysis for all participants and focus group interviews for randomly selected students. Questions were directed to four aspects: collaboration, motivation, pedagogic value and communication. Information gathered from the questionnaire was to gain further insight into students’ experiences.

**Ethical Issues:**
Permission was sought from students to allow the researcher to do the data collection. All students agreed to participated by completing a consent form.

**Data Analysis:**
The tasks tested students’ ability to identify different icons on the menu bar using the hotspot question type. Hotspot questions are based on students identifying an area in an image file. The area is set by pixel coordinates and if students click within this range, the answer is recorded as correct.

This type of questioning was suited for testing foundation skills and gives an indication of the students’ readiness to apply these to 21 Century Skill Building. Tasks were created by the Skills Facilitator after students had completed a hands on practical session in a face to face session at the Computer Laboratory on the eleven most popular question types that the facilitator chose to use for the online assessments. These included:

- Either/Or questions show two answer options, such as True/False or Yes/No
- Essay questions require students to enter an answer into a text box.
- Users upload a file from their computer, the network, or from the Content Collection as the answer to the question. This type of question is evaluated manually.
- Add question text that includes up to Blank 1 variables in square brackets x corresponding to locations in the text where the fill in the Blank 2 fields should appear. Variables must be unique and cannot be reused. Click Next after completing the fields on this page to specify answers.
- Hotspot questions are based on students identifying an area in an image file. The area is set by pixel coordinates and if students click within this range, the answer is recorded as correct.
Jumbled Sentence questions ask students to select the correct word from a set of words in a drop-down menu to complete the sentence. Add question text that includes variables in square brackets corresponding to locations in the text where the drop-down list of answers should appear. Variable names must be unique and cannot be reused.

Matching questions ask students to pair items in one column with items in another column. A matching question may include a different number of items in the questions column and in the answers column to make the question more difficult.

Multiple-Answer questions allow users to choose more than one correct answer. Up to 100 answers can be added to the question.

Ordering questions ask students to put a series of items in the correct order.

Short Answer questions require students to enter an answer in one or more text boxes.

The Computer Skills Test use the hotspot question type. This type of question is appropriate in assessing how the exploration and exposure allows the student to build foundation skills and apply to a real world problem (21st Century Skills).

Students had to Click on the information bar, click on the Task Bar, click on the Menu bar, click on the working area, Click on the MS Word icon on the task bar.

RESULTS

Results from the Hotspot test indicate that the majority of the students were proficient in using an online environment to identify the different icons and complete an assessment.
The focus group interviews gave additional clarity on students’ attitude towards online learning. The interview questions focussed on how effect the online environment was in respect of collaboration, motivation, building computer skills and pedagogic value. Responses were grouped into the themes under consideration and some exemplars were tabulated in Table 1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Student Response</th>
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<tbody>
<tr>
<td>Collaboration</td>
<td>“The instructor allows us to discuss items on the discussion forum and we can also send emails and ask others for help.”</td>
</tr>
<tr>
<td></td>
<td>“What I find good is that the instructor responds timeously to our queries. It is also easy to make an appoint to meet the instructor to help understand some technique.”</td>
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<tr>
<td>Motivation</td>
<td>“Using computers motivates me to do my work and it is easy to find things I want to learn.”</td>
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<td></td>
<td>“This course makes it possible for us to do better in our other courses that also using the Blackboard for teaching, learning and assessment.”</td>
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<tr>
<td>Pedagogic Value</td>
<td>“I find the Blackboard Learning Management system convenient and easy to use.”</td>
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<td></td>
<td>“You can always go back to check out things if you have difficulty.”</td>
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<tr>
<td></td>
<td>“One can go and do a set of work repeatedly to master the technique.”</td>
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<tr>
<td></td>
<td>“I find this way of learning exciting and very interesting. It is better than being lectured to in the computer laboratory.”</td>
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<tr>
<td>Computer Skills</td>
<td>“Although I did not use computers before the Skills Course was well structured to teach me the ways to make good use of the Learning Management System.”</td>
</tr>
<tr>
<td></td>
<td>“I find this a new experience and still need time to master some aspects. This is the first time I have been using computers to study.”</td>
</tr>
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Table 1 Items and student responses
The Hotspot test results gives some indication of the student’s readiness to work in an online environment. This is a good indicator that the majority of the cohort have the necessary pre-knowledge skills to function in an online environment.

The three phases suggested must be reworked with the group that failed the test to improve their abilities. Students can be encouraged to work in groups to get hands on experience and then do an online test to test their capabilities.

The focus group interviews design used to get student’s view on collaboration, motivation, pedagogic value and their computer skills shows that some students still need more practice to build their confidence. The majority of the students were able to function effectively and found the experience rewarding.

Being able to revisit concepts, revise and review material with ease is a key factor to improving foundational digital literacy skills.

Conclusion and Recommendations

As a lecturer in Bachelor of Education programme, in the initial teacher training programme at the Durban University of Technology a clear distinction can be made between students that show capabilities in a digital environment and those that do not.

Many of the students interviewed were able to access the module on their cell phones using the free Wi-Fi services at the university. The University must make these services available to students that reside at residences off campus.

For the majority of the students this was a new experience. The lecturer must focus on improving and reinforcing the foundational skills as these become a necessity to work in other related tasks within the study programme.

Students indicated that the digital pedagogy is interesting and they are motivated to work on sections outside the class sessions. More work can be done in less time since all the resources are available using one device like the cell phone or computer. There is no need to adhere to library hours since you can access the library anytime using the computer.

Statistics show that less than 5% of the schools using ICTs afford the cost of internet (Isaacs 2007). Government needs to engage in partnerships with major telecommunication industry to make internet facilities affordable.

The researcher did not find the need to do a post-test since results indicate a positive attitude for the use of online support for this course.

References

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