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Abstract *This study made use of a qualitative approach with an intrinsic case study to explore how handheld devices applications were integrated in teaching and learning in Textiles, Clothing and Design programmes. Participants of the study were purposively sampled from the Textiles and Clothing department at a selected university of Science and Technology in Zimbabwe comprising eight lecturers and thirty-two students. In-depth, focus group interviews and observations were used to gather data for the study. The findings of the study showed that participants were still at the stage of actively experimenting with very limited handheld device applications for the purposes of teaching and learning. Photoeditors and digital cameras were the commonest applications used in most modules of the Textiles, Clothing and Design programmes. Though the photoeditors and digital cameras were found to match the multimedia category of the Functionality framework, these were not fully utilised by students. It was recommended that there is need for the Textiles, Clothing and Design lecturers to provide opportunities for students to use a variety of applications on handheld devices for collaborative designing in practical modules of the programmes as these can encourage the development of critical skills necessary for creating innovative textiles and fashion designs.*

Key words *Handheld Devices, Textiles, Clothing and Design, Application, Multimedia*

Introduction

Textiles, Clothing and Design programmes in universities are technical degree programmes which combine the study of every aspect related to the textiles and apparel industry (Kent-Onah & Mastamet-Mason, 2013). The comprehensive textile-clothing pipeline encompasses all of the production activities of the textile, design, fashion and apparel complex as well as the functions of distribution and retail operations to the end users. Textiles and Clothing degree programmes in Zimbabwe include Bachelor and Master Degrees in Clothing Fashion Design, Clothing/Apparel Management, Textiles Design and Technology.

These degree programmes are highly needed in Zimbabwe as they play a key role in generating the new technological knowledge needed in the textiles and apparel industry. The demands on the teaching of such programmes in universities, occasioned by globalisation, are that the programmes should not only provide students with merely the necessary cognitive skills and competencies but also equip them with technological, critical thinking and collaborative skills for working in a knowledge society through integrating different forms of information and communication technologies (Trilling & Fadel, 2009). The technical training system is informed by the skills obligatory in the workplace at a time when industries change, skill development, creativity, innovation and collaboration are key elements in the makeup of the economic and social context of work in the knowledge society. Therefore, to be able to work creatively and collaborate effectively in twenty first century workplaces, graduates have to be taught to work with diverse teams using diverse technological devices not only in their physical workspaces, but also in their online interactions.

Textiles, Clothing and Design programmes need to equip students with new technologies capable of rapidly adapting to a fast changing work environment and ensuring they are prepared to respond to the unpredictable and ever-changing demands of the sector. The unpredictable nature is due to how globalised the textiles and clothing industry has become. As has been observed by Marshall (2009), today's textiles and clothing designers may be expected to design different brands for different cultures, present work in just one fashion city and sell to stores in other continents. With such a scenario, it is necessary for Textiles, Clothing and Design students to be well educated in the nuances of the expanding global markets, sub-cultures and technologies.

The textiles and clothing industry's uncertain future, and the complex demands placed on designers are affecting the teaching and learning of Textiles, Clothing and Design programmes (Faerm, 2012). It follows that universities that prepare students for careers in textiles, clothing and design should provide an environment that not only exposes students to traditional technologies, but also integrates all forms of emerging technologies into all teaching and learning processes so that students become comfortable in a digital environment. By integrating technologies in all areas, programmes aim to prepare students to succeed in the evolving global industry while having the ability to synthesise their practice in order to invent products. While in Zimbabwe the number of graduates from universities has increased since five years ago, this has not translated into positive economic development (Dzidonu, 2010). These graduates were reported by Dzidonu (2010) to be technologically unrefined resulting in severe technological skill deficiencies in textiles and clothing industries. Lack of critical technological competences among graduates in Zimbabwe was highlighted by Zhangazha's (2014) study who attributed it to poor and limited time to use technological computers provided in university during student training. As has been reported by Van't-Hooft (2013), the contact with fixed computers in colleges and universities has been disappointing to many, as students had very limited time of fifteen minutes or less per week to use the computers. Many studies have acknowledged the use of handheld devices like smart phones as an alternative to fixed desktop computers in university teaching and learning. The increased functionality of handheld technology compared to fixed desktop technologies means that they can support learning in new

ways.

It has been reported by Srivastava (2014) that by 2017 around 69.4% of world's population is expected to use mobile devices. Reflecting global trends, mobile device penetration in Zimbabwe as in March 2016 reached 95.4 whilst the mobile internet penetration rate reached at 50.1% (Gambanga, 2016). Given the ready-at-hand availability of handheld devices, it is reasonable to take the valuable benefits of these technologies to enhance the practice of teaching and learning in universities to meet the needs of a generation for whom mobile devices are becoming an integral part of their everyday. The regular and continuous access to handhelds by students could have numerous constructive effects on their learning as the devices offer unparalleled contact to communication and information. It is against this background that this study was motivated to explore how handheld devices had been integrated in teaching and learning of Textiles, Clothing and Design programmes in universities in Zimbabwe. The study endeavoured to answer the following research questions:

- a) Which applications of handheld devices have been integrated in teaching and learning in Textiles, Clothing and Design programmes at a selected university of Science and Technology in Zimbabwe?
- b) How are the handheld applications used in teaching and learning in Textiles, Clothing and Design programmes?

Literature review

Handheld devices are gadgets that use mobile and wireless technologies and can be carried and used to enable learners to access knowledge anytime and anywhere (Sarrab, Elgamel, & Aldabbas, 2012). Handheld device applications have multimedia functionalities that can be used for the purposes of teaching and learning such as: information and knowledge access, process and storage; communication; entertainment and amusement; organisation and management such as scheduling and planning (Kearney, Schuck, Burden, & Aubusson, 2012). As such handheld device applications can facilitate learners to look away from their screen in order to engage with their surroundings and peers. In recent years, many studies have acknowledged the use of handheld devices like smart phones in university teaching and learning. Davies and Prigg (2013) found that the benefits coupled from using handheld devices stem somewhat from the skills developed by the students from exposure to technology as well as from specific applications related to the subject matter involved. They found that there were potentially considerable gains made in student engagement and active learning, student directed learning and on collaborative learning. Other research reported significant positive influences on both student learning and teaching practices. One such study by Keengwe, Schnellert, and Mills (2011) revealed a positive impact on student learning and engagement through the improvement of student motivation and autonomy.

It was noted that with technology evolving time and again handheld devices like smart phones had become widespread in developed countries as educational tools. Case studies that were conducted by

Kearney et al. (2012) found personalisation to be one of the benefits of using handheld devices among students. Hand held technology is alleged to facilitate access to personalized learning content. As explained by Kearney et al., “personalisation occurs as a result of being able to adapt learning content and activities to suit the individual learner’s needs and of the sense of agency and independence the student feels from being able to customize his or her own learning” (p. 20). Through the use of applications on handheld technologies, learning can be contextualized in ways that make the lessons relevant to the student. Wong (2012) found out that along with the ability to learn outside traditional classroom settings, handheld technologies support self regulated learning and the increase in meta-cognitive skills. These results were also noted by Alyahya and Gall (2012) of twelve university students’ perceptions of using a tablet. Students described the main benefits of a Tablet as having ‘everything in one device’ which was felt to make it easier to manage their learning. These studies confirm that access to mobile handheld technology allows students to design their own learning contexts in terms of when, where and how they feel they learn best. Through the use of handheld technologies learning becomes increasingly self-directed. Contrary, in another study by Rossing and Miller (2012) on exploring perceptions of Tablet use among university students in United States of America, some students found the devices very helpful, while others found them to be a distraction or difficult to take notes on.

Collaboration was found to be another benefit of learning through handheld technologies. Van’t-Hooft (2013) elaborated that mobile devices support collaborative learning due to their high mobility and their small factor. The small size of the handheld allows for easy portability and students can pull their handheld out of their book bag or desk any time they need it. The ease of use of handheld devices, ability to turn on directly, the capability to create, access and display information in various modalities like text, video, audio or graphics and the ability to share information are some of the features of mobile handheld technology that support collaboration between students and teachers.

Other studies like Mueller, Wood, Pasquale, and Cruikshank (2012) and Finn and Vandenharm (2004) found that the handheld devices were used primarily for data-capturing of students’ assessments where all course information for students were kept in a manner that all the information could be accessed almost at once allowing the lecturer to offer comprehensive information on the progress of individual students whenever the need arose. This showed that handheld communication and feedback can result in greater student motivation and understanding of the learning process. In another study by West (2013) it was as well established that ongoing digital assessment through application on handheld devices can give students opportunities to mirror on their learning progress. This in turn encourages self-regulated learning among students leading to greater student autonomy.

Additional studies like “Rodriguez, Sousa, & Torre, 2012” and “Daher, 2010” see the potential of handheld devices to achieve large-scale impact on teaching and learning because of portability, low cost, and communications features. However, it has been noted by the researcher that most studies were conducted on the benefits of the handheld devices but did not analyse the pedagogical underpinning of the applications on handheld devices used for teaching and learning. This study explored and analysed the handheld applications used in the teaching and learning of Textiles, Clothing and Design degree programmes.

Theoretical framework

The Functionality framework was used to analyse the suitability of handheld applications for teaching and learning. This framework was developed by Patten, Sanchez, and Tangney (2006) as a framework for categorising applications found on handheld devices into seven groups namely administrative; referential; interactive; microworlds; data collection; location aware and collaborative. The framework showed that administrative applications are those that are mostly used for storing and retrieval of information. It can be noted that, applications in the administrative category merely replicate for convenience sake those tools already available on traditional platforms. As has been observed by Smordal and Gregory (2003), those administrative applications have little pedagogical philosophy underpinning their implementation. Referential applications are applications that enable students to access content. C. H. Chen (2008) maintains that referential applications such as Microsoft office tools, dictionaries and e-books such as Microsoft Reader and Adobe Reader enable teaching staff and students to access content for teaching and learning activities. Such applications can allow lecturers and students to access and store documents in various formats. Interactive applications provide students with a series of exercises based entirely around question and answer activities with supporting information and images. Naismith, Lonsdale, Vavoula, and Sharples (2005) indicate that interactive applications are built on the belief that learning is enabled by creating an association between a particular stimulus and a response. As explained by Patten et al. (2006), many of the interactive applications are of the drill and test type aimed at encouraging memorization of information for individual learners through multiple choice style quizzes. Locationware are applications that aim to contextualize learning activities by enabling the learners to interact appropriately with their environment (Patten et al. 2006).

Data collection applications focus on encouraging participants to learn more about their context through recording relevant information and providing immediate feedback through on-the spot analysis. As elaborated by Patten et al. (2006) three sub-categories are identified within the data collection category to include scientific, reflective and multimedia. Scientific data collection focuses on encouraging participants to learn more about their context through recording relevant information and providing immediate feedback through on-the spot analysis. Another subcategory of data collection is the reflective applications that expand on the administrative and referential themes. These applications encourage reflective social practice by focusing on storing information in the learning context for later evaluation and reflections (Mueller et al. 2012). The other subcategory of data collection looks at the multimedia applications. These applications are capable of capturing images, sound and video. It has been stressed by McGreen and Sanchez (2005) that multimedia applications tend to adopt a constructivist pedagogy requiring students to generate new ideas based on their current and previous knowledge. According to N. S. Chen, Kinshuk, and Yang (2008) collaborative applications undertake to establish a learning environment of knowledge sharing whilst the educational microworlds are applications that allow learners to construct their own knowledge through experimentation in constrained models of real world domains. The micro-world applications allow learners to construct their own knowledge through experimentation in constrained

models of real world domains. These applications are more consistently informed in pedagogical principles and tend to adopt a constructionist approach to learning. The functionality framework merges two perspectives of functionality and pedagogy into one framework. Therefore, in this study this framework was used to analyse the applications that were used in the teaching and learning of Textiles, Clothing and Design degree programmes.

Methodology

The intentions of this study was to take the emic approach to understanding the use of the handheld devices in teaching and learning in Textiles, Clothing and Design programmes. One university of Science and Technology in Zimbabwe was selected as it was found to be the only university offering programmes related to the design of textiles and clothing and fashion products. The qualitative approach accompanied by an intrinsic case study was used as it enabled the researcher to study the participants in their natural settings. Purposive sampling was used to select participant for in-depth interviews as well as for observations. The selected participants were seven lecturers and one head of the Textiles, Clothing and Design department. Quota sampling was used to select thirty-two participants for the focus group interviews from the Textiles, Clothing and Design students. In-depth interviews, observation and focus group interviews were used to generate data for the study. The data obtained from the study were analysed for content using thematic analysis after coding. In this method, data analysis was determined deductively using the research questions and inductively through multiple readings and interpretations of raw data.

Findings and Discussion

Demographic information was sought from eight lecturers who were given codes such as TCL1-8 and thirty-two students who were allocated codes such FGS1.1 as reflected in Table 1 below.

The findings showed that lecturers possessed handheld devices in form of smart phones such as Samsung galaxy, Sony Expria and Lenovo Tablet. Of the students who participated in the study's focus group interviews, six were males and twenty-six were females. Just like lecturers, students possessed different types of handheld devices such as Samsung, Nokia, Sony Expria, Huawei and Android mobicel. All the handheld devices were personal owned by participants and not university property. The demographic information of participants was used in the discussion of the findings on the use of the handheld device application for the purposes of teaching and learning.

Table 1.
Demographic information of the participants

Participant code	Gender	Handheld device owned	Participant code	Gender	Handheld device owned
TCL 1	Male	Samsung IPad 4	TCL 5	Female	Samsung galaxy
TCL2	Female	Samsung Galaxy	TCL6	Female	Sony Expria
TCL3	Female	Huawei smart phone	TCL7	Female	Sony Expria
TCL4	Female	Lenovo Tablet	HOD 8	Female	Mobicel Android
FGS1.1	Female	Samsung phone	FGS3.1	Male	Sony Expria phone
FGS1.2	Male	Nokia 201	FGS3.2	Female	Nokia 201
FGS1.3	Female	ZTE mobile phone	FGS3.3	Female	Small Nokia
FGS1.4	Female	Sony Expria phone	FGS3.4	Female	Sony Expria
FGS1.5	Female	ZTE android phone	FGS3.5	Female	Vodafone smart phone
FGS1.6	Female	Sony Expria	FGS3.6	Female	ZTE phone
FGS1.7	Male	Android Mobicel IPad	FGS3.7	Female	Sony Expria
FGS1.8	Female	Huawei Smart phone	FGS3.8	Female	Android Mobicel iPad
FGS2.1	Female	Nokia Smart phone	FGS4.1	Female	Nokia Smart phone
FGS2.2	Female	ZTE phone	FGS4.2	Female	Android Mobicel iPad
FGS2.3	Female	Android Mobicel iPad	FGS4.3	Female	Huawei smart phone
FGS2.4	Female	Sony Expria	FGS4.4	Male	ZTE Smart phone
FGS2.5	Male	ZTE phone	FGS4.5	Female	Samsung Galaxy
FGS2.6	Female	Samsung galaxy 6	FGS4.6	Female	Samsung Ipad4
FGS2.7	Female	Huawei Android	FGS4.7	Female	Mobicel Android
FGS2.8	Female	Small Nokia	FGS4.8	Female	Huawei Android

Handheld device applications and how they were used in teaching and learning in Textiles, Clothing and Design.

The findings of the study unveiled that the handheld device applications that were used for the purposes of teaching and learning included digital camera, photoeditor, fashion design, voice and video recorder and WhatsApp. These are discussed in the paragraphs that follow.

Use of digital cameras

It was disclosed by lecturers and student participants that digital cameras found on smart phones were of high use especially in practical modules of the programmes. Student participants pointed out that the digital cameras were used to photo shoot different designs and environment surroundings as quoted below:

For Fashion Photograph, I used the camera on my mobile smart phone to take photographs and even edit my photographs on the phone which I would use later to construct boards (FGS1.7).

Evidence from the interviews with lecturers corroborated the above views indicating that most students used their phone cameras to make photo albums which they used to create fashion boards like inspirational boards. One of the lecturers confirmed that:

These students are very creative. They use their phone cameras to take a variety of images which they use later for practical assignments (TCL 6).

The photographs that the students take would later be edited and used to create different types of fashion boards such as inspiration and story boards. From the observations it was noted that students created their own albums of different photographs which would then be used as resource materials for assignments and projects given by the lecturers. Most of the photographs were used on projects that required the creation of different fashion design collections and textiles designs. The use of the digital cameras was very suitable in modules of the programmes such as Fashion Illustration and Photograph which required a variety of pictures. According to the Functionality framework, handheld digital cameras could be grouped under the multimedia and reflective applications as they are capable of capturing images. As applications, the digital cameras can also encourage reflective social practice as they are capable of collecting, displaying and storing information that can be used by students for reflection in lectures (Patten et al. 2006). This might inform that digital cameras are pedagogically useful in the teaching and learning of Textiles, Clothing and Design modules.

Use of photoeditor application

It also emerged from the findings that applications such as photoeditor found on smart phones were manipulated by students for a variety of purposes. Students pointed that this application was downloaded from google play store and installed on their devices. Lecturers expressed that the photoeditor application was used by students to edit photographs taken from the environment into mini boards on the handheld device which would then be used to create a large fashion board when transferred onto laptops. One of the lecturers indicated that:

iii, some of these students are very creative, they are using applications like photoeditors on their phones to edit photos and combine images into mini-boards which they use for their practical assignments (TCL1).

Students authenticated the above claim by lecturers. One of the students said:

I use ...this application called photoeditor on my Vodafone smart phone to edit my photos which I use for my assignments (FGS4.1).

In addition, another student clarified the use of the photoeditor application by saying:

It's easier with this Samsung smart phone to use the photoeditor application to edit images. I then use the images to make collages, inspirational or even story boards (FGS2.3).

It was, however, revealed that the use of this application was common among students than lecturers. This finding is in line with the findings of Sloan (2013) that access to applications on handheld devices allows students to design their own learning material, thereby allowing them to become increasingly self-directed. From the student participants' narration, the photoeditor sounded to be an application with high pedagogical value as students used it to combine a number of photographs. This idea of combining enables students to develop cognitive skills. The usefulness of photoeditor is as well authenticated by the Functionality framework as the application fall on the category of multimedia applications of the framework. The use of such applications in teaching and learning implies a constructivist pedagogy which requires students to create new ideas basing on the photographs they would have shot from the environment.

Use of fashion design application

The findings of the study revealed another application found on handheld devices called Fashion design. It was observed that this application was installed on smart phones like Samsung iPad4, Sony Experia and Android Mobicel. Focus group participants mentioned that the fashion design application was very useful as it enabled the students to sketch textiles design, add colour and edit several times on the handheld device until the desired look was achieved. One of the student participants narrated that:

On my phone, the Fashion design application assists me to sketch design and even add colour to the designs (FGS3.5).

Of interest was that these focus group participants helped each other to install these applications on their phones as they indicated that the applications were very useful to their design studies. Another participant acknowledged that:

A friend of mine in part four installed this Fashion design application on this Sony Experia phone of mine and its very good when I want to create even sketches of textile designs (FGS3.7).

In reaction to the views of students, lecturers stated that they have never tried the fashion design application but have seen students formulating ideas about their designs on the phone. One of the lec-

urers admitted that:

These students are very cunning they try everything using these applications on the phone to make their life easier (TCL7).

Of concern was the observation that this fashion design application was possessed by few students who had smart phone with high storage and processing power. As a result, the application was used by very few students and one lecturer only. The fashion design application allowed students to experiment with more than twenty different croques provided by the application to develop and portray their illustrations. The fashion design application seemed to match the category of educational microworlds of the Functionality framework for the application allowed students to construct their own textiles, clothing and fashion designs through experimentation (Patten et al. 2006). The fashion design applications, however, did not have features that allow students to test their designs on virtual fashion model due to its limited visual representation. This is even supported by Junco and Cotton (2011) who indicated that microworlds applications can be used beneficially on laptops and desktop computers that have high processing power. It points out that the Fashion design application was pedagogical valuable to the teaching and learning of Textiles and Clothing programmes as students were able to formulate their ideas and sketches of designs on the hand held devices. From the findings, it was noted that the effective use of the Fashion design application was compromised by the fact that very few students had smart phone with high processing power. The application could be used well in Textiles and Clothing programmes if all students had the same type of iPads and smart phones like Samsung iPad4.

Use of voice and video recorder

Emanating from the handheld applications was the use of voice and video recorder during teaching and learning sessions. Focus group participants revealed that through fashion events, students attended during their course, they were forced to use voice and video recorders to capture textiles, clothing or fashion exhibition events. One of the focus group participants reiterated that:

I use applications on my Sony Experia phone like voice and video recorder to record fashion events like the Zimfashion so that I use them later to get inspirational ideas (FGS2.6).

On the same note, other students pointed out that they used voice recorders to record even lectures so that they would replay them later. One of the participants mentioned that:

I use the voice recorder on my phone to record even lectures or presentations so that I replay them later (FGS3.3).

As a follow up to the students' sentiments on the use of voice and video recorders, lecturers gave

totally different views that the lazy students were the ones who recorded lectures because they did not want to take down notes. Student participants clarified that the video recordings were used as inspirational sources on how to organize and manage events which they would be asked to do as assessment projects. As authenticated by the Functionality framework, applications that are capable of recording and storing information for later use and evaluation are reflective applications. This might imply that the information captured by the students could later be used for stimulating reflective discussions in lectures. Using such applications might as well encourage collaboration by enabling learners to share their reflections with a wider community through utilizing a variety of social applications like facebook and pinterest. Therefore the use of voice and video recorders cannot be over emphasised in teaching and learning of Textiles and Clothing programmes.

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Use of WhatsApp

From the data that was solicited from lecturers and students, it was shown that WhatsApp was used in the teaching and learning of Textiles and Clothing programmes to conduct group or tutorial discussions. One of the lecturers noted that:

In terms of these social networks, we usually use WhatsApp to do group discussions with the students especially after lectures (TCL 7);

Students admitted that they used WhatsApp as a group to discuss questions they were given by their lecturers. One of the students intimated that:

Our group send even presentation questions on WhatsApp to discuss and give each other idea (FGS2:1).

The HOD gave the benefits of using WhatsApp as compared to other social media platforms. The HOD remarked:

The WhatsApp platforms are commonly used by lecturers and students and taking the lead because one do not need to do a lot but just waiting for a message to come on the phone and you do not log on to anything as compared to these other platforms on desktops computers (HOD8).

Data from the participants above revealed that WhatsApp as a social media application was manipulated by both lecturers and students into a teaching and learning tool. The findings showed that WhatsApp was used for conducting group discussions between lecturers and students. Most of these group discussions were conducted after lectures as a way of reflecting on what has been learnt by the students. Conducting the discussion through WhatsApp provided a way for critical reflection of the learn-

ing process as students are encouraged to look for gaps in whatever information they are given and to then seek ways in which these gaps can be filled in. This helps students to engage in reasoning, developing knowledge, applying reflection thereby developing critical thinking skills as they would be challenged to respond to the question asked on the WhatsApp application. Critical thinking requires cognitive levels that fall within the higher-order levels of Bloom's (1956) revised taxonomy namely analyzing, evaluating, and applying. Facione (2011) stresses that providing graduating students with opportunities for critical thinking is essential as it will enable them to be productive members in the knowledge economy who can function effectively and solve problems in ways that are sensitive and caring for others and the world as a whole. The capability of WhatsApp to encourage sharing of information renders it features of collaborative applications as propounded by the Functionality framework. This is confirmed in the findings of Wankel (2011) and Mason and Rennie (2007) who stress that collaborative platforms, if used effectively, tend to establish a learning environment of knowledge sharing. This shows that WhatsApp can be used to share and critique information on creative design among students in Textiles and Clothing thereby encouraging collaborative learning for co-creation of knowledge thus contributing to improved teaching and learning. Such skills have been valued greatly for students to become active members of the knowledge economy. It has been emphasised by Trilling and Fadel (2009) that, in the 21st century learning and work contexts, collaboration has taken on new dimensions which require people to work effectively with others that they have never met, don't know or will never meet face to face, but with whom they need to be able to cooperate on a common task or tasks. However, the effective use of WhatsApp was compromised by the fact that it was a paid application hence some of the students could not manage to keep their subscriptions updated. Consequently, some of the students failed to get the information send to them on time. Therefore, if the WhatsApp application is effectively integrated by all lecturers and students, it could improve the teaching and learning encouraging students to collaborate with other Textiles and Clothing students across the globe.

Conclusions

From the findings, it was concluded that the Textiles, Clothing and Design programmes had no specific handheld devices acquired by the department for teaching and learning instead students and lecturers used different personally owned devices. The use of different personally owned handheld devices among lecturers and students revealed lack of an innovative educational framework on the use of handheld devices in university teaching and learning. This posed great challenges on the equal distribution of information among students as different types of handheld devices tend to receive information differently. There were very limited applications on handheld devices that were used for teaching purposes in Textiles, Clothing and Design programmes showing limited knowledge on educational applications among lecturers. Though handheld applications like photoeditors, fashion design and digital cameras were pedagogically useful, these were not found among all the devices possessed by the participants to support the effective acquisition of technological, collaborative and creative skills that were specifically required in the textiles and

clothing industry.

Recommendations

From the findings of the study, it was recommended that:

- The university should provide facilities for students to acquire handheld design related smart-phones like Samsung iPad 4 that could be used for design purposes as these have high processing power capable of handling applications that are faster when accessing information needed.
- There is need for the Textiles and Clothing lecturers to provide opportunities for students to use a variety of handheld device applications that encourage students to virtually design and test prototypes in practical modules of the programmes as these can encourage the development of critical skills necessary for creating innovative textiles, clothing and fashion designs.
- Professional development programmes focusing on the use of handheld applications need to be organised by the university to assist lecturers to develop competences necessary for teaching.

Limitations and Suggestions for Future Research

As this was an exploratory study that on how handheld device were integrated in teaching and learning in Textiles, Clothing and design programmes at a university of science and technology in Zimbabwe, its scope could be too narrow to provide results which could be generalised. Nevertheless, the educational affordances of the handheld device explored in this research may shed some uses of handheld device applications. This may help inform researchers and lecturers in the Textiles, Clothing and Design field of how to take advantage of the affordances of the handheld devices in their pedagogic practices. It is therefore, suggested that the study could be conducted at a number of universities in order to compare the results to provide detailed information for the development of an innovative educational framework on the use of handheld devices in university teaching and learning. Because the results indicate that a number of applications that fall within the multimedia category were mostly found in use, it is suggested that further studies investigate those handheld applications that could match the microworlds or location ware and applicable to Textiles, Clothing and Design programmes.

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