

Using Tablets to Enhance the Teaching and Learning Environment in Landscape Architecture: A Pilot Study

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Abstract. Higher education has a responsibility to empower students to cope with technology-driven changes in the labour market. Subsequently there has been a trend in higher education to shift from lecturer-centered to student-centered pedagogies. With this in mind, through a pilot study we sought to investigate the impact of tablets in landscape architectural design education. A series of learning activities using a range of tablet applications was designed for the 25 Foundation and 20 First year landscape students who participated in the pilot study. Data collection included three student questionnaires, student reflections, two focus groups and the digital outputs of the activities themselves. The findings showed how tablets can play a role in enhancing the learning environment: redefining learning spaces; influencing pedagogies and; encouraging shifts in lecturer and student roles. The innovative nature of the tablets produced unexpected effects, providing insights into students' perceptions of the landscape design process and learning environment. These insights have influenced our teaching practices and developed an understanding of the role in which tablets can contribute to a dynamic teaching and learning environment.

Keywords: Tablets, emerging technologies, student-centered pedagogies, landscape architecture, design studio, learning spaces, digital stories, scaffolding.

1 Introduction

Increasingly, societies and global economies are being transformed by emerging technologies and are experiencing shifts from industrial to knowledge-based societies [1]. Consequently, higher education graduates are expected to be creative; innovative; work collaboratively; monitor their own learning; and solve real-world problems [1]. Researchers are recognising that higher education cannot continue with traditional, lecturer-centred learning environments and that there is a responsibility to equip students to cope with global changes and challenges [1], [2], [3], [4]. In addition to responsive pedagogical models, emerging technologies have been identified as having potential to offer solutions for some of the problems lately affecting higher education such as: greater demand for graduates; increasing costs of higher education; and inadequate preparation of students for real-world demands [1], [3], [5]. Although

higher education institutions are investing in digital technologies, their use is mostly limited to data projectors, laptops and online learner management systems. While these technologies are useful for allowing students to review class content, the use of technology is being used to reproduce traditional learning environments. Traditional teaching and learning remains largely unaffected by technology [1], [5]. There is substantive research to suggest that there needs to be a shift from lecturer-centred learning to student-centred learning [1]. While traditional learning environments assume knowledge is passively acquired, student-centred learning is moving towards learning environments in which students actively participate, in contexts relevant to their studies [1]. There is a call for higher education to identify how emerging technologies, driven by responsible pedagogy [6], [3] could transform and enhance the teaching and learning environment [5], [7], [8].

As mobile technology improves and becomes cheaper, it is increasingly being tested in higher education [9] for its potential as a teaching and learning tool. Murphy [10] outlines some of the advantages that mobile devices can bring including: portability; multimodal media formats; allowing for collaboration; research; and content generation by students. In a design context, Souleles [11] has comprehensively outlined the advantages and disadvantages of tablets and traditional drawing tools and found that each type of tool provided unique opportunities for learning.

It was into this context that in 2014, the Fundani Centre for Higher Education Development (CHED), a strategic unit for teaching and learning support at the Cape Peninsula University of Technology (CPUT) launched an investigation of the impact of tablets as a teaching and learning tool in higher education. Fundani CHED purchased 30 Nexus 7 tablets and encouraged lecturers in a range of disciplines [12] to run a six-week pilot study where tablets could be integrated into the teaching and learning environment. The authors of this paper were teaching in the Foundation and First year mainstream classes of the landscape architectural diploma programme at CPUT, and took up the opportunity to join the growing research, particularly the use of mobile devices in design fields [11], to better understand the impact of tablets in the landscape architectural design education environment.

"I came to the Cape Peninsula University of Technology not knowing which course to do, I decided to do Landscape Technology although I didn't even know what the course was about." (Digital Story, Foundation year group, Bellville, 18/10/2014).

The quote above is a sample of student reflections in the study and illustrates what we were observing in the Foundation and First year classrooms - that approximately three out of four students had not selected landscape architecture as their first choice of study. We were concerned that students' limited exposure to landscape architectural design were affecting their participation and engagement during class as well as their confidence in communication and spatial design. Given the potential of mobile technology to transform pedagogy [5], [11], we conducted a six-week pilot study to interrogate the extent to which tablets could innovate or enhance landscape architectural pedagogies that would support student-centred learning. The findings went beyond the anticipated outcomes of the projects and influenced the way we may structure the landscape architectural teaching and learning environment and its processes.

The following three sections discuss the study and the results of the analysis in more depth. The first section outlines the research methodology, data collection and analysis and the types of tablet activities during the study. The second section, discusses the outcomes of the data analysis process with a focus on the issues pertinent to this special issue: the potential for tablets to transform learning spaces, pedagogy, and teacher/student roles. This latter section also connects the findings to current theoretical understandings. The third section concludes the research study and the impact of the findings on our future teaching and learning.

2 Research Design

This section describes the study's research methodology, data collection, data analysis and a description of and rationale behind the selection of the various tablet activities.

This research project makes use of an action research approach. Action research [13] is when practitioners systematically and carefully investigate an aspect of their own classroom environment [14] in order to improve [15] their own practices. While action research has come under scrutiny from the scientific background [14], action research aims to generate insight and new practices. Action research is cyclical and has been influenced by the 1981 Kemmis and McTaggart model of 'Plan-Act-Observe-Reflect' [15]. Action research draws heavily on reflective practice and seeks alternative perspectives that have practical implications [15].

2.1 Data Collection

Data was collected over a six-week period from 45 students registered for a National Diploma in Landscape Technology programme at CPUT. Of the 45 participants, 20 were in the First year class and 25 were in the Foundation class. The two classes were each facilitated by different lecturers, and while there was some overlap, the classes at times participated in different activities. The tablet activities were carried out in design studio class time and were supplementary to the normal syllabus. The first session was introductory and enabled the students to connect to WiFi, familiarise themselves with the tablets, and create or log into individual *Google* accounts. Each session, lasting 90 minutes, was devoted to one activity with one specific design problem.

Action research promotes an understanding of the situation before the research cycle [15]. Before using the tablets, 11 Foundation and 25 First year students anonymously completed an online questionnaire. The initial questionnaire sought to understand students' previous experience or exposure to mobile technologies as well as their perceived participation and confidence in classes. A second questionnaire was completed by 20 Foundation and 15 First year students towards the middle of the study and 20 Foundation and 23 First year students completed a third questionnaire at the end of the study. The latter two questionnaires included open-ended questions such as 'to what extent tablets played a role in design', 'what was your favourite tablet experience' and 'what did you find challenging'. In addition to the questionnaires, students were encouraged to write their comments and reflections of

the tablet activities after each class in a shared *Google Doc* that ensured reflections were anonymous. To ensure adequate triangulation and saturation of data we felt it necessary to conduct two focus groups at the end of the research period. Eight participants from each of the Foundation and First year classes were selected to take part in one of the two focus groups. Although each class lecturer was present during the focus group interviews, the sessions were led by an independent facilitator. What sets action research apart is its focus on “researching with” as opposed to “researching on” participants [14]. Because we had engaged in initial data analysis before the focus groups, these were well-timed to provide an opportunity to invite students to offer their views and reflections and contribute to negotiated understandings of the data. The results of the questionnaires were shared with the students during the focus groups and used as a springboard into the discussion. Focus groups provided an additional benefit of a collaborative discussion where students can bounce ideas off of each other, compared to the questionnaires and reflections which were completed individually.

2.2 Data Analysis

Thematic data analysis [16] was used to analyse the data from the focus group meetings, reflective writing activities and all three questionnaires. The first stage of the analysis process started was identification of different units of analysis through an open coding process. Although our research question sought to understand the impact of tablets on student-centred learning, particularly student participation and confidence, our open coding process allowed for unexpected categories to emerge. The second stage of the analysis was an axial coding process where the units were grouped to different themes and the final stage was a selective coding process. In response to the specific focus of this special issue, as well as space constraints, this paper focuses on the findings connected to themes that address the impact of tablets on pedagogical practices, learning spaces and lecturer/student roles.

2.3 Tablet Activities

By its name, ‘action research’ implies that an intervention or change is designed for the research study, and the effects of this are analysed and reflected upon [15]. This section describes the nature of the ‘action’ that took place as well as the pedagogical approach of the various activities and why these were selected. The different activities took place in the students’ studio classrooms and consisted of: a conceptual design activity using *Home Outside Palette*; a precedent research study on *Blackboard*; a digital story using *Com Phone*; a site analysis using *Sketch* and reflective exercises on *Google Drive*.

Site Analysis and Conceptual Design Activities. During this class activity, students were given tablets and encouraged to use the *Sketch* application (by *Evernote*) to complete a desktop site analysis of a hypothetical residential landscape project. This activity was completed by 25 students from the First year class during one studio

session. The *Sketch* application includes preset drawing elements such as arrows, lines and texts. These can be inserted onto a drawing and amended in terms of size, direction and colour. In a separate class activity, the *Home Outside Palette* application was used for a conceptual design of a residential landscape plan. The app includes pre-existing landscape design elements such as trees, paving, ponds which can be scaled, copied and placed on the plan. This activity was completed by 20 Foundation students and 25 First year students in two separate class sessions.

The pedagogical approach in selecting these two applications was one of scaffolding. Scaffolding in design education becomes an important tool that can facilitate students' self-regulated learning. Scaffolding, in general, involves providing assistance to students on an as-needed basis, fading the assistance as the student's competence increases [17]. Because both applications included preset drawing elements such as arrows and trees, it removed the need for students to be able to draw these elements by hand. Our assumptions were that students would be able to focus on the tasks of site analysis and conceptual design layouts regardless of their skill or confidence in hand-drawing. With our research focus in mind, we were interested to discover the impact of these digital scaffolding tools.

Precedent Study Activity. This activity was prompted by existing research in the use of mobile technologies to allow students to participate in their own learning and access knowledge and resources beyond the physical bounds of learning spaces. Changes in demands from graduates are prompting educators to instill particular qualities in students including being able to engage with teamwork, effective communication, problem-solving and lifelong-learning [18]. In light of this, we wanted to design a student-centred learning activity that could promote both the process and the product of learning [18], [19]. In order to debunk the notion of the lecturer as the single source of knowledge in a classroom, students can engage in learning activities where they can create their own meaning through assimilation and social interaction [18]. In this particular activity, a content-based lecture was redesigned into a series of questions. The questions were presented on *Blackboard*, CPUT's official learner management system. A group of 15 First year students participated in the activity during one studio session. Each student was given a tablet to use and placed into teams. Each team allocated a leader who coordinated the quiz and gave individual students research tasks which they could research and share with the group.

Digital Story Activity. The students were asked to create a digital story on a recently completed student landscape construction project. The brief for the digital story was for students to reflect on the extent to which the construction project changed their perspective of landscape architecture. The students received training on how to take photos and create digital stories using the *Com Phone* application on their tablets. This activity was only completed by 20 students in the Foundation class and took place over five studio sessions.

Herrington et al [8] argues that emerging technologies can be used for more than just content-delivery, they can also be used as reflective tools for learning, connecting new knowledge with lived experience and blend it into existing narratives of meaning.

This reflection works at the boundary of emotional and epistemological learning, bridging theory and practice [23], [24].

3 Key Findings

This section presents the results of the data analysis. The first discussion relates to the potential of tablets to transform learning spaces both in terms of expanding beyond the physical boundaries of classrooms spaces, as well as how tablets allow students to reconfigure their own interactive learning spaces. The second subsection discusses how tablets allowed for changes to pedagogical practices, including: learning through collaboration; rapid design development and feedback as well as the role in scaffolding design skills. Additionally, this subsection also discusses how the use of tablets provided a juxtaposition against which traditional hand-drawn studio pedagogies were evaluated. The third subsection describes how the use of tablets during the study affected student and lecturer roles: enhancing student confidence and participation in class and increasing peer-to-peer learning.

3.1. Tablets as a Tool to Transform Learning Spaces

The traditional lecture space has perhaps been the prevailing model due to its efficiency in transmitting knowledge from one lecturer to a large number of students [20]. Well-suited to lecturer-centred pedagogies, the traditional lecture space may not be ideal for student-centred learning spaces. Analyses from this pilot study indicated the potential for tablets to support student-centred learning and to transform learning spaces: by connecting to knowledge and information beyond the physical classroom as well as encouraging students to self-organise their own learning spaces.

De-linking Knowledge from Physical Space

The pilot study showed that as suggested by Lai [1], mobile technologies can support access to knowledge and information beyond the physical boundaries of learning spaces, in order to promote student-centred, self-driven learning. The following extract is an illustration of how students saw their participation and access to knowledge.

Extract 1

[This extract is taken from the First year group focus group. The group is discussing the water-themed landscape precedent quiz.]

Interviewer: When you do group work with a tablet versus group work without the tablets how was it different?

Lindi: If you don't know something you could always just search it.

Interviewer: Okay. I'm thinking if I was in lecture and the lecturer suddenly started talking about [unclear], you know and even if the name is on the board if I want to maybe look up the picture so you could do that.

Interviewer: Okay.
Lindi: It would help me focus. I don't know the trees so then now
I can see it [unclear].
(Focus group interview, First year group, Bellville, 03/10/2014, all the names were anonymised.)

In the following extract, the students in the focus group are discussing the potential future uses of tablets in a classroom - beyond the tablet pilot study - and how they would make use of them. The conversation reinforced the potential of tablets to supplement lecturer-driven content with information relevant to the needs of an individual student.

Extract 2

Nathi: I also enjoyed working with the tablets because we were given a chance to research more about things that we didn't know. For my own, for an individual opinion I would research about things that I would like to know but with the lecturer he will tell me what to research about, which I didn't know it really exists or it was there to know about then it really help me with that.

Interviewer: Okay. So that's a combination of lecturer guidance and your own initiative that you would be able to use it, okay.

Nathi: Ja it was fun because maybe you're going to hear about a certain App that you can quickly check up on and see what it's based on.

(Focus group interview, First year group, Bellville, 03/10/2104.)

Interactive Spaces for Learning

Tablets and other mobile technologies hold the potential to disrupt the physical organisation of the traditional lecture. Lectures, characterised by rows of desks facing the focal point at the front of the lecture theatre - the lecturer - have been a consistent feature of higher education since medieval times [20]. This particular format is not tied to a single pedagogy but played host to pedagogical transformations from the original oral practices to the inclusion of technology and social media in contemporary lecture theatres [20]. Despite these changes, the lecture theatre often replicates pedagogies that support lecturer-centred learning. While Mazur [21] shows that it is not impossible to conduct participative and interactive student-centred learning spaces in traditional lecture theatres, forward-facing, rigid rows of desks can present some limitations. With reference to Thomas Kuhn, Vincent [22] proposes that when people exist in a particular environment, they struggle to not think and act according to the conventions of that environment. Vincent [22] goes on to describe traditional lecturer-centred academic environments where students sit in rows, silently and passively absorbing content. Her suggestion is that if educators want students themselves to be able to critically engage, to take ownership of their own learning journey, to think and act differently to traditional pedagogical expectations, there needs to be a change in the "process of production" [22] of students. During the tablet

pilot study, there was a noticeable difference in the engagement and participation of the students. Perhaps this is an indication that as Vincent suggests, that when learning spaces break out of the mould of tradition, so too do the expectations of traditional lecturer-student roles to which students and lecturers have been socialised [22]. It was not only the lecturers who witnessed a transformation in the learning environment - it was also noticed by Themba, as recorded in the focus group interview, who spoke about how using tablets in class “*created a different vibe*” where he felt “*free*”.

Extract 3

[The focus group had been discussing the differences between working on tablets and after the pilot study when classes were held without the use of tablets.]

Interviewer: Ja. Themba you said when you came back and the tablets, we didn't have them anymore what was it you missed? What is it that you missed?

Themba: I think it's the interaction with other students.

Interviewer: Okay.

Themba: And it just created a different vibe when you were using tablets you are free in class, ja.

(Focus group interview, First year group, Bellville, 03/10/2014.)

As discussed in the previous sub-section above, the affordances of online technology allowed students to be active and participate in learning activities. When conducted in traditionally-organised classrooms, interaction between students is often limited and likely to take place between adjacent students. During the pilot study, we noticed that portability of the tablets provided more freedom for students to move around the class and to work in physical arrangements that were more comfortable and conducive for interaction. In the extract below, Noma explains how tablets enabled her to work more effectively in groups as they were not limited to fixed spaces. In addition, the differences between Figures 1 and 2 show how the use of tablets enabled students to reconfigure their own learning spaces - including choosing to sit on the desk itself - and less likely to take place in a traditional lecture space. Tablets cannot achieve this flexibility on their own however, and we acknowledge that their use is more effective in classrooms fitted with movable desks and chairs.

Extract 4

Interviewer: I want to just focus here on something. You've done the group work in Landscape with the tablet and then you've done group work in Communication with a normal computer. You have to do research on a normal computer, okay. How did the tablet group work and the normal computer group work, work for you?

Noma: In terms of movement as a group we have to meet somewhere and discuss our stuff. It's okay with the tablet because with a computer we can't move it around. We have that [unclear] and we have to be here. It's a group of us on one computer and someone wants to use this

computer and I'm right next to him or her and I'm disturbing them whereas with the tablet you can just go to another class and do this thing together without anyone disturbing us. In the lab while everyone can – a lecturer can just come and go like, I have a class here. We go to the IT Centre, it's full. At the library we can't discuss anything, that's it.

(Focus group interview, First year group, Bellville, 03/10/2014.)



Fig 1.A typical class space even with access to online technology

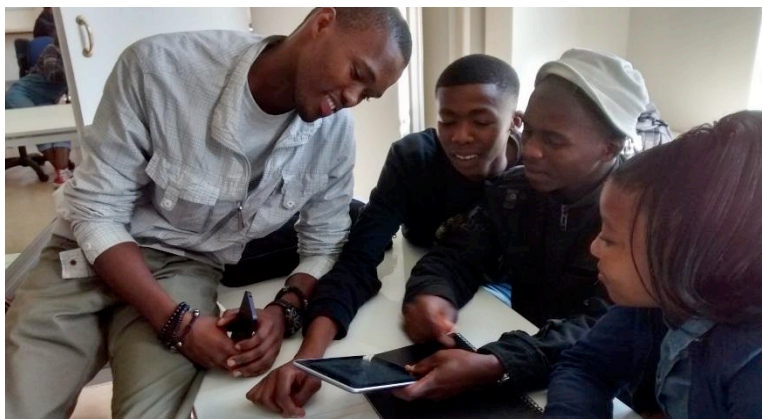


Fig. 2.Use of mobile technology allows students configure their own learning spaces

3.2 Tablets as a Tool to Transform Pedagogical Practices

Laurillard [3] identifies emerging technologies are unlikely to change how students learn, but may have a significant impact on the types of pedagogies employed. The tablet pilot study showed the potential of tablets to enhance reflective learning; studio design development and feedback; and scaffolded design skills. Through the focus

groups the use of tablets highlighted students' understandings of the design process, which led to improvements such as explicit pedagogical practices.

Reflective Learning through Digital Stories

The use of digital stories is an example where emerging technologies can support reflective learning and where students construct their own meanings from their own experiences [18]. The quote below is from the students' reflective exercise and shows that the student experienced a change in their own understanding of the course.

"I learned a lot in this project, I learned how to co-operate in a group and in class. Making the movie was a very exciting experience I ever had. I enjoyed taking pictures, to see it as an interesting class project made me feel different about the landscape course and I love it now. I loved every story and all the group did a very good job." (Foundation class reflection 28/08/2014)

Creating digital stories enabled students to use their own voice and provided the potential for wide representation and communication of their ideas. Helping students to develop their own identity, is a social process, our concept of identity is dialogical and so narrative can play an important part in the construction of that identity [23].

"Today's class was exciting. Seeing our work on screen was the best moment. We watched all the videos and I now have a different perspective of what the landscape is about. Working with the tablets makes life easier because everything on it is clear" (Foundation class reflection 26/08/2014).

Oppermann [24] found that students recognised the importance of voice in presenting an argument and that this helped in the development of their own sense of agency. This can be seen as a contact zone between the cognitive and the affective. This is particularly so when students participate in activities that encourage them to engage with social and cultural issues through presentation of their own personal stories about their experiences.

"But when they mentioned that we will be doing it with other senior classes and working with them... It is like going to a snake's hole even when you know it is going to bite you. We have been with them in several classes and the way they treat foundation class and don't even listen to our opinion...guess what, we have our differences, but we managed to work throughout the project and did all we could, we adapted to and they somehow started to include us in the group. Through my struggle of trying to keep up with the seniors I realized things I didn't know about landscape technology. That with it and designs one is responsible for people's life; that one is given the power to modify life or rather to program people's life" (Digital Story, Foundation year group, Bellville, 18/10/2014).

Students become emotionally engaged with the creation of the digital story leading to a 'spiral of engagement'. Creating a story is a powerful stimulus for reflection, for re-living and drawing more meaning from an experience. This was clearly expressed by the narrative written by a student:

"I always thought that Landscape was all about pencil and paper. It is all about working hard, expressing ideas, being creative and getting dirty...To my surprise... it was not easy at all. The worst part was when we had to come up with the ideas for the working design. We struggled during the whole process. We had to work on Saturdays while it was raining, lifting heavy stuff and getting muddy, wet and dry up again.

There were days I felt like crying...It was my first time to experience such an exhaustion in my life"(Digital Story, Foundation year group, Bellville, 18/10/2014).

While emerging technologies may increase the range of possibilities for teaching and learning, Laurillard [3] cautions that these possibilities should be integrated with sound pedagogy. However Coventry [23] observed that digital storytelling encapsulates the important pedagogical principles of restatement and translation that are central to helping students engage with difficult material: *"Designs are not just drawn to scale, not just to look pretty. They are designed with purpose, every element has its own purpose and reason"* (Digital Story, Foundation year group, Bellville, 18/10/2014). This communication of understanding to others allows a different perspective to be introduced and new questions to be asked, which can potentially prompt further thoughts and reflections. Learning is an iterative meaning-making process and digital storytelling can make this explicit:

"Now when we think back to the days of us laughing at the man in dirty work suits we realise that, that man is actually a builder of our future and deserves to be treated with respect and dignity because without man like him we have no schools, hospitals, malls, tall buildings etc" (Digital Story, Foundation year group, Bellville, 18/10/2014).

Scaffolded Design Skills

In this process of providing assistance to the students in terms of comprehension of theoretical concepts, tablets created a bridge between level of design skills and development of design concepts. A student might struggle to understand a specific design concept (concept plans or site analysis plans) because of they may not have mastered the specific design skills (drawing or sketching) needed to express their concept.

"I'm struggling with hand drawing and the tablet was helping me to learn how to... because with the hand drawing there's some graphics that I don't even know how to draw it... there's some graphics that we need to draw" (Focus group interview, First year group, Bellville, 03/10/2014).

One of the students specifically said: *"it taught me how to design without drawing."*

This showed how tablets can bridge the gap between the skill and the concept by providing "pre-drawn" landscape elements like walls, trees and planting. Using these allowed students to more easily express their comprehension of the concept and reinforces Souleles [11] suggestion that tablets could assist students with limited drawing abilities to express their ideas. Students in the focus groups indicated that the design application, *Home Outside Palette*, gave them the opportunity to experiment with various configurations of design elements in a short time span without worrying how to draw it: *"Ja, and it also make it easier for us to try some things. You know when you are doing maybe a design on paper, you get that idea in your mind to put maybe a water feature in this area but you might think what if it will look bad. Then I have to erase it again. But with the tablet you just take the water feature there and then you see no, it's not good, you just erase it, remove it faster. So it makes everyone not to be lazy on trying new things in a design and things like that"* (Focus group interview, First year group, Bellville, 03/10/2014).

This experimentation of various configurations and usage of different design elements forms a conceptual link to van Dooren et al's [25] framework of generic elements in the design process. It specifically addresses the experimentation element in design process that balanced developing new possibilities and alternatives with selecting, testing, evaluating these alternatives to make the final decisions:

"it plays a big role because I am able to come up with ideas." (Interim tablet survey, Bellville, 25/08/2014).

Thus, scaffolding can be seen as cognitive and social supports designed to augment a student's problem-solving inquiry. It is essential however to assess the ongoing state of students' knowledge in order to bridge their capacity to inquire and to fade the support as students learn to accomplish their problem-solving goals without scaffold.

"I think bringing technology into our lectures is a brilliant idea, ...the Home Outdoor Palette app is great for quick conceptual work, however I think a pen and paper, or even better CAD and Photoshop, are a lot less limited, and for that reason I don't think I'd use the app too much...Ja, the drawings on the tablets also limits you because you cannot, you only draw with available designs or designs which are in the tablet and we cannot use other graphics" (Focus group interview, First year group, Bellville, 03/10/2014).

Rapid Design Development and Feedback

The use of tablets created the opportunity for students to rapidly explore and receive feedback on a small-scale residential design exercise. Design is a process of experimentation where the designer engages in a sequence of hypothetical moves exploring potential effects of particular actions. The design process is iterative: suitable designs are often not generated after the first attempt as alternative ideas need to be generated and tested [25], [26], [27]. Because students usually draw their design sketches on paper, it can be a relatively time-consuming process of both completing a drawing and engaging in critique resulting in erasing and refining elements or reworking the design on multiple sheets of paper. During one of the class sessions in this study, in which students were asked to develop a small residential design in the *Home Outside Palette* app, one of the students reflected in the interim questionnaire: *"they've given me easier ways to work through my conceptual ideas in a less time consuming way... making my design process much more convenient"*. The students were also required to adjust the scale of landscape elements in plan and then had to reflect on how it influenced the scale of the plan. As an example of this, in the following extract, Neo identified that the tablets enabled him to engage in the experimental phase of the design process by making changes and receiving feedback much faster than when he was working by hand.

Extract 5

Neo: Ja, it will also enable us to have more consultation with the lecturers. You can change your work, very quickly.

Interviewer: Okay, so then you would be able to – they would say try maybe this way or that way, then you can try, then you can go back and ask again.

Neo: Ja.

(Focus group interview, first year group, Bellville, 03/10/2014.)

In the following extract Lerato indicated that normally feedback from lecturers may only be in the next class or the following week because of the time it would take her to redraw her design. She felt that when using tablets she received feedback and was able to make changes immediately. This feedback is an example of results of our analysis that echo Souleles' [11] findings that tablets could allow the fast development of design ideas.

Extract 6

Interviewer: So you found that because the - you were more active because you could move faster. Did I understand you correctly? And was there a different feeling attached to it?

Lerato: Ja it was because I had to hear from the lecturer the errors that I made and I had to quickly fix them and show it to him or her again and then ...

Interviewer: Okay. So it felt like you could move faster, okay. And when you're doing it just with paper what's different?

Lerato: It will take me time to redo the errors that I did and then I have to see him in the next week or in the next period.

Interviewer: Okay. Okay. So that's actually really important. It's the rapid feedback.

Lindi: Ja but that's how concerned you are to how neat you want to work. On the App they look neat already. But now because you could just erase what you did and then draw another little something or move it around. But because it doesn't look as neat as they do on the tablet she doesn't want to show them, I think.

(Focus group interview, First year group, Bellville, 03/10/2104.)

In the extract above, Lindi touched on what was to be an unexpected but significant theme in the focus group discussions. This is discussed in more detail in the following subsection.

Making the Design Process Explicit

The innovative nature of the tablets produced unexpected effects, to the extent that the use of tablets became a platform to stimulate focus group discussions with students. These discussions provided surprising insight as to how students perceive both the design process and the teaching and learning environment. These insights have influenced the future planning of teaching the landscape design process. The extract below follows a conversation between the interviewer and the Foundation students and their discussion comparing the use of tablets and hand drawing on paper. We were surprised to discover the students' perception of the design process did not account for rough exploratory drawings that designers may use during the design process and were attempting to draw presentation-style drawings [26], [27] for the interim and informal cycles of the design process.

Extract

[Foundation focus group discussion]

Interviewer: and then the other question what does it feel like drawing on the paper?

- Bongi: Ja but going back that question that Mr Griesel has given us. You see, it's more neatly, ma'am, when you're doing it on the tablet, than doing it on the paper. I, for one, feel very comfortable working on the tablet because I know my work is going to be dirty when I'm working on the paper, you see?
- Interviewer: Okay, so you don't like the messiness and the dirtiness of the paper?
- Bongi: No.
- Busi: I don't mind working. I just don't like writing like, I prefer drawing and see okay, I'm good at things. Okay, I'm not good at that but I'd prefer to use the computer too and to see okay, this looks good here and then compare it with my stuff and correct my stuff. But with hands you have to be more careful like Bongi said, it's messy and all those things.
- Busi: And the template, that made us comfortable because when we are doing the design, we are using the Design App. When I was doing my garden I will just ask the person next to me, look at my garden. But then when I'm given the paper and the pencil to write, I will be ashamed to show him or her my drawing. But then while I was using the tablet, I will be like, look at my garden how beautiful it is.

(Focus group interview, Foundation year group, Bellville, 02/10/2014.)

Through the analysis we were able to identify that the pedagogical practices in the design studios were implicit and did not include explicit pedagogies. Design studios are a recognisable phenomenon of design education [25] where students actively engage in simulations of projects in practice. As Schön describes, students must initially take part in a “willing suspension of disbelief” [27] where they are required to trust that the reason for the studio experience will become apparent later. Moore [28] and van Dooren et al [25] are concerned that there is an unfair expectation that knowledge and design skills will be gained implicitly by the student - that after some time, students will just “pick it up”. There is much support from design education research [25], [28] and responsive pedagogical research [29] to argue that immersion in tacit learning practices is not enough, and that if the design process is made explicit to students, there is less random guesswork and confusion. The intention behind van Dooren et al's [25] framework is to make the five generic principles of the design process explicit to students. The New London Group [29] dub this ‘Overt Instruction’ and caution against not reverting to traditional, lecturer-centred learning, but to engage in scaffolded learning activities. Explicit and tacit learning practices on their own do not adequately support learning, and must therefore be held in balance in a healthy learning environment. The juxtaposition of student's experiences uses tablets and hand-drawing brought to light a need to adjust our pedagogical practices to include both explicit and tacit strategies in the landscape studio environment.

3.3 Tablets as a Tool to Transform Student and Lecturer Roles

Through the pilot study tablets showed the potential to enhance student-centred pedagogies that can transform the roles of students and lecturers in the landscape studio environment. The following discussion outlines two aspects of changing roles including: increased student participation and peer-to-peer learning.

Enhancing Student Participation and Confidence

The students in the focus group acknowledged that in general they feel quite self-conscious about contributing to discussions or asking questions in class: *“The things is as teenagers, this youth, we tend to think then we don’t want to feel embarrassed in front of our peers. But the thing is we don’t realise that we’re not here for X to think Y is better. ... X doesn’t even noticed that you asked something stupid. Maybe he is getting something from what you said. More than you even think or more than what you wanted”* (Focus group interview, Foundation year group, Bellville, 02/10/2014).

During the reflection times in the foundation group, the students would all collaborate on the same Google docs file that was projected on screen for all to see, one of the students indicated in the final questionnaire: *“They have taught me how to engage with the rest of the class”* (Final tablet survey, Bellville, 01/10/2014).

The students felt more comfortable and wanting to participate in the discussions because the reflections were anonymous and the students could see their comments up with everyone else’s comments: *“We just thought everyone can see and then they can now know what we think and everything. But when we realised no, no-one can see the names, we just, okay, that’s good now. Let me just write anything right now, it was good...You know during that period of the tablets project there was that reflection page that Mr Griesel has created in the student folder for us. You know us as students – for us to learn something to be able to speak in front of the crowd. It gets so easy when you have to write it before you say it. So I think that reflection thing we were doing there built a lot of confidence for us because now at least I know that I can express the way I feel about this. I can share my view on this and my opinions on that. Then when we got used to that reflection thing on the Google Drive, we tend to gain more confidence to speak in class and say things that you want and tell everyone that no, I don’t like this or I wish this would go this way. Or I think this thing about this one. So I’ll say the tablets help us in a way that now we can feel free to express our views and share our opinions with the rest of the class”* (Focus group interview, Foundation year group, Bellville, 02/10/2014).

The process of typing out their ideas and what they learned gave them the opportunity express themselves better and gave them the opportunity to have an opinion and participate in the class but also and actively engaging in content based discussions: *“It gets so easy when you have to write it before you say it. So I think that reflection thing we were doing there built a lot of confidence for us because at least I know that I can express the way I feel about this. I can share my view on this and my opinions on that”* (Focus group interview, Foundation year group, Bellville, 02/10/2014).

The tablets created a supportive and collaborative learning environment that encouraged the students to participate in class discussions and the reflection activities:

“it made everything to seem interesting... I did my work much quicker in my own class than having to go to the lab....it has helped me gain confidence... I’ve got the confidence to ask. I can answer if the lecturer is asking a question and no-one is going to laugh at me. If I try, I try and if I go wrong I go wrong. I think the confidence of the students, all the students, including me has gone up” (Focus group interview, Foundation year group, Bellville, 02/10/2014).

Peer-to-Peer Learning (Lecturer as Facilitator)

During the process of the pilot study, the use of the tablets created a space where the role of the lecturer could more easily change from instructor to facilitator [3], placing the focus on the student and the interaction between peers. One of the discussions in the focus group meetings focused on as the perceived value of skills transfer from peer groups. Some students revealed that while working on the tablets, it created a space for working with peers and through that discovered the potential value of their peer’s skills: *“I was more comfortable asking what I did not understand”* (Final tablet survey, Bellville, 31/10/2014) and *“I became more active in class while we were working with tablets...they’ve enabled me to communicate my ideas with other student and encouraged participation...because I want to know something, he might know. At the end of the day I am the one who wants to pass, who wants to go the next level. If I want to know something, I am going to ask.”* (Focus group interview, Foundation year group, Bellville, 02/10/2014).

By facilitating this peer interaction, it created an environment for a simpler design processes and a shared burden of the repetition of the design process [30]. This environment of peer support enabled the student to actively participate in both the transfer of knowledge between peers as well as engaging in their own learning process: *“This youth, we tend to think then we don’t want to feel embarrassed in front of our peers ...we’re not here for that. We want the same thing. So Xena doesn’t even notice that you asked something stupid. Maybe he is getting something from what you said. More than you even think or more than what you wanted”* (Focus group interview, Foundation year group, Bellville, 02/10/2014). Being the participants of this learning environment not only helped the students in the process of learning, it also encouraged them to develop their skills for the future: *“I think it should help them because like technologies keep on changing and most of the students they are coming from rural areas. So when they get here and being introduced to tablets it will help them a lot”* (Focus group interview, First year group, Bellville, 03/10/2014).

4 Conclusion

Flavin’s [5] challenge to identify the transformative use of emerging technologies as an opportunity to enhance teaching and learning, reflects the primary aim of this pilot study. Higher education has the responsibility to empower students to cope with technology-driven changes in the labour market. In order to meet these demands, there has been a trend in higher education to shift from lecturer-centred to student-centred pedagogies. This pilot study represents an opportunity to research the extent to which emerging technologies such as tablets can enhance student-centred

pedagogies. It is hoped that by conducting this research in the context of landscape architectural design education, recommendations based on actual practices can influence the way in which student-centred learning can be supported in landscape architectural design studios. The findings showed that tablets can play a role in enhancing the learning environment: from redefining learning spaces that cater for students' individual access to information as well as the format of physical spaces; to influencing pedagogies that support reflective learning, scaffolded design skills, rapid design development and feedback and explicit design processes; to encouraging a shift in lecturer and student roles where students may gain more confidence to participate in class as well as engaging in peer-to-peer learning. This paper has attempted to not make generalisations [6] about the effectiveness of tablets and has sought to portray the range of perspectives of the participants. The findings also reflect those of similar studies such as Souleles [11] who found that when comparing traditional drawing tools to tablets there were characteristics that the other could not replicate but that tablets offer significant opportunities for supporting student-centred learning environments.

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References

1. Lai K-W.: Digital technology and the culture of teaching and learning in higher education. *Australasian Journal of Educational Technology*, 27, pp. 1263–1275 (2011).
2. Sumsion J, Goodfellow J.: Identifying generic skills through curriculum mapping: a critical evaluation. *Higher Education Research & Development*, 23, pp. 329–346 (2004).
3. Laurillard D.: Technology Enhanced Learning as a Tool for Pedagogical Innovation. *Journal of Philosophy of Education*. Blackwell Publishing Ltd, 42, pp. 521–533 (2008).
4. Machemer P. L., Crawford P.: Student perceptions of active learning in a large cross-disciplinary classroom. *Active Learning in Higher Education*, 8, pp. 9–30 (2007).
5. (2016)
6. Bullen M., Morgan T.: Digital learners not digital natives. *La Cuestión Universitaria*, 7, pp. 60–68 (2011).
7. Cidre E.: Using iPads as a Dynamic Learning Tool to Develop Skills in Graphic Communication and Enhance Spatial Awareness. In: Souleles N, Pillar C, editors. *iPads in Higher Education: Proceedings of the 1st International Conference on the Use of iPads in Higher Education (ihe2014)*. Cambridge Scholars Publishing, pp. 1–4 (2015).
8. Herrington J., Reeves T. C., Oliver R.: *A Guide to Authentic e-Learning*. New York: Routledge (2010).
9. Mang C.F., Wardley L. J. Effective Adoption of Tablets in Post-Secondary Education: Recommendations Based on a Trial of iPads in University Classes. *Journal of Information Technology Education: Innovations in Practice*. 2012;11: 17.
10. Murphy G. D. Post-PC devices : A summary of early iPad technology adoption in tertiary environments. *eJournal of Business Education Scholarship of Teaching*. 2011;5: 18–32.
11. Souleles N.: iPad versus traditional tools in art and design: A complementary association. *Br J Educ Technol*, 48, pp. 586–597 (2017).

12. Kleinveldt L. T., Zulu M.: Integrating tablet technology into information literacy training at CPUT libraries: a pilot project. *Library Hi Tech News*, 33, pp. 10–14 (2016).
13. Ferrance E.: *Action Research*. Brown University (2000).
14. Cousin G.: *Researching learning in higher education: An introduction to contemporary methods and approaches*. New York: Routledge (2008).
15. McAteer M.: *Action Research in Education*. London: SAGE Publications, (2013).
16. Wagner C., Kawulich B., Garner M.: *Doing Social Research: A Global Context*. New York: McGraw-Hill Higher Education (2012).
17. Azevedo R., Hadwin A. F.: Scaffolding self-regulated learning and metacognition – Implications for the design of computer-based scaffolds. *Instructional Science*, 33, pp. 367–379 (2005).
18. Luca J., Oliver R. *Developing An Instructional Design Strategy To Support Generic Skills Development*. *Winds of change in the sea of learning: Charting the course of Digital Education*. 2002.
19. Mitra S.: Knowing stuff? No, thanks. That’s so last century. *The Times Educational Supplement*, 5173 (2015). Retrieved on December 2017: <https://search.proquest.com/docview/1739142500?accountid=14500>.
20. Thesen L.: The Past in the Present: Modes, Gaze and Changing Communicative Practices in Lectures. In: Archer A, Breuer EO, editors. *Multimodality in Higher Education*. Leiden and Boston: Brill, pp. 31–52 (2016).
21. Mazur E.: Education. Farewell, lecture? *Science*, 323, pp. 50–51 (2009).
22. Vincent L.: What’s love got to do with it? The effect of affect in the academy. *Politikon*. Routledge, 31, pp. 105–115 (2004).
23. Coventry M.: Engaging Gender: Student application of theory through digital storytelling. *Arts and Humanities in Higher Education*, 7, pp. 205–219 (2008).
24. Oppermann M.: Digital Storytelling and American Studies: Critical trajectories from the emotional to the epistemological. *Arts and Humanities in Higher Education*, 7, pp. 171–187 (2008).
25. van Dooren E., Boshuizen E., van Merriënboer J., Asselbergs T., van Dorst M.: Making explicit in design education: generic elements in the design process. *Int J TechnolDes Educ*. Springer Netherlands, 24, pp. 53–71 (2013).
26. Lawson B.: *What designers know*. London and New York: Routledge (2004).
27. Schön D. A.: *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions*. San Francisco: Jossey-Bass Publishers (1987).
28. Moore K.: *Overlooking the visual: Demystifying the art of design*. Abingdon: Routledge (2010).
29. The New London Group. *A Pedagogy of Multiliteracies: Designing Social Futures*. *HarvEduc Rev.*, 66, pp. 60–93 (1996).
30. Howard T. J., Culley S. J., Dekoninck E.: Describing the creative design process by the integration of engineering design and cognitive psychology literature. *Design Studies*, 3;29, pp. 160–180 (2008).