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Creative education: the design of web-based learning environments for design students

By

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DECLARATION

I declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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November 2012

ABSTRACT

The current studio based approach in design education is not enough to keep the "new age" design students' attention and a blended learning environment is needed to facilitate student engagement. Multiple learning preferences exist within the design classroom and design educators must consider this when designing a curriculum.

The research asked what the considerations were when designing the online component of a blended learning environment to enhance the learning experience of and engage design students? The areas of investigation included:

- The learning preferences in a specific group of graphic design students to see if there are any predominant preferences,
- Whether the web-based learning environment enriched the learning experience and whether students gained understanding of the dynamics of the intervention
- Whether there were links between learning preferences, online performance and in-class performance and how we could use these links to design blended learning materials that:
    - Incorporate collaborative problem solving (Vygotsky, 1978)
    - Encourage the building of design knowledge (Schon and Wiggins 1992)
    - Help students move from the periphery of the community of practice to the core (Wenger 1998)
    - Simulate the world of work (Jonassen et. Al 1998)
    - Consider the individual learning preferences of students and engages them on multiple levels (Cazden et al 1996)

This research concluded that a blended learning environment is necessary in order for design education to move forward and be inclusive. The new generation design curriculum needs to stimulate at many different levels using multiple ways and media. This multimodal stance in design education will afford students the opportunity to become reflective knowledge builders who are able to solve problems collaboratively and transfer existing knowledge to new contexts.

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DEDICATION

I dedicate this thesis to my husband Lucien Morris who's unwavering faith has taught me to never give up and believe that all things work together for good to them that love the Lord and are called according to His purpose.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Chapter 1: Introduction

1.1. Introduction

Educational Computing has been developing for many years. In these years, the evolution of the Internet and the World Wide Web has and "will continue to transform everything we do" (Alessi & Trollip, 2001:3).

Although technology and its availability have greatly improved and there have been significant developments in the world of computers and instructional computing, the actual improvement in learning has not been as dramatic (Alessi & Trollip, 2001:3). Russell (1999) calls this lack of improvement the "no significance difference" phenomenon and states that learning materials or media have no effect on students' performance. Even with this "no significant difference" (Russell, 1999) in learning efficacy, there are other opportunities that web-based learning provides. These benefits include: time saving, cheaper distribution of materials, convenient 24 hour access, easier access for those with disabilities, no geographical constraints and immediate feedback.

However, in design education, the studio approach has long been used as the main source of learning. It began in the French Royal Academy and continued with the methodologies of the École des Beaux-Arts (Bender & Vredevoogd, 2006:115). This format has prevailed in many institutional contexts worldwide.

One such example is in the United States, where it became traditional for schools to pattern their instruction in Beaux-Arts format, in which the studio is the central focus of the curriculum. Studios (where drawing, debate, and analysis of design take place) are considered more of an active learning experience than a lecture-style classroom. The strength and assurance of the Beaux-Arts approach was influential on the creation of architecture and design programs in the United States in the early 20th century (Association of Collegiate Schools of Architecture, 2000). Since that time, studio instruction has essentially remained unchanged. Students then, and now, attend a studio where instruction is delivered from master to apprentice within a small group setting (Bender & Vredevoogd, 2006:115).

Students in design have been emulating the world of work and the process of learning and teaching design that has been largely artefact driven. Students would typically be assessed on the final product, while the skills and knowledge acquired along the way would not be assessed individually, and thus seem to be forgotten. “The nature of this traditional educational process is well symbolized in what is perhaps the Achilles heel of the traditional studio, that is, that evaluation is based on the final product rather than on a measure of increments of knowledge acquired as a result of the studio” (Oxman, 1999:3).

The theory of “creative cognition” discussed by Finke (1992) relates to knowledge structures in the creative processes and has given rise to the proposition that, “learning through the structuring and manipulation of knowledge in design may be considered a significant educational objective in design education” (Oxman, 1999:3). The structuring and manipulation of knowledge that Oxman suggests, implies that the design curriculum should encourage learners to draw from the knowledge they have in order to manipulate it and apply it to the design problems they are presented with.

Meanwhile, constructivism is a psychological term that refers to “learning as building knowledge structures irrespective of the circumstances of the learning” (Harel & Papert, 1991:1). Constructivism is an informing theory rather than a pedagogical one and offers the framework within which the knowledge building experience of a design student would be designed. Latour (2006) stated:

> “The problem with constructivism is that no one could account for the building of anything, even the simplest shack, by using this metaphor as it has been popularized in social sciences... If any mason, any architect, any Little Pig was trying to build anything with the theory of action implied by constructivism, they would fail hopelessly to assemble any durable whole.”

Constructivist theory thus, in itself is not enough to design a curriculum but needs an informing pedagogy to make sense. The search for this sense gives way to Constructionism (Harel & Papert, 1991), which implies that besides building knowledge structures, as implied in constructivism, knowledge is developed “in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe” (Harel & Papert, 1991:1). It has been an assumption made in design education that design students develop their designer thinking through “doing” design and constructionism has become the informing principle in most design curricula.

Simoff and Maher (1997: 2) “developed and applied the concept of a web-based virtual design studio (VDS) as an environment for teaching students about collaborative design. This environment was a virtual combination of the classroom and the computer laboratory, which transcended “geographical and time scheduling constraints”. According to Simoff and Maher (1997:2), design education is characterised by the lack of clear separation between theoretical knowledge and practical skills, and an environment where the design studio is combined with easily accessible information sources has been proven to be an optimal learning environment for design students.

The question remains then; how does one move from an artefact driven, largely studio based method of teaching and information dissemination to a curriculum, learning materials and learning environments that encourage creative cognition, promote constructionism and provide easy access to information? What are the factors to be considered when designing an online environment as part of a blended classroom for design students and what are the implications of these factors in the online learning environments?

This study sought to answer those questions and looked at specific areas of interest including: learning preferences of students, instructional design and web-based learning, and blended learning. The study looked at the possible integration of web-based materials with a group of students involved in the graphic design Extended Curriculum Programme (ECP) at Cape Peninsula University of Technology (CPUT).

1.1.1 Learning Preferences

Students live in an age where their attention is demanded from many places, all at the same time. Therefore the attention economy is a vital influence in planning learning. One needs to find the tools that help educators grab the attention of students. Therefore as educators, we need to continually ask: what captures students’ attention, what appeals to them and how does one use this in our favour?

1.1.2 Instructional Design and Web-Based Learning

There are very specific guidelines when designing instructional media. These guidelines include usability, navigation and many other factors. The guiding factors are similar when moving into the design of web-based environments and as such, specific goals have to be set for web-based environments. These goals should be made explicit from the start and be kept in mind during the design phases.

This study explored the design of the web-based learning environment from an educational perspective based on Merrill's phases for effective instruction (2002:44) and also Jonassen et al.'s major skills (1998). The aforementioned paradigms concentrate largely on the cognitive aspects of the design rather than the technical ones.

1.1.3 Blended Learning: Studio Teaching Improved

This research also investigated blended learning modes and their appropriation. The studio approach has traditionally been used in design education. The process of design and growing students' "kinds of seeing" (Schon & Wiggins, 1992) is key in the principles of studio-based teaching. However, it has become apparent, with the advances in technology, that teaching methods should not only be emulating the world of work. One should be aware of and implement the tools needed to stay on the road to evolving the design classroom. Design should be as available to students as everything else is in their world.

1.2 Problem Statement

According to Keller (1987:3) In order to increase the motivational appeal of instructional material the designer should look at Attention, Relevance, confidence and Satisfaction (ARCS) of the student. The current studio based approach in design education is not paying enough attention to these factors and therefore not doing ˝enough to keep the "new age" design students' attention. A blended learning environment is needed to satisfy the need for student engagement, easily accessible information and the satisfaction of the needs of the multiple learning preferences present in a design classroom.

1.2.1 Research Question, Sub-Question and Objectives

Table 1-A below presents the research problem, question, sub-questions, methods and objectives in table format. It is an attempt at clarifying the path that this research followed.

Table 1-A: Table representation of the research problem, questions and objectives

Research Problem	Current design educational practices at CPUT are not providing students with an engaging blended learning environment.	
Research question	What are the considerations when designing the online component of a blended learning environment to enhance the learning experience of design students?	
Research sub-questions	**Research methods**	**Objectives**

What are the learning preferences amongst a group of graphic design students?	VARK questionnaire	To establish the learning preferences in a specific group of graphic design students and see if there are any predominant preferences.
How do graphic design students' interact with online learning environments?	Student Questionnaires	Establish whether the web-based learning environment enriches the learning experience and whether students gain understanding of the dynamics of the intervention
How do ECP students perform in an open ended online task?	Online task completion and rating.	To establish whether there are links between learning preferences, online performance and in-class performance.

1.3 Current Status Of The Research Area

1.3.1 Design Education

Schon and Wiggins (1992:108) suggest that the way that design students "see" affects the way they approach design problems and in turn, the way they learn. Going through the design process from concept to finished artefact is seen as building knowledge of design. While designing, students are building an archive of design knowledge, which can be automatically triggered or accessed when they are placed in situations which are similar to when they first solved that particular design problem.

In recent years, the debate around the studio approach and the cognitive development of the design student has changed the face of design education. Design education is now not only artefact driven, it is expected that in the process of learning design, students should construct knowledge of design. The process of learning design will only be complete, according to Oxman (1999:110), when the knowledge of design is physically constructed. It is this type of physical construction that has been the driving force behind the practical graphic design course at CPUT for a number of years. Students engage with a practical work-simulating environment on a daily basis and therefore learn design through design.

Traditionally the definition of what a graphic designer is and does has resided in the visual realm. With technological innovations and advancements this definition needs to be revised as the skills and professional attributes of a graphic designer are changing (Bonsiepe 1994:47). Graphic designers are expected to do more, know more and produce more than they have ever had to. The lines that have so clearly separated graphic designers from fashion designers or even industrial designers have become more and more blurred. This

change in industry standards means higher education now has to produce multifaceted designers. In line with this CPUT's vision is to be at the heart of technology education and innovation in Africa and so the graphic design curricula should embrace this vision while also supplying the needs of industry.

Ellmers, Brown, and Bennett (2009:67) suggest that to address the limitations of the age old design curriculum, a pedagogical approach has been developed in global design education that seeks to: support cognitive engagement through reflective practice, encourage abstract levels of cognition, and support articulation of generalisations from the learning experience. Through this process of generalisation, the aim is to assist the learner to articulate the knowledge represented in their design experience, establishing a platform to support transfer of knowledge to other situations.

Harel (1991) in his book Constructionism speaks about instructionism vs. constructionism. The author explains that the instructionism vs. constructionism split goes much deeper than just the way a student receives knowledge but also addresses the nature of knowledge and the nature of knowing. The nature of knowledge is technical and applies to the methods employed. The nature of knowing speaks to the epistemological, core issues that become the students own. Epistemological in this case is defined as "the study or a theory of the nature and grounds of knowledge especially with reference to its limits and validity" (Merriam- Websters New Collegiate Dictionary 1974 pg 385)

Bender and Vredevoogd (2006:115) admit that studios are learning environments that have a special place in the history of design education but suggest that this traditional environment should be combined with online technology in order to implement "blended learning". The idea is that the blended learning combines interactive classroom sessions with the flexibility and time defying properties of the online classroom. The key argument is, however, that online instruction cannot replace, but rather enhances the existing studio structure.

1.3.2 Learning Preferences

Fleming (1995) emphasizes the importance of student and teacher awareness when it comes to learning preferences. Individual preferences are seen as a tool for selecting practical strategies that will enhance the learning experience (Fleming, 1995:1). Fleming presents us with four learning preferences, or VARK modes:

V- Visual

A-Aural

R-Reading and writing

K-Kinesthetic

The reading and writing preference is an addition Fleming has made to previous learning preference guides, which only accounted for the other three aforementioned preferences namely the Visual (text and diagrams), Aural (hearing and speaking) and Kinesthetic (learning through simulation or real world examples). Fleming separates the previously conflated visual preference into the Visual (graphs, flowcharts, diagrams, etc.) and Reading and Writing (the actual written text). Fleming's four preferences are not seen as dictating methodologies for instruction but rather as a guide for not only the dissemination of information, but also the internalisation thereof. The literature on learning preferences presents the possibility of those with a single strong preference but also highlights the possibility of multiple, or multimodal, learning preferences.

Cazden et al. (1996) reinforce the existence of the multimodal student by insisting that information be presented in multiple modes in order to give all students a fair chance at success. Cazden et al. (1996:61) takes the stance that presenting learning multimodally transcends cultural, language and gender inequalities.

On the other hand, Coffield et al. (2004: 28), questions the reliability and validity of learning style testing. The author criticises learning style tests and say they are subjective interpretations of students' lack of self knowledge (Coffield et al., 2004:33).

Meanwhile, Aragon et al. (2001) look at learning preferences and their relationship to the design of online and face-to-face learning environments. The authors find that whether the environment is online or face-to-face does not matter but rather that the design of the learning material should be the focus. The learning materials should encourage the construction of knowledge in multiple modes and establish students' "preferred environmental and social conditions for learning" (Curry, 1991:6).

1.3.3 Blended Learning Design

Schon and Wiggins (1992:135) say that design is characterized by a uniquely significant component of visual reasoning. It is this visual reasoning that leads one to investigate whether a web-based interface, which stimulates visual reasoning, can become a tool that adds value to the education of traditionally studio taught graphic designers.

Simoff and Maher (1997) predicted that Virtual Design Studios would develop into a virtual space shared and owned by all the participants in the studio. When one looks at the current state and number of online communities and social networking sites, one realises that in the years since Simoff and Maher's publication that much of this prediction, and more, has taken place. Today there are wikis, blogs, Facebook and many other examples of online communities.

Barab, Kling & Gray (2004) state that what makes different students visit the same online environment is a sense of community. Having something in common, e.g. a shared learning preference creates a sense of community. Riel and Polin (2004) discuss learning as a social construct and in this sense; the community is seen as playing an important role in the education of the student. It is not merely the coming together of souls, but the community around the user that influences the way they interact with that particular environment.

The sense of community offered by a blended learning environment means students and staff can be drawn closer together by sharing experiences and engaging with educational technology. This closeness is both physical (in the studio) and virtual (online) (Aspden and Helm 2004:245) and both types of interactions are valued equally. The online environment is not seen as superior to the face-to-face interaction but rather enhances the classroom experience and adds value. Blended learning makes engagement possible in many different ways, and students can fit their activities together to suit their situation. Where blended learning is used appropriately, it provides better opportunities for students to connect with their learning experience according to their needs (Aspden and Helm 2004:251). This effective blend of face-to-face and online learning is what Bender and Vredvoogd (2006) call a modified design studio.

Bender and Vredevoogd (2006) suggest that design education employ a modified design studio process, which includes the online environment as a complement to the traditional design studio. Bender and Vredevoogd suggest, amongst other things, that one-on-one critique and discussion be streamlined and done en masse and online for the benefit of all.

The findings comparing the traditional studio (in-class face to face contact) to the modified design studio (in-class face to face contact combined with online) are set out in Table 1-B.

Table 1-B: A comparison of the two Instructional models (Bender & Vredevoogd, 2006)

Traditional Design Studio	Modified Design Studio
Assignments are introduced by the lecturer and submitted by the students during class time.	Assignments are introduced in the same manner, but are submitted electronically 24-48 hours before class time.
Class size is typically 15-20 students to one instructor per section. The same instructor may oversee two or more sections.	Class size remains the same but the instructor can handle an increased number of sections with assistance.
The individual critiques provided in class are seldom shared with other class members. Therefore the same feedback may be reported to several students within the same class period.	Students receive feedback via the audio critique and group feedback during the weekly lecture period.
The critic repeatedly corrects the same or similar student errors.	The critic needs to address student errors only once.
The competitive nature of design classes limits the sharing and nurturing of ideas and causes many students to work independently.	Design skills are strengthened by the student's ability to build on the feedback of other students' projects and feedback.
Students have to be physically present in a studio when critique is given. Unless recorded it cannot be reviewed at a later time.	Students can review critiques on demand and can "attend" the critique from remote locations.
Guest critics must travel to the class site during a specified class period to participate in critiques.	Guest critics can review the projects and provide an audio critique (independently or with others) at their convenience.
Work done in the studio may turn into a collaborative effort between the student and the instructor making it difficult to determine what part of the project the student has done. The instructor must be cautious about doing the assignment for the student.	The instructor does not guide any single student through the design process, but guides the class as a whole.

This research aimed to bridge the current pedagogical practices in the design classroom and practices in web-based environments. It explored the implications of combining the key factors in design education to create an environment that utilises technology and design to create an interactive, knowledge building and self-exploratory environment.

1.4 Research Design

Qualitative data was collected from a class group based in the Extended Curriculum in the Graphic Design Department on the Bellville Campus of Cape Peninsula University of Technology (CPUT).

An analysis of the students' learning preferences was done using the VARK questionnaire. Students were then categorised using the preference results.

Students were required to interact with an existing online environment called Whyville, originally designed as a safe online environment for teens and preteens. While using Whyville students were required to complete a specific design task. The results of the task were rated and analysed using a performance level scale adapted from Simpson's psychomotor domains. This performance data will be discussed along with the classroom performance of students as observed by the researcher in Chapters 4 and 5 of this paper.

Data on the online experiences of the students while using Whyville were gathered using a questionnaire to be completed by students after the intervention. The questions in the questionnaire were set to probe what students did and experienced in the online environment and whether it possibly enhanced learning. The data gained from the questionnaires were combined with the VARK results and researcher's observations to develop possible criteria for the design of an online learning environment for design students.

1.5 Delineation of the Research

This research concentrated on the online experiences of the students within the Graphic Design Department at the Bellville Campus of CPUT. Only the student perspective is given as the research specifically looks at the experience of the student and not what the lecturers think they are providing students with.

The research does not aim to provide specific guidelines on how online design education should be conducted, but rather aims to understand the implications of the design of the online student experience.

No solutions will be provided to the individual learning challenges of students, but the research will rather concentrate on the curriculum of the Graphic Design Programme at CPUT and how this could be implemented effectively using a blended learning approach which incorporates the online learning environment and is cognisant of student learning preferences.

1.6 Contribution of the Research

The research aims to provide new insight on the approaches to the design of online learning environments specifically for design students. It seeks to open the door to interactive ways of promoting creativity and encouraging the internalisation and building of design knowledge structures and thinking for graphic design.

2 Chapter 2: Literature Review

2.1 Introduction

The review will examine the views of particular authors as it relates to learning preferences, instructional design (with the focus on online learning environments), studio teaching and blended learning. This review will also provide literary evidence for the relevance of the study.

The design of online environments for design students is an area of interest because it addresses the relevance and appropriateness of current practices within online education in higher education. The study recognizes the effectiveness of these practices, but asks how do we enhance current practices with the help of learning preferences so that the learning environment still appeals to our students?

The main search engine used for academic articles was Google Scholar as it searched a comprehensive list of databases. In addition, the researcher searched databases such as Science Direct, Proquest and Springerlink and received articles from colleagues doing research in similar fields such as mobile learning and Information Technology in education. The phrases used in the searches were:

- E-learning graphic design
- Web-based design education
- Virtual design studio
- Design higher education

Because of the dual meaning that design could have in these instances (it could mean both the design of instructional media but could also refer to the design discipline i.e. Graphic design) the search terms had to be more specific.

Where there was no literature that spoke directly to the topic it was divided into areas of interest and then searched for using Google Scholar. The main areas that emerged were:

- Design education
- Studio based teaching

- Web-based education
- Information and Communication Technology (ICT) in Higher education
- Design online learning

After reading some of the literature it was found that there were other topics that influenced the above-mentioned themes. These topics are:

- Constructivism
- Constructionism
- Learning preferences

In order to bring these areas together, one would have to study the aforementioned topics individually and then make the necessary links to create a body of literature.

2.2 Learning Preferences and Learning Taxonomies

The following section makes use of Bloom's taxonomies (1956), which are commonly referenced in education, and refer to the different domains, or outcomes, of learning that student's experience. These domains include the cognitive, affective, and psychomotor domains of learning and, in turn, each of these domains contains skills that require progressively deeper, or complex, ways of understanding. These skills are hierarchical and, therefore, one must master a lower level skill before being progressing to the next level of desired outcomes. The cognitive domain deals primarily with the thought processes involved in learning a topic and includes a student's knowledge, comprehension, and critical thinking of that topic. The affective domain of learning refers to the way in which people understand a topic emotionally, and how they internalize knowledge with regard to their feelings and attitudes. Finally, the psychomotor domain refers to the way in which students understand the tactile and physical skills; this domain is centred around the idea of doing and understanding how to manipulate tools and objects. The following sections will make use various literature sources with reference to these taxonomies and how they relate to the creation of a web-based component of instruction for graphic design students.

2.2.1 Cognitive

Fleming (1995:1) expresses the importance of both teachers and students being aware of how they learn best. The how of learning in Fleming's case is governed by learning preferences. These preferences can be defined as the manner in which students prefer to

receive information intended for learning. The learning mode or preference that best suits them is not necessarily the only way they can interact with new information but indicates their inclination and dictates the mode of preferred delivery. Information does not necessarily have to be taken in the manner in which it is going to be disseminated (Fleming, 1995:1). It is therefore possible for teachers to deliver the information to the students in ways that compliment the student's learning preferences. The awareness of preferences does not imply a diagnostic labelling of students and their learning style but rather a platform that can be used as a starting point for the development of teaching and learning resources (Fleming, 1995:1). Although VARK has very good educational value it cannot be validated statistically. It's strength lies in helping people think about their learning in multiple ways and giving them options they might not have considered. (Fleming and Baume 2006:6)

Fleming discusses the VARK modes which is defined by four learning preferences:

V – visual

A – aural

R – read/write

K – Kinesthetic

The visual preference speaks to those who prefer information presented as graphs, charts and flow diagrams. These students develop maps of their learning and develop patterns of information. Students with this kind of preference also tend to work well with symbols. The aural preference is anything audible. This preference is for those who want to hear their information. They would, for example, prefer lectures and pod casts. The read/write preference wants to access information through the printed word. They will take notes and print emails in order to read them. The last category is the Kinesthetic. These are students who want to use multiple senses in processing information. They want to touch, hear, smell, taste and see. These students want to learn by doing but are equally able of internalizing abstract concepts through analogies and real life examples. Those with a Kinesthetic preference learn theory through its application. One finds that the Kinesthetic and visual preferences are not always well served at tertiary level, as the modes of traditional teaching do not include all the sensory experiences needed by these learning preferences.

Fleming (1995:2) also discusses multi-modal students. These are students that prefer different modes of information internalization in different situations. It is said that even though these students might have a strong preference for two or more modes they could also exhibit a weakness with the other modes. Some multi-modals will need input in more than one mode before fully understanding a concept.

The ideas of multimodality and multiple literacies is discussed in great detail by Cazden et al. (1996) which implies that information should always be presented in multiple modes. The authors argue that this manner of information input brings forth a rich reinterpretation. The multiple forms in which information is available include text and multimedia and stretch beyond the boundaries of the formal classroom. This must be considered when one designs learning materials that are to encourage full social participation and transcends differences in culture, language and gender (Cazden et al., 1996:61). In an educational environment such as the ECP programmes, which are intended to grant access to the professional fields that were adversely affected by apartheid, this consideration is crucial. The approach suggested by Cazden et al. called "Multiliteracies" is defined as a way to focus on the realities of increasing local diversity and global connectedness. It speaks about the textual relation of the visual, the audio, the spatial, the behavioural and so on (Cazden et al., 1996:64).

The pedagogy of Multiliteracies (Cazden et al., 1996:64) suggests four components:

- Situated Practice, which draws on meaning made in lifeworlds, the public realm and workplaces. It helps students understand the world of work.
- Overt Instruction, through which students develop an explicit meta-language of design. This includes lecturing, active interventions from teachers and experts and scaffolded learning activities.
- Critical Framing, which interprets the social context and purposes of practices in the field of study and involves students standing back and viewing what they are studying in context.
- Transformed practice, in which students as meaning makers put what they have learnt and the meaning they have created into practice in other contexts.

Cazden et al. (1996:71) uses lifeworlds as an example of the multiple layers that exist in each person's life. People are simultaneously members of multiple lifeworlds and so their

identities have multiple layers that are complexly related to each other (Cazden et al., 1996:71). This argues that just as there are multiple layers to identity, there are multiple discourses of identity and recognition. In order to address and engage proficiently with these multiple discourses, pedagogy must also adjust.

Fleming's (1995) VARK modes suggest that each individual has a unique preference or combination of preferences that considers their personal needs. A simplistic interpretation of this would mean that providing the same learning materials in multiple modes affords students the privilege of personalized learning materials/media. The multimodal pedagogy however digs deeper than this.

The VARK modes provide students with a set of strategies to "take in information matched to their sensory mode preferences". Fleming (1995:309) states that learning material and recommended textbooks should consider the learning modes of students and should cater to them. Furthermore, Fleming asks whether a student's weaker mode should be improved, whether tertiary education is the place where this experimentation should be taking place, or whether the strengths and preferences of the students should rather be used to improve their learning.

Fleming (1995:310) suggests that when students have done the VARK questionnaire and are aware of their learning preferences or modes based on this questionnaire, they can change their current practices and experience the results. He discusses cases where this change has dramatically improved the results of the student. However, students do not always prefer the same mode for distributing information as they do for receiving it. Likewise, teachers also have preferences for delivery. Fleming (1995:312) speaks of Lincoln University where many teachers become readers/writers because the academic community rewards this mode of delivery. Most university materials are geared toward the read/write modalities as they are predominantly printed.

Fleming (1995:312) encourages the development of multiple modes of presenting information to students. He admits that it will increase the workload of the teacher but highlights the positive effect it will have on the learning of the student. Similarly, Prensky (2005:60) says, the methods employed in the classroom should engage learners as much as all the other activities in their lives do. It is therefore important to investigate which activities students pursue and why they find these engaging. Fleming (1995:313) stresses the importance of not implementing one's own preferences on students, but recognizing their

needs and catering to them. Virleen M. Carlson, of Cornell University, on the VARK website, says: "Teach me my most difficult concepts in my preferred style. Let me explore my easiest concepts in a different style. Just don't teach me all the time in your preferred style and think I'm not capable of learning" (VARK, n.d.).

In addition, Cazden et al.'s (1996) proposed multilateral approach has three elements:

- Available designs (the resources)- The Available Designs refer to discourses and existing sets of behaviour, procedures, standards, etc.
- Designing (the process)- The designing is the shaping of emergent meaning. This takes the Available Design and transforms it.
- The Redesigned (the result)- The transformation of the Available Designs (Designing) into a new construction and representation of reality becomes the Redesigned. The Redesign is not original but is based on existing meaning (Available Design), which now becomes a new Available Design.

The pedagogy of Multiliteracies therefore refers to the relationship between the pedagogy (a combination of situated practice, overt instruction and critical framing which leads to transformed practice) and the design (the resources, process and results).

A study conducted by Aragon et al., (2001) explored the relationship of learning preferences and learning success for students enrolled in both online and traditional face-to-face courses. The study presented here did not look at which environment is best for learning, but rather aimed to establish whether the design of the learning environment can lead to success irrespective of learning style. It also looks at optimal design for online instructional media. In contrast to this, Coffield et al. (2004:28) questions the reliability and validity of learning style testing. The authors' criticism is that learning style tests are "self-evaluations performed by students with very little self-awareness" (Coffield et al., 2004:33).

Aragon et al. (2001:6) claim that learning style preferences are only a fraction of what makes a learning environment work. They discuss motivation maintenance and task engagement as other factors that must be considered in the design of a learning environment. They draw on Curry's (1991) Theoretical Model of Learning Style Components, which states that motivation levels are only maintained once the learners "preferred environmental and social conditions for learning" are established (Curry, 1991:6). These statements would imply that one could use a student's preferred style of learning and design instruction that appeals to their preferences and by doing so, create the preferred environmental and social conditions

for learning. Curry (1991:6) says that task engagement is gauged by "the amount of attention paid, the level of concentration, participation, enthusiasm and persistence". It indicates how deeply the student is engaging in the task at hand both in and out of class. This implies that it is not only learning preferences that influence how students interact with a learning environment but also how they engage with the environment.

Given this, it is the researcher's intention and this study's purpose to look at what students do both in and outside class, what makes them visit the online sites they do, what they do while on those sites, and why they like doing those things. The study presented here does not seek to imply that learning styles influence learning in a great manner but will attempt to use learning preferences as a starting point for engagement criteria for an online learning environment. It is also imperative that the creative, visual aspect of the respondents be considered along with the constructionist notions that exist in the design classroom. These cognitive structures have to be entertained in the design of an online environment for design students and it is, therefore, the purpose of this study to find strategies to engage these design students in the same way as Mxit, Facebook, Twitter and the many other social software does.

Aragon et al. (2001:10) discusses that when the performance of traditional (face-to-face students) and non-traditional (online) in courses are compared, there is no significant difference. This is an issue that caused huge debate between R. Clark and R. Kozma from 1983 – 1994. However, a recent article by Hastings and Tracey brings a new perspective on the argument. Hastings and Tracey (2005:30) state that the debate now is "to ask not if, but how media affects learning". Hastings and Tracey (2005:30) acknowledge the limitations of media comparison studies and say that media are interchangeable. Nevertheless, the authors believe that computers in current times have capabilities that cannot be replicated by any other medium and this makes it different. This study presented here will concentrate on using online activities and courses along with traditional studio instruction. It will show online instruction as a means to encourage "anytime anyplace learning" (Oliver, 2002:5) and in turn encourage learner motivation. Aragon et al. (1991:14) say that, "As motivation increases so does learning". They recognize motivation as an internal factor but also agree that there are external factors such as the teacher, course design and learning activities, which can influence the levels of student motivation.

The link between Argon et al. and Fleming becomes apparent in that both say there are very clear factors that influence the way students approach and perform their learning activities.

When one recognizes the learning preferences of a particular group of students, you can design the learning materials and activities to appeal to these preferences and stimulate their cognitive development. This could in turn increase the students' motivation and therefore, their learning. Having looked at the cognitive aspects of learning design, it is also important to consider the affective domain and how this influences student engagement.

2.2.2 Affective

Reid and Solomonides (2007) write on how design students experience engagement and creativity and how this experience influences their learning. The authors discuss the complexity of the term creativity and furthermore, how difficult it is to decide whether creativity is an attribute of a person, a process or an object (Reid & Solomonides, 2007:27). The authors' assertion that creativity is not just a process, but also the ability to recognize a problem and design many different solutions to that problem, has implications for design teachers. These implications include adapting creative assessment methods to not only assess the solutions provided for a design problem, but also assess the process of analysing the problem (Reid & Solomonides, 2007:30).

Reid and Solomonides (2007:28) refer to Swede (1993:3), which suggests that creativity is not limited to an individual effort but that groups of people can also be creative. This suggests that creativity is also constructed socially. There is a perception that something which is creative is "unique and of value" to a particular community of practice (Reid & Solomonides, 2007:28). In design education, this community consists of both the design teacher and student. It can however be said that the creative process followed is different for each design student. The question asked by the authors is: how do students of design use their views on creativity to "support their levels of engagement" (Reid & Solomonides, 2007:28) This question links to an earlier discussion by Aragon et al., (2001) on Curry's, (1991:6) idea that engagement is gauged by the amount of attention paid, the level of concentration, participation, enthusiasm and persistence. It can be argued that if creativity influences engagement, then the defining factors of the way in which a student's creativity works is dictated by that student's attention, their the level of concentration, participation, enthusiasm and persistence. The student's concentration speaks to how he/she perceives the problem. The participation, enthusiasm and persistence will dictate how many different solutions to the same problem he/she can come up with. Creativity can therefore be linked to the ideas that Curry (1991) discusses as gauges for engagement and creativity.

Reid and Solomonides (2007:30) speak of a "student's sense of being", which is at the centre of their experience of engagement and creativity. Their sense of being would include confidence, happiness, imagination and self-knowledge. The four factors that feed from the central sense of being are artistry, designer, transformation and context. The student's sense of being impacts these four aspects of the "experience of being a design student". Figure 2.1 shows the core values that contribute to students in the study's sense of being.

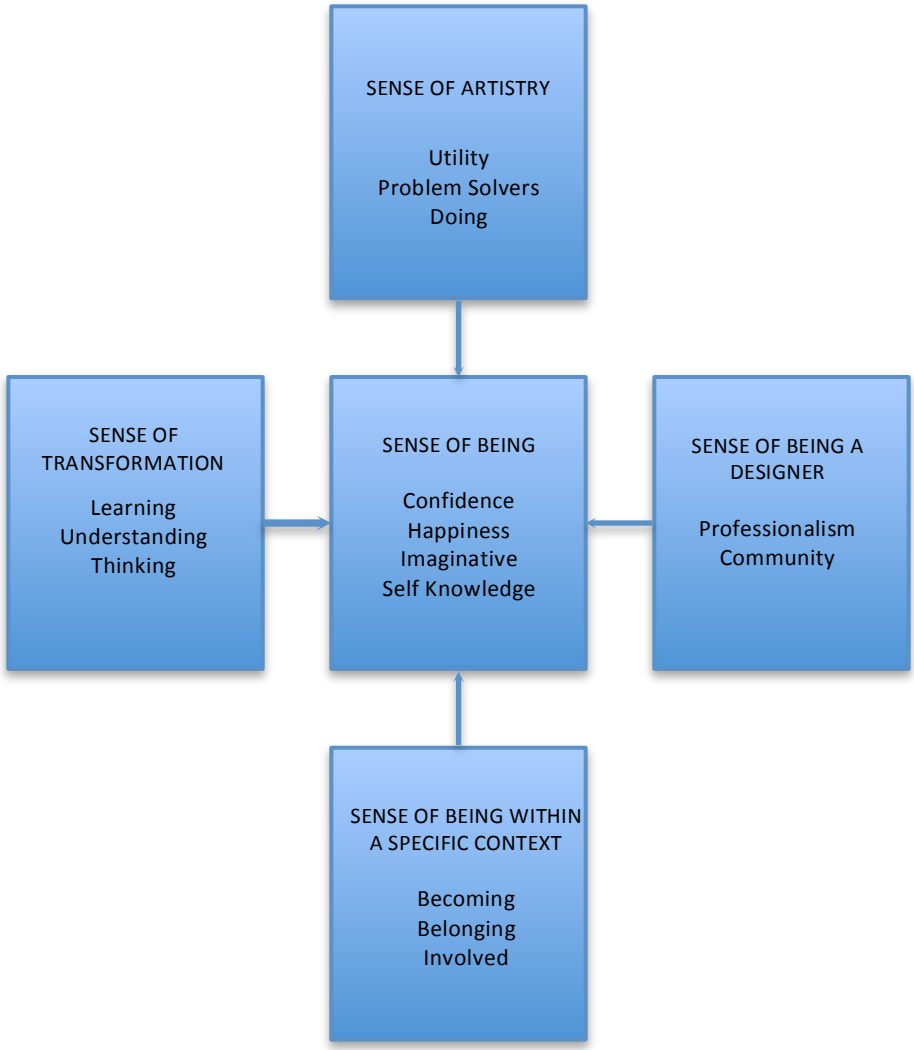


Figure 2.1: Design Students' experience of engagement and creativity (Reid & Solomonides, 2007: 27 – 39)

The sense of artistry is linked to the activities of being a designer. These activities include making objects and solving of design problems. They are seen as the practical utilities. The students' sense of being as a designer is influenced by being professional and by feeling part

of the design community. The sense of transformation speaks about how learning transforms the student. The learning that takes place while students are at university helps them to transform their thinking and they develop an appreciation of "the work and life of a designer" (Reid & Solomonides, 2007:33). In Reid and Solomonides (2007:33) students indicated that they were able to adapt their working and thinking to suit their context. They described a sense of context that allows them to fully engage with the design problem at hand and come up with a solution unique to the context. The authors say that if students experience a sense of artistry, being a designer, being within a specific context and this transformation of thinking will increase their confidence, happiness, self-knowledge and imagination.

The authors state that in the design disciplines, engagement and creativity are "merged and mutually supportive" (Reid & Solomonides, 2007:35). They say that students need to do more than just engage in course activities; they need to feel that they are learning in the right context and furthermore, that they are doing that which would contribute positively to the design community. Reid and Solomonides (2007:37) suggest that tasks are set to engage students in a "passionately meaningful way". They also suggest that there should always be a link to the professional community of designers.

Once the cognitive and affective domains have been activated, students need to practice these acquired skills. This means that the physical construct/result of their learning has to take place. The psychomotor domain of Bloom's taxonomy is where these constructs happen. The following section will discuss the value of psychomotor skills in the design disciplines.

2.2.3 Psychomotor

The psychomotor skills of the designer are crucial. It is the skill that allows the process of design to be complete. Once students have developed their cognitive and affective domains and both these needs have been satisfied, they need to be able to translate this knowledge and these feelings of what is right and wrong to an actual artefact. They need to use their sense of knowing to make something, evaluate it and then they need to be skilled enough to know how to fix what is wrong with it. The consistent development of the cognitive and affective domains should lead to the students developing guided responses, complex overt responses, adaptation and eventually origination at the graduate level.

The learning preferences of design students and the unique requirements of teaching and learning in design forces one to look closer at the requirements for instruction that will be based in a design classroom. The following section looks at the existing literature in the field of instructional design. It looks at the literature relating to instructional design, online instruction and communities, and the digital nature of contemporary education.

2.3 Developing Teaching Materials/Instructional Design

Merrill, (2002: 44) suggests five principles for instruction:

- Learning is promoted when learners are engaged in solving real-world problems.
- Learning is promoted when existing knowledge is activated as a foundation for new knowledge.
- Learning is promoted when new knowledge is demonstrated to the learner.
- Learning is promoted when the learner applies new knowledge.
- Learning is promoted when new knowledge is integrated into the learner's world.

Figure 2.2 below shows a diagrammatic representation of Merrill's principles as a problem centred approach.

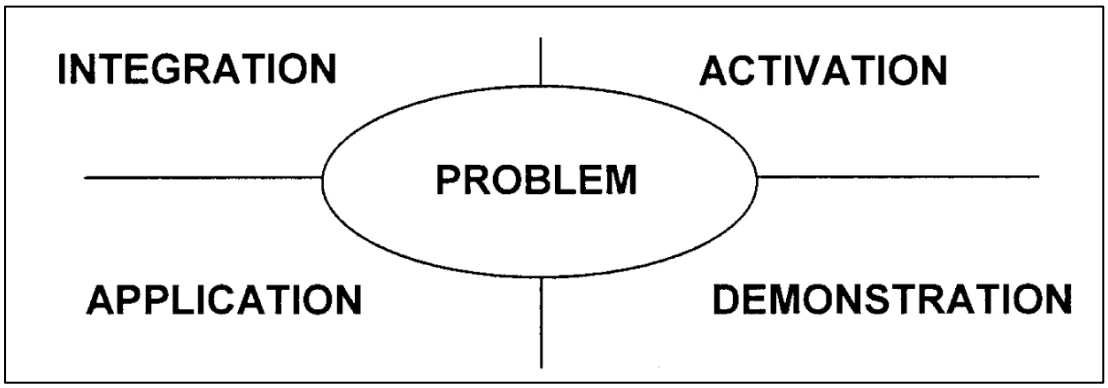


Figure 2.2: Phases for effective Instruction (Merrill 202:45)

Meanwhile, Jonassen, Carr and Yueh (1998:24) discuss the topic of computers as mindtools. They define mindtools as technologies that do not merely support learning but are used to

construct knowledge. Mindtools are "knowledge construction tools that learners learn with and not from" (Jonassen et al., 1998:24). When learners are constructing their own knowledge they function as designers and the computer is just a tool used to organize their ideas and knowledge. Merrill's (2002:44) concept of activation is key in the statement that using computers as mindtools will encourage learners to think about what they know in "different, meaningful ways" (Jonassen et al., 1998:24).

Jonassen et al. (1998:25) describe the different classes of mindtools. They cover semantic, dynamic modelling, information interpretation, knowledge construction, conversation and collaboration tools. In addition, they discuss examples of the different classes of mindtools and what one uses them for. In relation to this study, Jonassen et al. (1998:30) discuss microworlds as exploratory "learning environments". This would relate directly to Merrill's demonstration and application strategies, which requires a demonstration of how to solve a problem and how to apply the problem solving skills to another context in an appropriate manner. Jonassen et al. (1998:30) see microworlds as spaces where learners can manipulate the environment, create objects and also test the effect that they have on each other. They describe microworlds as "the ultimate example of active learning environments" (Jonassen et al., 1998:30). This is attributed to the fact that the user has so much control over the environment.

Jonassen et al. (1998:33) refer to Papert's, (1991) term "constructionism" that speaks about learners constructing knowledge by constructing things. The authors imply that learners learn more about objects when they construct them rather than study them. Jonassen et al. (1998:34) are aware of the fact that learners need particular skills in order to construct things. They list the major thinking skills the students need as:

- Project management skills
- Research skills
- Organisation and representation skills
- Presentation skills
- Reflection skills

The major thinking skills proposed by Jonassen et al. could be compared with Merrill's phases for effective instruction. This comparison (Table 2-A) shows the phases during

learning activities to be considered by educators (based on Merrill), and which of Jonassen's major thinking skills can possibly be developed during each phase.

Table 2-A: Comparison of Jonassen et al.'s major thinking skills with Merrill's phases for effective instruction

JONASSEN ET AL	MERRILL
Project management	Problem
Research	Activation
Organisation and representation	Demonstration
Presentation	Application
Reflection	Integration

Furthermore, Vygotsky (1978:85) suggests at least two levels of development when talking about learning. One is the "actual developmental level" (Vygotsky, 1978:85) and the other is the "zone of proximal development" (Vygotsky, 1978:86). The actual development level is the student's abilities when working as an individual and solving a problem in isolation. The zone in which a learner's intelligence level is measured by their ability to perform tasks, assisted or guided, by a more skilled peer or teacher is the "potential development level" (Vygotsky, 1978:86). The "zone of proximal development" (Vygotsky, 1978:84) exists between the actual and potential development level. This is the place where most social learning takes place. Jonassen et al. (1998) state that newer learning theories emphasize the social as well as constructivist aspect of the learning process. They say that one normally learns more from socially negotiating meaning rather than being taught a concept. This statement refers to available computer-supported environments such as chat tools, social networking sites, email, blogs, etc. These communication tools perpetuate the long existing cycle of social learning through "interpersonal exchanges among students". Vygotsky (1978:85) said "a student's intellectual development cannot merely be measured by what he/she can do as an individual, but should also take into account the level at which he/she operates when working in conjunction with a peer or other person more skilled than themselves". This would suggest that in some instances, the learning of a student could increase in a social context rather than working in isolation. Jonassen et al. (1998:34) draw attention to the fact that online communication tools presume that students can communicate and actively participate in conversations. They say that many students are incapable of having a coherent conversation, as it has never been expected of them to

contribute their opinions about topics. Jonassen et al. (1998:34) hold the social constructs of learning in high regard and encourage teachers to use the available collaborative conversation tools and in this way help students to establish these important communication skills. This usage of the conversation tools will encourage students to develop beyond their "actual development level" (Vygotsky, 1978: 85) and operate in their "zone of proximal development" (Vygotsky, 1978:86). Dewey (1938:25) suggests that the teacher not be excluded from social group activities but "be included as a leader in the group activities that take place in the social learning situation".

Oliver (2002:2) says that the contemporary curricula should look at the competency and performance of students and should be increasingly concerned with how information is used rather than what information is used. The how speaks to the organization of information in the mind and how the mind is trained to organize specific ideas/concepts in a specific manner. Jonassen et al. (1998:36) rationalize their promotion of technology as mindtools by asking the question: "why do mindtools work?" They imply that the person who learns most from designing instructional materials is the designer himself. Similarly, Resnick (2002: 33) makes a finger paint and television analogy. Resnick advocates that computers should be seen less like television and more like finger paint. It is a creative tool and does not only provide information but presents the opportunity to disseminate information and should be seen as a tool for creating learning opportunities. Consequently, when students construct their own learning they learn more about the topic than merely being told about it. When more skilled peers and teachers guide this learning, the student moves from their "actual development level" (Vygotsky, 1978: 85) and operate in their "zone of proximal development" (Vygotsky, 1978:86).

Adding to this, Papert and Resnick (1995) speak of digital fluency. They describe it as not just knowing how to use ICT but also knowing how to construct "things of significance" using the tools. Jonassen et al. (1998:31) recognize that not all students can immediately use mindtools and minimal training will be necessary to ensure competence. Jonassen et al. (1998:31) recommend mindtools as not only information dissemination tools, but as tools for "engaging learners in reflective, critical thinking about the ideas that they are studying". In this same spirit, one must ask the question: how do we engage design students to the point where they can construct complex ideas and meaningful solutions when faced with a design challenge?

Storey, Phillips, Maczewski and Wang, (2002:91) discuss the usability of web-based learning tools. They define web-based learning environments as either an addition to face-to-face instruction or a distance learning delivery method. Similarly, Ardito et al. (2006:270) say the purpose of educational software is to support learning. Ardito et al. (2006:270) believe that e-learning will help avoid a digital divide and that the different ways in which students learn should be taken into account when these environments are being designed. Even though many pedagogical studies have been done to look at different web-based applications, Storey et al. (2002:91) comments that very few studies have looked at usability. Storey et al. (2002:91) note one WebCT study showed a significant amount of learners who found it difficult to use WebCT, however the study did not show why these learners found it difficult to use.

Storey et al. (2002) define usability as the extent to which the environment assists the user to perform their task. It normally refers to the interface design and navigation of a particular environment. When designed for educational use, there are several additional factors that play a role in usability. These are the design of the learning activities that take place, as well as the learner's ability to control certain aspects of the activities (Storey et al., 2002:92). Ardito et al., (2006:270) stress the importance of the relevance of the usability features to the learning task objectives. Storey et al. (2002:92) examined usability through questionnaires, observation, interviews and professional review.

Moreover, Storey et al. (2002:92) say that there are three main factors to look at when designing a user interface:

- Visual Hierarchy - The important elements must be clearly visible.
- Appropriate feedback- For every action the user performs the interface should give feedback so that the user can evaluate their action.
- Consistency- The treatment of navigation, links, sequences, etc. should be consistent in order to make sure the user becomes familiar with the interface.

A study conducted by Storey et al. (2002) comparing Blackboard and WebCT noted that most of the web-based learning tools that they evaluated violated the above rules (Storey et al., 2002: 92). This impacted negatively on the students' experiences and attitudes towards using the tools. They found that the users rated the Blackboard system better in terms of usability than the WebCT. The feedback from users also reflect the factors mentioned previously. It speaks to the importance of feedback given to the user, ease of navigation and

clear labelling of buttons, links, etc. They also looked at usability from the Lecturer/administrator's point of view. Ease of navigation and action sequences played a great role in the evaluation of administrative usability.

The impact that the design of a web-based learning tool has on learning was not measured in the study presented here. It did, however, look at what factors improve usability. When a web-based learning tool is designed under the guidance of sound principles, it creates a tool that is seamlessly integrated into the curriculum. It then allows more time for the construction of knowledge as previously discussed. It is inherent that when users are struggling to learn to use a web-based tool, it interferes with the process of learning and gives rise to a lack of interest and also impacts negatively on the learning process. To be able to effectively construct knowledge through constructing things, the environment within which construction happens has to have easy and consistent navigation. This also increases user confidence in the tool and subsequently increases learning. In addition to the usability issues, the context of the web-based tool is important. Students said that the hardware should be able to accommodate the tool and all it's functions.

Barab, Kling & Gray (2004:3) link usability, earlier discussed by Storey et al. (2002), and sociability. In this case, however, usability speaks of the design and use of the online environment creating a sense of community. The authors state that an online environment can easily be created but learners have to be attracted to it to visit it. Barab et al. (2004:4) say that a sense of community will bring different learners to the same online environment. This sense of community is created by the following factors: "a significant history, a shared cosmology and a common cultural and historical heritage". The definition of a community is different depending on context. What constitutes a community, how the occurrence of communities is measured and the efficacy of communities as a learning environment is not clear (Barab et al., 2004:6). Barab et al. (2004:7) admit that it is difficult to prove that such a community actually supports learning and is relevant to learning. Wenger (1998:2) says that "members of a community of practice are informally bound by what they do together and that the community itself dictates the practices".

However, it does not mean because one builds an online environment, an online community exists (Barab et al., 2004:7). There are many other factors which influence how users interact with the online environment. Designing "for virtual communities involves balancing and leveraging complex dualities…from the inside rather than applying some set of design

principles from the outside"(Barab et al., 2004:8). The authors caution a careful balance between wild claims and data supported theories.

Riel and Polin (2004:18) discuss how learning takes place within online communities. They describe learning as a social construction. They say that even when an individual seemingly has completed a task individually, the community around them has still influenced them. Whether these influences are apparent or not, they do exist. In the same way as the surrounding community influences the individual, so also does the individual's ideas influence the communities around them. It is therefore a perpetuated cycle of influence. This once again refers us back to the difficulty in defining what constitutes a community. The authors define community as a "multigenerational group of people, at work or play, whose identities are defined in a large part by the roles they play and relationships they share in that group activity" (Riel & Polin, 2004:18). The difference between a group of people and a community is the depth and strength of the culture established among them. This links with Barab et al.'s (2004:4) definition of community, which speaks of common interests amongst the members of a community. In a similar manner, Riel and Polin (2004:18) refer to other authors whose writing informs their definition of learning. They define learning as "a process of identity transformation – a socially constructed and socially managed experience".

Riel and Polin (2004:20) suggest three distinct types of learning communities or "communities designed specifically to support learning":

- Task-based
- Practice-based
- Knowledge-based

The authors look at the similarities and differences of these communities based on:

- *Membership*- Who joins the group? How do they get to the group? What is the life span of participation? And how are members defined?
- *Task features and learning goals*- What is the purpose of the group/community coming together?

- *Participation structures* - Do all members have full access? What are the roles that members play?
- *Mechanisms for further growth and reproduction*- How does the community grow and continue to exist whether members stay or leave?

The comparative Table 2-B shows the three types of learning communities and how they are structured.

Table 2-B: Comparison of Task Based, Practice Based, and Knowledge Based Learning Communities (Riel & Polin, 2004)

Dimensions	Task-Based	Practice-Based	Knowledge-Based
Membership	Members assigned or grouped on basis of task features	Members seek participation to become more experienced practitioners	Members participate by virtue of relevant expertise and common interest.
	Members know one another	Members may or may not all know each other	Members ay or may not know each other
	Temporary group identity with task	Strong identity with a role in on-going practice/profession	Strong identity with knowledge/expertise
	Informal or emergent division of labour	Formal division of labour based on roles and identities	Formal division of labour based on roles and identities
	Formal or informal leadership, linked to completion of task	Leadership emerges from acknowledged experience and expertise, a source of on-going tension in the community	Leadership evolves from knowledge-building successes and reputation in the knowledge field.
Task Features/ Group Learning Goals	Well-defined topic, project or problem with clear start and finish	Productive, collective activity comprised of many tasks	Evolution of the knowledge base through current use and for future users to improve practice.
Task Features/ Group Learning Goals	Learning goals as a part of the project	Learning as the tacit or explicit consequence of on-going practice, continual re-design and experimentation to solve challenges accommodate variation and integrate development of tools.	Learning as knowledge; focus on knowledge production, validation and dissemination
Participation structures	Small group interaction with informal division of labour	Open access to practice, practitioners, culture and tools of practice. Changes in members' roles reflect changes in their knowledge. Roles are related to the division of labour	Written dialogue and documents used to externalize, construct and reconstruct the knowledge base

Dimensions	Task-Based	Practice-Based	Knowledge-Based
	Ends with the completion of the product that reflects the learning.	Engaged in continual production of practical work, in the course of which learning opportunities arise	Organized and defined by the production of intellectual work and theoretical constructs.
Reproduction and growth mechanisms	Explicit transfer of practices and procedures across groups through products, procedures and guidelines.	Evolution of the practice through discourse, tools, artefacts of work, action routines, anecdotes about practice and other cultural mechanisms both tacit and explicit.	Develops and evolves a set of procedures for evidence and interpretation that are passed from one group to the next.
	Shared vocabulary and agreed-upon practice for the duration of the task.	Shared values and language; reproduction and evolution of valued practices, i.e. an evolving culture	Shared values and language reproduction and evolution of valued practices, i.e. an evolving culture
	Community practices carried between discontinuous groups by organizational leaders or programs.	Exchanges with adjacent, relevant practice communities, e.g. across companies in an industry, or across departments in a company or school, often through intentional brokering.	Interaction with similar knowledge-building learning communities, often through intentional brokering

There is an overlap of these three different kinds of communities. This overlap is called organizational learning and is a core of shared features and activities. The organizational learning speaks to the unit within which the communities exist and can be a business, school or institution. Within a learning organization system, knowledge is shared and instead of users re-inventing the wheel, new users can benefit from the past experiences of other users in the community. Bikowski (2007: 131) says, "Cultivating a sense of community in education has become increasingly popular". She explores what creates that sense of community in students and also how they experience online environments. The author discusses what makes students feel part of an online community in terms of social presence theory (Short, Williams & Christie, 1976) which states that the most important factor in establishing any media related relationships is that the communicator should feel like the other communicator is a real person. This research aims to find out what constitutes online friendship/community for a very specific group of students. According to Bikowski (2007:136) there are three main factors that contribute to developing friendships online:

- Individual factors
- Sharing and

- Support.

Individual factors include things like personality, interests and comfort with technology. Sharing is the project, the students themselves and consideration. Support from faculty, teammates and technology is also included. Bikowski says the presence of these three factors generate trust and group identity and ultimately friendship/community.

Riel and Polin (2004:21) suggest the use of knowledge management software or databases to link individual users to a larger community of people. They suggest that this kind of approach will build a culture of sharing knowledge and also of learning socially.

The sharing of knowledge and expertise and collaborative problem solving is a key concept that instructional design should encourage. It has also been the cornerstone of the studio approach that has been employed for many years in design education. It has however become time for the design studio to grow beyond the physical brick and mortar to a click and mortar age (Selwyn, 2007:84). The section to follow discusses literature around the studio approach to education in design.

2.4 Studio Approach to Teaching

The studio approach to teaching in design has been the standard practice for many years (Bender & Vredevoogd, 2006:114). Oxman (1999:107) states, "Traditional models in design education are based upon the replication of professional task performance". The emphasis, in this approach, is on the replication of a task and producing a result rather than the discovery of the process that leads to the result. Oxman, (1999:105) argues for the change from "an orientation to the production of design artefacts to a cognitive-based approach". The design classroom then becomes a simulation of the professional design world. The students go through the design process from concept to feedback and redesign stage. Oxman says that we have adopted experience-based learning as a basis for design education. The discussion initiated by the author is whether the processes employed in the traditional design classroom is effective in transferring design knowledge.

This section will argue that design education should consider the complexity of the cognitive structures within creative education and thinking. The focus of design education should not only be the artefact, although this is the ultimate goal, but to model students' thinking for solving a multitude of design challenges and develop knowledge of how to construct

solutions to different problems. This solution driven approach needs to recognize the rich nature of design knowledge as both didactic and tacit.

Oxman (1999:108) implies that students have to be modelled to become design thinkers. This modelling includes taking into consideration the duality of design learning, which involves both visual and conceptual knowledge. Oxman briefly discusses the dialectic nature of design thinking and also hypothizes that "modelling the representation of design thinking can be a lucid medium of design education" (Oxman, 1999:110). Pappas, (2002:1) reinforces the idea of modelling thinking by saying that when educating engineers, one can no longer solve all the "increasingly complex engineering problems" using traditional methods. Engineering educators will have to start teaching students to "solve complex design problems" (Pappas, 2002:1) and put the emphasis on students understanding how things work and how many processes come together to form a single solution. It is impossible to teach students all the solutions to all problems, but it is possible to teach them the process of thinking of solutions.

Harel and Papert (1991) introduced the idea that by constructing things that require students to think as designers, students then develop their ability to think in designerly ways. Their theory is named Constructionism and implies that design learning is the process of physically building knowledge. This is in agreement with literature that indicates a significant difference between "knowing" design and having "knowledge" of design (Oxman, 1999:110).

Constructionism as discussed by Harel and Papert (1991) is at the core of the studio approach used in design education. The concept discussed by Harel and Papert implies that students learn through constructing a physical entity. It is portrayed in contrast to Piaget's Constructivism. Harel and Papert also say that different people have different ways of constructing different things. These differences are what make constructionism such a viable tool. It allows for students to construct meaning and build knowledge structures in ways that make sense for them.

Harel and Papert make it clear that constructionism cannot be defined. The nature of constructionism ensures that it cannot be limited to a single definition. Each Constructionist is according to Resnick (1996:3) constructing in two ways: he/she is constructing a physical object and knowledge structures. Constructionism runs much deeper than just the making

of knowledge. It speaks to the internalization of concepts and the complex meaning making that takes place in the process (Resnick, 1996:3).

Resnick, (2002:36) makes a striking connection between learning and design and says that design "creates a rich context for learning". He notes that there has not always been a connection of the two. Learning theories and design theories, which used to stand separately, are now the building blocks for "learning through design" (Resnick, 2002:33). Resnick notes a convergence between the artefact-driven design field and the learning theories. There is a definite link between the constructionist theories and the studio teaching that has been taking place in design education. The simulation that is taking place in design classrooms encourages the development of a professional identity and consequently the construction of discourse driven knowledge structures. What Resnick explores through his study of the "computer clubhouses" (Resnick, 2002:33) initiative at MIT is the link between real-life design activity and learning.

Although these theories seem to explain the design education situation, there are also other factors that influence how students learn in a design environment. Students in design fields are classified as creative. It is therefore essential that we do not omit the impact this creativity has on their learning experiences and preferences. Schon and Wiggins, (1992:135) talk about "kinds of seeing" in design. They discuss the two kinds of seeing involved in the design process. The first kind of seeing is just merely seeing what has been designed. The second kind of seeing is being able to look at and evaluate what you see. Schon and Wiggins, (1992:137) imply that if a designer does not possess these two kinds of seeing they will not be able to "set problems nor be able to tell when they have solved them".

Schon and Wiggins, (1992:138) speak of appreciations, or appreciative systems, as systems of beliefs or values on which a designer's judgement of phenomena is based. These "appreciations" are expressed in tacit acts of judgement. It is a "feeling" (Schon and Wiggins, 1992: 144) that designers have for works/phenomena and the ability is nurtured and developed over a period of time and differs from person to person and also from different design disciplines. This resonates with Harel and Papert (1991) who say that different people have different ways of constructing meaning and building knowledge structures. Even though these "appreciations" Schon and Wiggins (1992:138) speak of are different for each designer, there are sometimes overlaps. Where these overlaps occur we find the emergence of design communities. Wenger, (1998:1) defines this community of practice as a group of people "informally bound by what they do together". Wenger suggests that the community

of practice is built around "what it is about, how it functions and what capabilities it produces" (Wenger, 1998:1).

Students each need to develop their individual appreciative system and capabilities by simulating the world of work and receiving feedback at a level that enables them to see, analyse (pass judgement) and improve (Schon & Wiggins, 1992). Therefore, a designer's abilities to see and their appreciative systems help them recognize good and bad design, evaluate it and make recommendations (Schon & Wiggins, 1992). Improvement will help them to move from the "periphery" (Wenger, 1998:2) of their community of practice to the "core" where they become an integral part of this community of practice. As the level of seeing of the student develops, so also will his/her appreciative system evolve and their contribution to their community of practice should increase. Involvement in the design community of practice helps students become aware of new aspects in their domain, and seeing abilities are improved. Even though a computer can never replace the human mind's perceptual ability during the design process, this research asks whether it could enhance the designer's ability to capture, store, manipulate, manage and reflect on the process of constructing design knowledge.

Although the studio approach has been an accepted practice in design education, this simulated real-world environment does not provide enough opportunity for the sharing of experiences and knowledge that needs to occur within a growing community of practice. Learning is seen as a social construct and can take place between participants with the same level of competency (horizontal) and also between participants with different levels of competency (vertical) within a community of practice (Wenger, 1998:2). In the studio setting, interaction (if any) between practitioners and students is limited to the horizontal and students levels of "design seeing" (Schon & Wiggins, 1992:135) is not developed enough.

An approach that encourages the development of different levels of design seeing, which also allows for vertical and horizontal interaction in communities of practice would have to be employed if we are to develop a design education environment that works. The tools used in the design profession have changed and includes the virtual, which should influence how we look at design education. In order to model the design thinking and behaviour we desire of students, we cannot ignore the integral role technology and ICT plays in their lives. If they are to construct the knowledge necessary for them to function as an integral part of their communities of practice, a curriculum has to be designed that recognizes this role. The

suggested solution is a blended learning environment, which incorporates online initiatives to enhance studio instruction.

2.5 Blended Learning

Bender and Vredevoogd (2006) are avid promoters of "blended learning" and explain that online classrooms are ideal educational environments and enhance studio instruction. They argue that the online teaching streamlines courses, provides opportunities for individual instruction and serves larger groups of students without increasing workload. The authors describe blended learning as face-to-face interaction where both student and lecturer is present, which is supplemented with "asynchronous or synchronous" online communication.

The hypothesis put forward by them is that "blending technology with traditional instruction will impact typical studio problems of high students to faculty ratio and high faculty workload" (Bender & Vredevoogd, 2006:116). They would call this environment the modified design studio. They also discuss the impact that the modified design studio has on the student learning and faculty workload. Comparisons are drawn between the traditional- and modified design studio.

"Integrating blended learning with the traditional studio can increase student learning" (Bender & Vredevoogd, 2006:119). The authors suggest that because technology provides the benefits of 'any-time' access and feedback to many students, it benefits their learning. It becomes apparent in this argument that because the feedback that students are given is in response to e.g. a range of work that has been submitted by different individuals, they are receiving richer feedback and can learn from feedback given about others' work. This perpetuates the notion of the horizontal and vertical exchange that takes place in a community of practice (Wenger, 1998:2). In a typical studio environment the feedback and knowledge exchange would only be vertical (from lecturer to student). In the online environment both vertical and horizontal exchange is happening simultaneously. The classroom then becomes a place where richer "intellectual communications" are taking place because feedback has already taken place online. Integrating computers into one's curriculum increases the efficiency of instruction and allows more time in class for other things. This research asks how one creates a blended learning environment that provides students with succinct and non-repetitive feedback and reduces the hours that might have been spent giving feedback to individuals. If one could reduce feedback to a minimal

amount of time, students wouldn't have to wait for hours before going onto the next stage of the design process and it would dramatically reduce the workload of the faculty.

Bender and Vredevoogd (2006:120) admit there are some pitfalls to including computers. One of these is that the users will first have to be taught the use of the technologies and feel comfortable using it. There needs to be technical support given to both the staff and students in order to ensure a pleasant experience. Another pitfall is that the general nature of feedback to students could lead to students not necessarily knowing what they need to do as individuals and this could lead to a lack of personal reflection. Furthermore, the students when using technologies as part of the curriculum will inevitably receive less individual feedback and attention. Clark and Maher (2005:2) put emphasis on the contextual experience that is shared in a face-to-face classroom. The authors say that one needs to create a collaborative space online in order for students to feel like it is their own. Prensky, (2008:2) says that the role of technology in education is to "support the new paradigm". This implies that educational technology is not intended to replace face-to-face or studio teaching but rather enhances it by reaching students at their engagement level. Bender and Vredevoogd, (2008:120) in agreement, admit that not everything can be done online as certain activities are best addressed personally. However, Bender and Vredevoogd, (2008:120) say that, the electronic submission of assignments "free students from the physical restraints of time and place". This changes the in-studio approach to concentrate more on meaning making and once this meaning is made, students can apply the knowledge they gained in their own space and time.

The research presented here does not claim that using technology in design education will replace the studio or face-to-face instruction. Bender, (2004: 8) makes this clear by saying that, "The benefits of instructional technology may not relate to educational quality, increased academic productivity, or better student learning, but instead, offer educators and their students opportunities which would not exist without technology". Instead this study poses the question: how can we effectively, taking into consideration our students' cognitive processes, use online technologies to enhance their experience of design? The research takes a realistic look at both the pitfalls and advantages of blended learning as Illustrated in Table 2-C and attempts to propose blended learning as a remedy for the gaps that exist in studio instruction presented in Table 2-D.

Table 2-C: Advantages and Disadvantages of Blended Learning

Blended Learning	
Advantages	**Disadvantages**
Assignments can be introduced face-to-face and submitted electronically 24-48 hours before class time.	Electronic responses to later difficulties may be delayed.
Class size could expand and increase accessibility.	Students could become “numbers” and lose individuality needed for successful design education as in Ecole Des Beaux Arts
Group feedback can be online and all can benefit from each other’s feedback meaning critic only addresses repeated students errors once.	Critic still has to give individual critic in class (double work?)
Design skills are strengthened by the student’s ability to build on the feedback of other students’ projects and feedback.	
Students can review critiques on demand and can “attend” the critique from remote locations.	

Table 2-D illustrates how blended learning fills the gaps that exist within the practice of studio teaching.

Table 2-D: Adaptation of Bender and Vredevoogd (2006) to illustrate how blended learning fills the gaps in studio learning

Traditional Design Studio	**Blended Learning**
Disadvantages	**Advantages**
Assignments can only be introduced and submitted during class time.	Assignments can be introduced and submitted electronically 24-48 hours before class time.
Class size is typically 15-20 students to one instructor per section.	Class size could expand and increase accessibility.
The individual critiques provided in class are seldom shared with other class members. Therefore the same feedback may be reported to several students within the same class period.	Students can receive group feedback and all can benefit from each other’s feedback meaning critic only addresses students’ errors once.

The competitive nature of design classes limits the sharing and nurturing of ideas and causes many students to work independently.	Design skills are strengthened by the student's ability to build on the feedback of other students' projects and feedback.
Students have to be physically present in a studio when critique is given. Unless recorded it cannot be reviewed at a later time.	Students can review critiques on demand and can "attend" the critique from remote locations.
Work done in the studio may turn into a collaborative effort between the student and the instructor making it difficult to determine what part of the project the student has done. The instructor must be cautious about doing the assignment for the student.	The instructor does not guide any single student through the design process, but guides the class as a whole.

Table 2-D above clearly illustrates what the Blended Learning approach can offer design education. It proposes to remedy the gap that exists by designing learning that provides a collaborative space where both vertical and horizontal knowledge exchange and meaning making can take place.

Blended learning is "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004: 96). In order to establish this careful integration we have to examine the online environments and the factors to consider when making it an integral part of a blended curriculum.

2.5.1 Online Learning

In the blended learning environment, a balance must exist between the blends of media. An integral part of this balance is the online environment. This environment is available in many forms, commonly classified as Information Communications Technology (ICT). This includes the computer, cellular phone, iPods, PDAs and other handheld devices.

Resnick (2002:32) said that the declining cost of computers and technology will make these devices more accessible. This means that how and what people learn will change fundamentally and give rise to a "learning revolution" (Resnick, 2002:32). The link is made between computers and education because of their common relation to information. The digital revolution has been running a parallel course with the evolution of the design classroom. Resnick (2002:33) draws from Piaget in saying that learning is not just a transfer of information but rather an active process in which people construct new understandings of the world around them through active exploration, experimentation, discussion and

reflection. In the same way Resnick (2002:33) says, "In addition to accessing Web pages, people can create their own Web pages. In addition to downloading MP3 music files, people can compose their own music. In addition to playing SimCity, people can create their own simulated worlds". This leads to the conclusion that new learning opportunities are being created through the use of computers.

Resnick explores the concept of the "Computer Clubhouse," a Massachusetts Institute of Technology (MIT) initiative, where learning centres are setup in disadvantaged communities. Clubhouse members come to these centres and use cutting edge software to create the technologies that they consume. Some examples from the initiative are that if a person loves games, they can design a game; if they like to watch videos they can create a video of their own. This enables them to learn how to manage a complex project from start to finish.

Resnick (2002:35) suggests a re-evaluation of the design of educational technologies. He suggests that instead of an objective conforming to the computer, the computer can be conformed to the objective. E.g. building mini computers into building blocks that can run motors like LEGO Mindstorms. The author says that many nations are realizing by improving education one can increase wealth, health and maintain peace. He suggests in order to increase and improve education we need to:

- Rethink how people learn
- Rethink what people learn
- Rethink where and when people learn

2.5.1.1 Rethink How People Learn

Classroom structures need to be re-assessed. Students should become active and independent learners. Teachers should be consulting and projects should be cutting across many different fields. Students of all ages and knowledge levels should work together on projects and the time spent on projects should be extended to encourage deeper and meaningful engagement (Resnick, 2002:36). Because members of a community of practice are informally bound by what they do together, and the community itself dictates the acceptable practices (Wenger, 1998:2), horizontal and vertical knowledge exchange takes place with less input from the teacher.

Often our perceptions of how people learn are based on how we have been taught, or prefer to be taught (Fleming, 1995:313). We need to recognize the individuality present in our classrooms and address the learning needs that exist. The work of Neil Fleming and the VARK methodology can be employed to help discover how individuals prefer to learn.

2.5.1.2 Rethink What People Learn

The Curriculum needs to be updated to fit the digital age. Educators need to prepare students for the new skills and ideas that are required for living and working in a digital society. With the current technological advances, students can learn much more than before. Computer simulations and explorations make many more concepts and experiences available. This supports the idea of building a body of professional knowledge through real world simulations enabling students to move from the "periphery" to the "core" of their community of practice (Wenger, 1998:2). Instead of just teaching students how to solve a particular problem we need to show them which processes to go through to solve a multitude of problems. We will have to start teaching students to "solve complex design problems" (Pappas, 2002:1) and put the emphasis on understanding rather than doing.

2.5.1.3 Rethink Where and When People Learn

Learning should not just be encouraged between ages 6 and 18 and should not be limited to take place from 08h00 to 15h00. There should be ample opportunity for people of all ages and in any location (home, museum, workplace, etc.) to learn. There should also be knowledge-building communities within which both adults and children can collaboratively work on projects. The online classroom makes learning available to students anytime and anyplace it gives an opportunity for learning to take place at the convenience of the learner.

Resnick (2002:36) stresses the "need for creative thinking in all aspects of our life" so as to create a society where we are constantly inventing new possibilities for our communities and ourselves.

Oliver (2002:3) states: "ICTs by their very nature are tools that encourage and support independent learning". In "contemporary learning theory, instruction is the process by which knowledge construction is supported rather than a process of knowledge transmission" (Duffy & Cunningham, 1996:171).

Oliver argues that the use of ICTs should significantly change the face of education. He discusses the impact of ICTs on what, how, when and where students will learn. This links

with Resnick's (2002:36) idea of rethinking when and how learning takes place and also encourages the building of learning environments that are available to students when they need it. The geographic location of a person becomes almost irrelevant in environments that are online. In the same spirit, Oliver (2002:5) states that when students are not limited in terms of class times and lecture theatres, a phenomenon he calls "anytime, anyplace learning" takes place. This research looks at the activities that students perform while using online environments, whether they use the environments for learning and have access to these environments after hours in order to enable "anytime, anyplace learning".

Teaching has always been structured around content delivery but recently it has moved in the direction of competency and performance (Oliver, 2002:2). Curriculum design needs to consider how information is going to be used rather than on the information itself. There should be a clear picture for the student as to the vocational value of what is being taught. Oliver (2002:2) suggests that as educational institutions gain access to more bandwidth and more shared resources, the ability to create this environment will increase. Oliver also recognizes the impact ICTs will have on increasing students' ability to evaluate a problem and source information to solve the problem. This increased availability will enrich the information literacy aspect of their education. However, in South Africa, the situation is different than in many first world countries. Though institutions are desperately trying to increase access to the online world, there are still many limitations regarding reliable access and bandwidth. The question should be asked: how do South African institutions incorporate ICT into competency-based curricula taking into consideration the unique technological situation we find ourselves in?

Oliver suggests that as we move away from content-based curricula we will also move away from teacher-centred learning to student-centred learning. This means that because of "anytime, anyplace learning," students are taking more responsibility for their own learning. Instead of lecturers depositing information, through the use of ICTs, students can choose who the experts they learn from are. This also means that students are constructing their own knowledge as Jonassen et al. (1998:10) encourages.

Oliver (2002:6) has found that with the integration of ICTs in education also come issues such as increased staffing, students and costs. The change from traditional education to ICT will mean having to employ teachers who are more facilitation driven than didactic. It will mean a larger group of students, as students who would have been unable to study due to time constraints would now have access to the classroom. The financial implications in

terms of developing "high quality technology-facilitated learning materials" are also quite large (Oliver, 2002:6). However, in the long term, the student that this kind of system is going to produce is going to be one that satisfies the needs of the workplace in the 21st Century.

It is recognized that the personality of a student and their preferences play an important role in the establishment of online friendships (Bikowski, 2007:136). Many students prefer face-to-face contact and conversations. They will use online environments if it is required, but only in that professional capacity. Others, however, embrace the opportunity to meet online and establish a real personal friendship with someone on the other side of the world. Bikowski's (2007:138) case study showed that having a feeling of friendship and community online, contributed to the success of collaborative projects because students felt more relaxed, and were willing to share more and be honest. The research in this paper also briefly examines the social aspect of online environments and to what it contributes to the learning experience. It asks whether students make distinction between the two and whether or not they ever meet.

Similarly Selwyn (2007:84) agrees that the use of ICTs in education should take into consideration the social constructs present. The author recognizes the need for this social element to build lasting online relationships. Even though there are many options available in the educational ICT sector Selwyn expresses a concern at the elementary use of these technologies in universities. Despite the amazing possibilities presented by educational technology researchers, the actual use of technologies leaves much to be desired (Selwyn, 2007:84). There are factors that influence how technology is implemented in universities. These include how much emphasis is placed on the use of technologies at management level. University students have many demands placed on them and Selwyn (2007:88) highlights that "learning to use technology" is not their only responsibility. This means that one should have realistic expectations of the use of online technologies. It is a gradual process and the implementation of technology into individual universities, especially in Africa must evolve realistically.

Current graphic design education practices in CPUT do not employ a blended model. There is an increasing need to recognize the role ICT can play in a blended design curriculum. This research investigates the factors to take into consideration when designing such an inclusive blended curriculum.

In order to successfully design a blended learning approach one needs to be aware of the learning preferences of students, their current online activities and how they perform online. All of these factors could help with the design of an online learning environment specifically aimed at design students.

2.6 Conclusion

After reading the relevant literature, it is necessary to ask how one designs the online component of a blended learning environment so that it:

- Incorporates collaborative problem solving?
- Encourages the building of design knowledge?
- Helps students move from the periphery of the community of practice to the core?
- Simulates the world of work?
- Considers the individual learning preferences of students and engages them on multiple levels?

The design of the research study that attempted to answer the aforementioned questions employed the Analysis, Design, Development, Implementation and Evaluation model and is presented in the following chapter. The analysis will encompass goal, target population, task, performance and media employed. The design, development and implementation will look at the research in terms of Gagne's nine events of instruction. Finally, the evaluation will look at the overall process and consider the validity, reliability and consistency of data.

3 Chapter 3: RESEARCH METHODS

3.1 Analysis

3.1.1 Goal

The goal of the research was to see how an online learning environment intended for design students could be devised to encourage student engagement. The important issues included predominant learning preferences within a specific group of graphic design students, the analysis of their interaction with an existing online environment in terms of social and academic engagement, and ways in which the learning preferences should contribute to the design of an online environment for design students.

Looking at these specific areas, questions were raised relating to:

1. What are the characteristics of a typical design student; what engages them and what appeals to them?
    a. What are the learning preferences amongst a group of design students and how do these preferences influence their learning experience and performance?
2. What do design students do and want when they go online?
3. How do we apply this to educational environments while also emulating the world of work?

3.1.2 Target Population

This study was conducted with a group of 28 Extended Curriculum Programme (ECP) graphic design students at Cape Peninsula University of Technology (CPUT), who the researcher was lecturing on a weekly basis at the time. The class consisted of 34 students, but only 28 were actively participating in classes. The researcher therefore had regular access to the respondents, was familiar with the structure within which these students were functioning, and could understand the context within which the students were learning.

ECP students are those students who apply to the three year National Diploma in Graphic design, have potential, but cannot gain access due to a lack of necessary skills. The ECP course permits these students to acquire the skills needed to complete their National diploma, during an extra year of study, extending their diploma to four years. The ECP students' second year of study is in conjunction with the three-year candidates first year of study.

3.1.3 VARK Questionnaires

The first task students had to complete was the VARK questionnaire (Appendix A on pg 119) to determine their learning preferences. The questionnaire consists of 16 multiple-choice questions. The calculations for the learning preferences were done according to VARK learning preference guidelines presented in Table 3-A

Table 3-A: VARK preference guidelines

Total No of Responses	Very Strong Preference indicated by a difference of	Strong Preference indicated by a difference of	Mild Preference indicated by a difference of
Up to 16	4+	3	2
17-22	5+	4	3
23-30	6+	5	4
31+	7+	6	5

Table 3-A shows the calculations used to determine the strength and predominance of the learning preferences of a respondent. Each question in the VARK questionnaire has 4 options. Because students are not limited to one answer per question they could have anything between 16 – 64 answers. The number of answers given by a student affects the predominance of any of the 4 learning preferences. E.g. Anny has a VARK score of 5, 8, 9, and 2 for each VARK category respectively. This means in total she had 5+8+9+2 responses = 24 responses. This means Anny falls in the 17 – 22 response category. In this category a very strong preference is indicated by a difference of 5+, a strong preference by a difference of 4 and a mild preference by a difference of 3. This means that Anny has a very strong preference for Aural and Reading and Writing with a mild preference for Visual and no Kinesthetic preferences.

3.1.4 Whyville Task

The second task the students had to perform was to create a wallpaper design using a specific tool in a specific location in Whyville. The design task required students to apply the knowledge of the design principles taught previously in the studio to an online design problem. They had to use the tools available in the wallpaper maker as shown in Figure 3.1.

Figure 3.1: Screenshot of the Whyville Wallpaper Maker

The task was given to students after showing them how to navigate and use Whyville. Therefore, students were expected to re-apply knowledge gained in their previous interactions with Whyville to complete the task. Cognitively, the task was aimed at the application level of Bloom, Anderson and Kratwohl's taxonomies. In Bloom and Anderson's affective domain, students were expected to act within the response category as they had to voluntarily perform the task and there was no external motivator.

The brief for the assignment given to the students specified the requirements of the task (Appendix H on pg 173). One must remain cognizant of the fact that the students in this study are enrolled in ECP and this qualification currently falls under the National Qualifications Framework (NQF) Level 5, which requires students to be able to use their knowledge to solve well-defined problems, both routine and unfamiliar, within a familiar context.

3.1.5 Performance of Whyville Task

Even though students were expected to perform at the above-mentioned cognitive, affective and psychomotor levels, their actual performance, when assessed by multiple raters, exceeded the level of work generally done in ECP, and in other instances, were below what was acceptable at this NQF level . The cognitive aspect often receded into the remembering level, as students would forget simple actions like logging in or navigating from one area of Whyville to the next. In the affective domain, the students mainly performed in the response category. A few of the participants however, went into the receiving domain, not really understanding what they are doing but merely following instruction. This occurrence lines up with the guided response level in Simpson's affective domain.

For the purposes of evaluating the designs created by the students, a five level performance rating scale was developed. The performance levels 1 – 5 are based on Simpson's psychomotor domains and exclude the perception and Origination phases. The ECP students, as previously mentioned, function at National Qualifications Framework Level 5, which requires students to be able to use their knowledge to solve well-defined problems. This meant that the perception level (a very low level of understanding) and the origination level (a very high level of interpretation) were irrelevant to these students. Simpson's reduced Psychomotor Domain was augmented to become the five performance levels and not only include the physical actions performed by students but also the cognitive choices they made. Performance Level 1 is the lowest level and Performance Level 5 the highest.

3.1.6 Media

The participants had been introduced to the basic design principles in the studio during a traditional face-to-face lecture. The initial introduction of the Whyville environment was done in the PC lab. Whyville was originally designed as a safe online environment for teens and preteens. Its goal is to engage its users in learning about a broad range of topics, from science and business to art and geography. As a simulation based virtual world, Whyville's users engage in games and role-play sponsored by a wide range of governmental, non-profit, and corporate entities. Whyville, one of the first virtual worlds for children, was launched in 1999, by Numedeon Inc. and is one of the few virtual worlds whose purpose is primarily educational. Whyville has been used for educational research and to study student interactions in virtual worlds. Although Whyville was designed for teens and preteens it was

used in this instance because of the web limitations/firewall issues at CPUT. Any of the other virtual worlds, e.g. Second Life, would not offer full functionality on the CPUT network.

3.2 Design

This research was limited to a specific group of graphic design students because of the limited time factor. This research studied the learning preferences of a specific group of design students and their interactions with an existing online environment in a qualitative manner. This section looks at how we can use the aforementioned VARK results to create criteria for the design of a web-based learning environment for design students. The intervention took place over 3 2-hour sessions and Gagne's nine events of instruction (1985) were used as the framework for the design of the intervention.

3.2.1 Gain Attention

The Whyville environment was designed for pre-teens, so the colours used, customizable avatar (or icon used to represent a person online), design and social interaction are all factors employed to gain the user's attention.

3.2.2 Inform Learners of Objectives

During the first session, the lecturer told students what Whyville is and how it can be used. They were told what tasks they would be performing and, also, what the expected outcome would be, which included:

- Create a personalized avatar
- User registration
- Obtain chat license
- Navigate to specific location to interact with friends
- Use the Dell computer centre to design wallpaper

3.2.3 Stimulate Recall of Prior Learning

Students were reminded of their pervious online interactions with environments such as WebCT and asked to use the knowledge gained from using social software like Facebook. They were told that similarly the Whyville environment allows for personalization and real-time online interaction. The students were also reminded of their earlier lectures about the design process and principles. They were then expected to re-apply this previously gained knowledge.

3.2.4 Present the Content

Using a live demonstration on a projection screen, the students were shown what the Whyville site is, what it looks like, how to navigate from one environment to the next, how to chat, and, additionally, how to customize avatars.

3.2.5 Provide Learning Guidance

Students were allowed to experience and explore the site individually. They were guided through the process of registration and customizing their avatar. This process also required guidance in terms of navigating around Whyville to complete the tasks. This provided an opportunity to break down sequenced actions into smaller tasks. It was expected that by performing these simple tasks with clear guidance, students should be able to, at a later stage, perform more complex actions using these basic principles.

3.2.6 Elicit Performance (Practice)

Using the skills and knowledge gained in the introduction to the Whyville environment, students now had to individually navigate around the site, to a specific location, to design wallpaper. While designing the wallpaper, students were required to use available tools in Whyville and use previously gained knowledge to complete the task.

3.2.7 Provide Feedback

During the design task, students were provided with feedback on their designs and the appropriate use of available tools. They were reminded of the basic design principles, which they were provided within the studio and were encouraged to use these as they created their wallpaper. This was done on an individual basis and by observing the students as they worked.

3.2.8 Assess Performance

Students were asked to save their completed designs and to submit it to the lecturer via email. These designs were assessed in terms of the creative use of the tools available in the Whyville Wallpaper Maker and also less importantly, the student's prior knowledge of the basic design principles. It must be noted that the design result was not as important as the process that the students had followed. The wallpaper designs were analysed using the rubric in Appendix I on page 176. This specified the five performance levels discussed earlier in this chapter.

The analysis of the artefacts produced by students, the results of the online questionnaire pertaining to the students' experience of the task, and cross referencing with the VARK learning preference questionnaire results produced data that is valid in terms of showing the link between the learning preferences of students, their performance levels and their interactions and experiences with online environments.

3.2.9 Enhance Retention and Transfer to the Job

Because Whyville is not an official learning management system and is not used at CPUT, it cannot yet be used as part of the students' day-to-day learning activities. It is envisaged though, that students would be encouraged to use Whyville to interact with fellow students and create a community of practice where the knowledge they have developed pertaining to the graphic design field would be shared and support would be provided from students with different levels of knowledge.

3.3 Development and Implementation

The lecturer was able to closely observe the students and had a fair amount of control over their activities during the two slots she had with them every week. The lecturer had class with them on Tuesdays from 14:00 – 16:00 and Thursdays from 9:00 – 13:00. These sessions took place in a dedicated PC lab in the IT Centre of the CPUT Bellville campus.

The students were given an opportunity to explore the environments as guests and could ask questions regarding Whyville. Students were given step-by-step instructions on paper on how to navigate around Whyville, setup a username and password, and obtain a chat license. The design task took place online and as there were no step-by-step instructions, students were expected to use their previous experiences with Whyville to solve the problem they were presented with.

3.4 Evaluation

The students' performance was evaluated using observation and the analysis of the artefacts produced. The experience of the students was also evaluated using an online questionnaire created with Survey Monkey. The online questionnaire results were then cross-referenced with the VARK learning preference questionnaire students had completed previously.

If repeated, the intervention is likely to produce different results. This is because the repetition of a task often leads to improved understanding, ability and internalization of

certain complex processes. It would mean that every time students had to design wallpaper on Whyville, the task would become easier. They would be more familiar with the tools, develop their "seeing" and also become "digitally fluent".

At the end of the third session the students had to complete an online questionnaire created using *Survey Monkey* covering the following:

- What about the online environment appealed to the students?
- What were the activities that they used the environment for? (Outside of the set task)
- Were the activities social or academic?
- What difference did the use of the environment cause in their academic life?
- What did and did not work in terms of technical issues?
- Of what academic value was the environment?
- What is the degree of access the students had to an online environment outside of class time?

The assessment of students' performance discussed earlier was considered as part of the evaluation of the whole process. Considering the small sample size of students, the data is encouraging and produces results consistent in terms of learning preferences and their relation to the interaction with the online environment.

3.5 Limitations

This study intentionally chose to examine this specific group of students interactions with online environments as it would give the researcher an idea of first year students' needs when experiencing an online environment. The learning styles questionnaire had to be completed honestly, as the responses were crucial in determining the emerging predominant preferences within the group. A challenge would be to ensure that the students do not respond in a manner they think the researcher wants them to, but that they be truthful in their responses in order for the data to be reliable. The questionnaires were completed manually in the classroom.

Whilst getting students to interact with the online environment, the challenge was to get them to engage with the environment beyond the tasks that were required of them. They had to first familiarize themselves with the new environment. Because the lecturer only saw them for six hours every week, and had to cover the set curriculum in addition to the Whyville intervention, it could not be ensured that students accessed the Whyville site at

other times. In addition, because the spontaneous visits to Whyville were not timetabled, or monitored, the amount of time spent interacting with the environment could not be measured.

Furthermore, while the students were completing the online questionnaire in class, there was no way of tracking how many students had completed the questionnaire. The researcher was only able to check the amount of respondents after students had left the classroom. The session took place close to the end of a term and students were quite focused on exams and not fully engaged with the task at hand. The researcher found that out of the 28 who were present only 12 completed the online questionnaire. This was in contrast to 28 completing the manual questionnaire. This raised questions about students' ideas around student accountability when it comes to face-to-face versus online environments.

The venue used for the interventions was a CPUT lab. This meant that there were limitations regarding the students' initial interaction with the online environment. Because of firewalls and proxy settings on-campus, students were not able to access certain Java functionality of the Whyville environment in the first session. Changing the IP address their computers used to access the Internet solved this problem. Then, during the second session students could not see each other's avatars in Whyville. This problem was solved in a consultation with the IT department of the university. A special request had to be lodged to allow the Whyville website to bypass firewalls so that students would be able to interact with each other. During the third session most of the technical problems had been ironed out and everything went well.

Survey Monkey is a free online questionnaire creation site. One can only however create a free questionnaire containing 10 questions. If one wants more questions, you must pay for the service. This problem was overcome by creating questions with multiple embedded questions (Appendix B on pg 122).

After studying the data from the online questionnaire, the researcher decided to conduct another questionnaire to confirm data and gain more understanding of students' in-class learning activities as they relate it to their learning preferences. This questionnaire was done in class with the same 12 respondents who responded to the previous online questionnaire.

The questionnaire was done using personal response systems/clickers and questions given through a PowerPoint presentation (Appendix C on pg 125).

3.6 Ethical Considerations

The students in this study were part of a class that the researcher taught daily. They gave informed consent and were made aware that they were under no obligation to participate in the task. In all reporting on questionnaire results or data, pseudonyms were used. There were no marks or credits attached to the task and an ethics review form was submitted with the topic proposal prior to beginning the study.

4 Chapter 4: FINDINGS AND ANALYSIS

4.1 Findings

The research, as explained in the previous chapter, aimed to answer the following questions:

1. What are the learning preferences amongst a group of design students and how do these influence their learning experience and performance.

2. What do design students do and want when they go online?

3. How do we use all the above in an online learning environment as part of a blended learning approach?

This chapter examines the learning preferences of a particular group of ECP graphic design students at CPUT. In addition this chapter examines how these students experienced and acted in an online learning environment, the artefacts they produced using this online learning tool, their in-class performance, how they performed in an open-ended learning task and how the aforementioned analysis can potentially inform the design of the online component of a blended learning environment for design students and possible even postgraduate students in other disciplines. The chapter concludes with a discussion of the interaction between learning preferences, performance, instructional design and blended design education.

4.1.1 Learning Preferences

The first research question was*: What are the learning preferences of this specific group of graphic design students?* The following are the findings categorized according to the cognitive domain (as discussed in the literature review), user acceptance and performance levels.

4.1.1.1 Cognitive Learning Preferences

The VARK questionnaire, developed by Neil Fleming, shows the cognitive learning preferences of students. The questionnaire was chosen as it allows students to give multiple responses to one question to create a more realistic picture of their preferred modes of learning/cognitive development.

Appendix F on page 163 shows the calculations done to determine the participants' predominant preferences and eliminators (the VARK categories which do not apply to them). According to Appendix F, there are 9 different categories of learning preferences among the specific group of students. Figure 4.1 below shows these 9 categories and the number of participants that fall into each of these are indicated on the left. The figure highlights the similarities between the categories. For example, 7 out of the 9 categories have a Kinesthetic component, 4 out of the 9 have a visual component, 4 categories have an aural component and 5 have a reading and writing component.

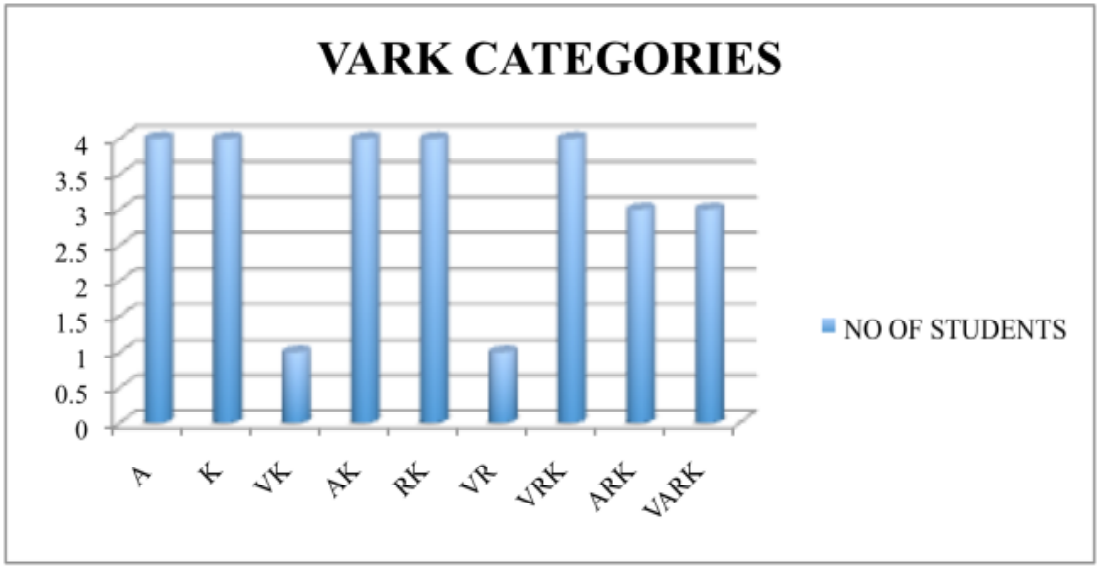


Figure 4.1: VARK Categories

Figure 4.1 shows us that the most predominant preference throughout the group is the Kinesthetic. It is a factor in the learning preferences of 23 of the 28 respondents. Much of the graphic design curriculum, including the studio approach, is aimed at recreating real world of work experiences. This attempts to satisfy the Kinesthetic experience design students need to make meaning of the design practices they are taught.

The *Whyville* questionnaire was designed to probe students' perceptions of their online experience while completing the open-ended task and any other time they accessed Whyville. The questions pertained to the academic, social and envisaged uses of Whyville. Students were asked whether they felt they had learned anything while utilising the environment. Results were analysed, then grouped together according to their relation to

the VARK categories in Table 4-A. The left hand side of the table shows the results from the Whyville questionnaire in percentages with the VARK category it falls into on the right hand side. The table is an illustration of how the design/interface of an online learning environment relates to learning preferences and the activities performed in these environments. It could be seen as a classification of learning activities according to the VARK categories.

Table 4-A: Questionnaire results as VARK categories

RESULT	CAT
Whyville appealed visually to 91% of the students The Whyville graphics helped 91% of them navigate the site 75% said the graphics made them curious	V
82.8% said they discussed what they were doing with their classmates 81.8% liked verbal briefs 45.5% listened first then wrote 36.3% spoke out loud before doing the task	A
63.6 % of respondents read the instructions 54.5% liked taking notes 45.5% liked reading the brief 18.2% made notes when studying	R
100% learned by doing the task 54.5% watched their classmates and copied what they did 9.1% tried to recall class activities	K
72.7% did a combination of notes, diagrams, reading out loud and recall when studying	VARK

Table 4-A shows a very strong Kinesthetic preference among the entire group as 100% said they "learn by doing". We also see that there is a high visual impact made by Whyville's graphics as indicated by the 91% who liked the visuals. The aural nature of the majority of the participants is also apparent in the 82% who prefer a verbal brief and discussing it with classmates. This was one of the learning preferences not satisfied by the Whyville environment. Students, however, filled this void by discussing their task with each other. The preference for verbal briefs and discussion speaks to the social aspects of learning as well as the environments necessary for learning, which are discussed in detail in the next section on User acceptance as indicated by the Whyville Questionnaire results.

4.1.1.2 User Acceptance

This section discusses the students' experiences of the online environment. User acceptance, in this case, is measured by looking at students' perceptions of:

- Academic value
- Learning activities/development of skills and
- Collaborative problem solving.

The online and clickers questionnaires probed areas such as learning and academic activities, context for learning, development as a designer and Whyville social activity. The results are based on what the participants felt and are subjective because they are based on the perception and emotional response of the participant. Simpson's affective domain is kept in mind while examining user acceptance in this instance. Some of the results are indicated in Figure 4.2 - Figure 4.6 below. The complete results of the online and clickers questionnaires can be found in Appendix D (page 143) and E (page 146).

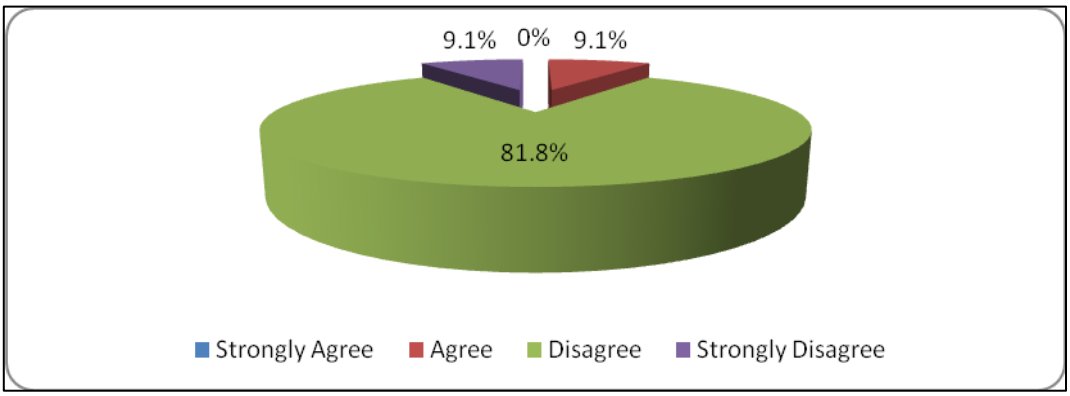
The majority of the participants indicated they cannot envisage Whyville as an academic environment and they did not feel they were performing learning activities in Whyville. There was a strong tendency towards collaborative problem solving, an increased interest in social learning and more than half of the participants felt they developed as designers. Although, these results indicate a lack of participant confidence in Whyville as a learning environment, it shows that Whyville could be used as a tool to teach problem solving and encourage peer learning.

4.1.1.3 Academic Value

Figure 4.2 shows the participants' perceptions of the academic value of Whyville. In user acceptance, it is important to establish whether students value the learning environment or whether the environment helps them feel they are part of a larger community of practice. This acceptance and learning context allows them to concentrate on the task at hand and makes learning take place seamlessly.

Question: Whyville can be used in my studies

91% of the respondents did not think Whyville could be used academically.



		Responses
Strongly Agree		0%
Agree		9.09%
Disagree		81.82%
Strongly Disagree		9.09%
	Totals	100%

Figure 4.2: Whyville can be used in my studies

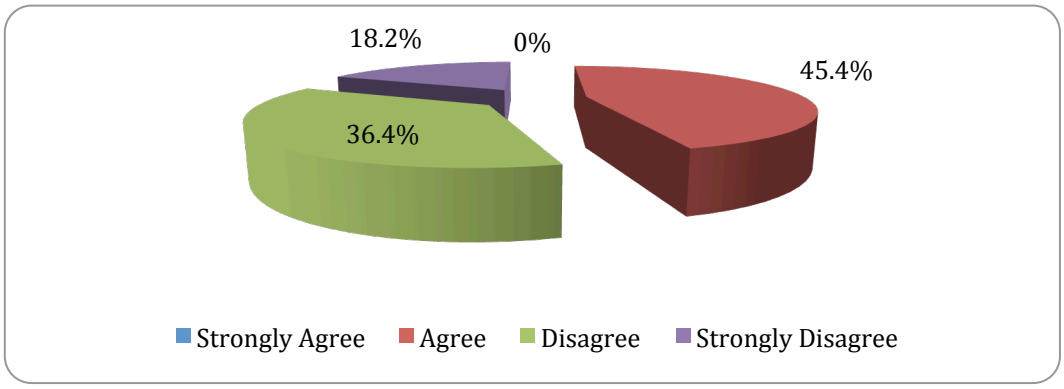
In another question in the questionnaire, 18% of respondents indicated their dislike of *Whyville*, which indicated that more than ¾ of the respondents liked Whyville. Despite this, only 58% of them said Whyville appeals to them academically. This conflicting result could be because students are not yet capable of judging the academic value of an environment such as Whyville. The non-acceptance of Whyville as an academic environment by a little less than half of the respondents could be attributed to the fact that the activities in Whyville do not all relate directly to graphic design and design education. One would be naïve to assume though, that students would accept an online environment designed

specifically for graphic design as a learning environment. There are many other factors that would influence the acceptance of a learning environment. These will not be dealt with in this research but would be interesting influences to explore in further research.

Figure 4.3 depicts students' perceptions on whether learning activities occurred in Whyville. Students' acceptance/perception of the learning that takes place is important as it helps them become reflective practitioners (Loughran, 2002: 35).

Question: I performed Learning Activities in Whyville

45.4% think they performed learning activities in Whyville. While 54.6% say they did not perform any learning activities in Whyville.



		Responses
Strongly Agree		0%
Agree		45.45%
Disagree		36.36%
Strongly Disagree		18.18%
	Totals	100%

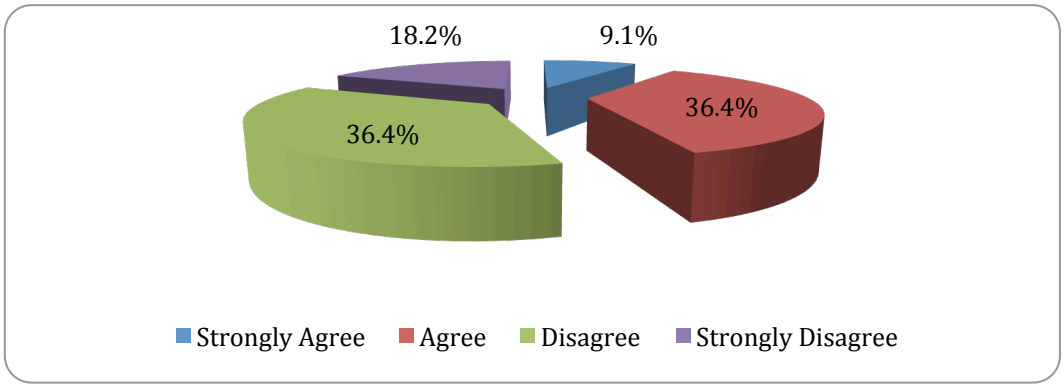
Figure 4.3: I performed learning activities in Whyville

The results in Figure 4.3 show those students' perceptions of what constitutes a learning activity could be different to what the lecturer envisions. All the respondents completed a design in Whyville, which in itself was intended as a learning activity. It could be said that some students were not able to recognize the integrated learning experiences in this online environment and did not feel as if they were in a learning context. This is a common occurrence at this level of study (ECP). The students find it difficult to distinguish the academic activity in an integrated open-ended task.

4.1.1.4 Learning activities/development of skills

Question: Whyville helped me develop design skills

45.4% say their design skills were developed in Whyville.



		Responses
Strongly Agree		9.09%
Agree		36.36%
Disagree		36.36%
Strongly Disagree		18.18%
	Totals	100%

Figure 4.4: Whyville helped me develop design skills

Figure 4.4 shows students' perceptions of the impact of the Whyville task on their design skills. The development of the participants' design skills lead to a confident designer and the development of a professional identity, which impacts the student's sense of being a designer as indicated in Reid and Solomonides (2007: 27 – 39) (refer to Chapter 2). This sense of being a designer, through professionalism and community, leads to a student who is confident, happy, imaginative and has self-knowledge.

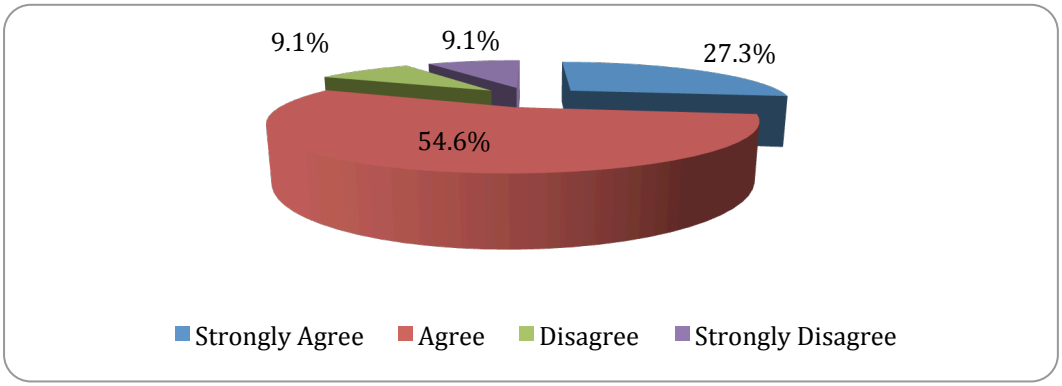
Furthermore, the results in Figure 4.4 shows that the open-ended design task helped some students develop their design skills and could have influenced learning. The statement is supported by 75% of respondents who said Whyville helped them develop as designers in the Online Questionnaire (Appendix D on page 143). These results indicate the development of a professional identity when faced with related learning activities in a simulation environment. Even though ¾ of the respondents felt they had somehow developed as designers using Whyville, only 33% said Whyville taught them about the world of work. The conflicting result could be attributed to the fact that these students do not yet make the link between their practices as foundation design students and the world of work. It is important to remember that if the development of design skills and activity is not apparent to students, they do not get the sense of being a designer, which builds the confidence, happiness, imagination and self-knowledge discussed earlier.

4.1.1.5 Collaborative problem solving

Design education places high value on the social aspects of learning. This is clear in the commonly used studio-based approach. When students discuss problems with each other, they are collaboratively solving creative problems and indirectly simulating the world of work. This is important in encouraging a "sense of being" in students. Figure 4.5 shows how many of the respondents interacted at this level.

Question: My classmates and I discussed the problems we had and helped each other solve them

82% of the students discussed and collaboratively solved their problems



		Responses
Strongly Agree		27.27%
Agree		54.55%
Disagree		9.09%
Strongly Disagree		9.09%
	Totals	100%

Figure 4.5: My classmates and I discussed the problems we had and helped each other solve them

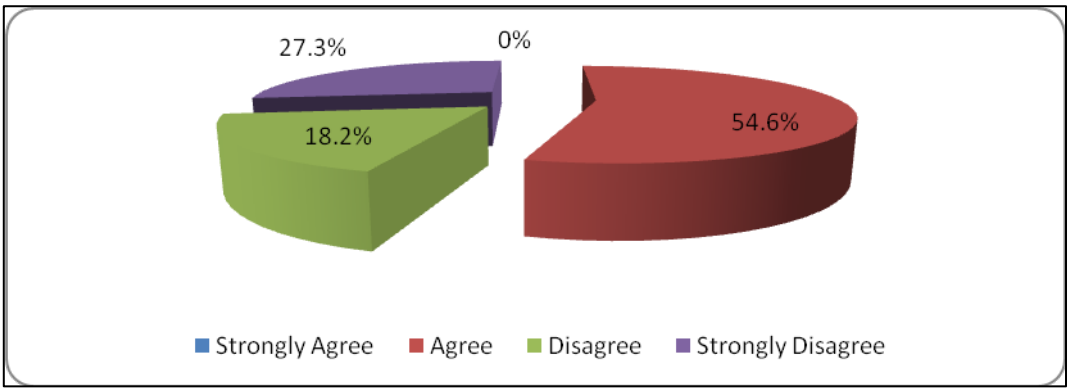
These results show that the discussion (which relates to the Auditory Preference of some learners) and collaboration, which Whyville encourages amongst students, helped the majority with problem solving. This indicates a socially constructed meaning making. In the online questionnaire, 75% of students indicated Whyville helped their communication with fellow students. This communication and interactive discussion contributes greatly to students' sense of community.

Figure 4.6 indicates students' social inclinations toward Whyville. The importance of Whyville, as a social tool, lies in the value of socially constructed meaning. This meaning is

not created by the impartation of knowledge but rather by the sharing of knowledge among peers. It could be called a horizontal rather than a vertical knowledge construction. Bikowski (2007:138) says that having a feeling of friendship and community online contributes to the success of collaborative projects because students feel more relaxed, are willing to share more and be honest. The criteria for the development of online friendships are often external. They are often influenced by personality and personal preference.

Question: I would use Whyville socially

54.6% of respondents said they would use Whyville for social interaction.



		Responses
Strongly Agree		0%
Agree		54.55%
Disagree		18.18%
Strongly Disagree		27.27%
	Totals	100%

Figure 4.6: I would use Whyville socially

The results depicted in Figure 4.6 are a stark contrast to 91% not seeing Whyville as a learning environment (refer to Figure 4.2). Even though more than half of the students would be comfortable using Whyville socially, they would not necessarily want to use it as

an academic playground. It is also apparent that the students very clearly separate socially classified peer-to-peer learning from social activities such as casual chatting. This does not mean that the pure social appeal of Whyville should be ignored. It can be used to create the feeling of friendship and community that Bikowski speaks of. Once this is established and students feel relaxed, willing to share and be honest, one can present an academic activity, which is integrated into this learning environment.

Whyville affords opportunities for socially constructed meaning making, although students do not recognize this aspect. The knowledge constructed by sharing rather than merely receiving knowledge is much richer and offers learners the opportunity to become an integral part of others' learning process. Collaborative problem solving is a key aspect in the creative world of work and students are learning this invaluable skill by using online environments like Whyville. Students were not able to recognize the integrated learning experiences in this online environment and did not feel as if they were in a learning context. However, this does not mean they did not learn. The learning experiences offered by online environments like Whyville are not always salient but this does not make them any less valuable.

The academic value of an online environment, its professional development capacity and collaborative problem solving opportunities are valuable in the blended design curriculum. It affords students the opportunity to develop the sense of being which Solomonides and Reid (2007) see as an integral part of students' engagement with a creative curriculum. Measuring the levels at which students engage with the curriculum includes their performance in tasks. The next section looks at students' performance in an open-ended task performed in Whyville.

4.2 Performance Levels

In this section, the Performance Level relates to the physical construction of objects and artefacts to fulfil set criteria. The construction of design artefacts is normally informed by a concept or idea. For the analysis of the wallpaper designs, 5 levels of performance were decided upon. Performance Level 1 would be the lowest and Performance Level 5 would be the highest. The performance levels, as discussed in the previous chapter, were derived from Simpson's Psychomotor domain and includes not only the physical act of creating the design but takes into consideration the cognitive decisions made by students.

Students were asked to design wallpaper using the available tools in Whyville. This was an open-ended task and no specific criteria were given for the content of the design. The artefact was expected to show the level of performance of the students in this online environment. Students could use all available tools and icons. The final artefacts were not evaluated on design exclusively, but rather looked at the participants' creative application of the available tools and icons to their blank canvas and how their prior knowledge was applied.

Table 4-B to Table 4-F shows the researcher's analysis of the artefacts according to the Performance Levels indicated in Figure 4.7.

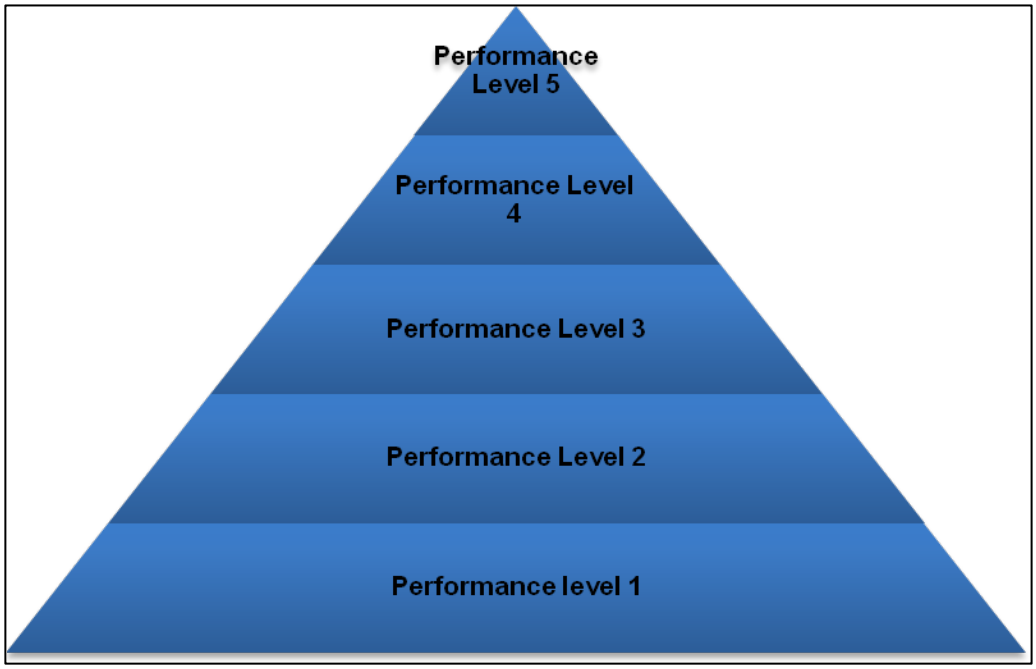


Figure 4.7: Performance Levels

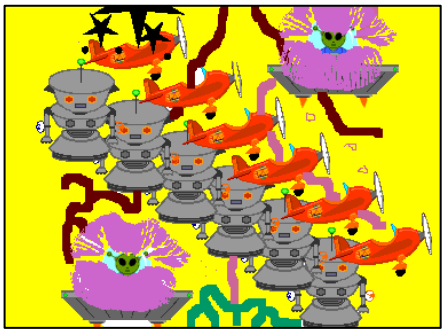
There were three independent raters who rated the artefacts using the rubric in Appendix I on page 176. Krippendorff's Alpha was used to determine the inter-rater reliability. It was found to be fair at 0.533 (See Appendix K on page 179).

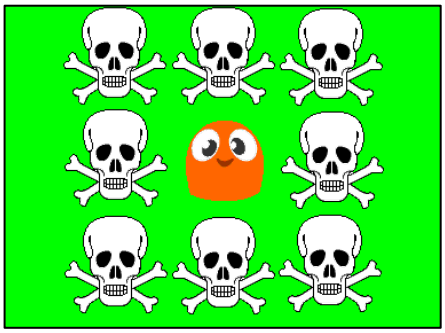
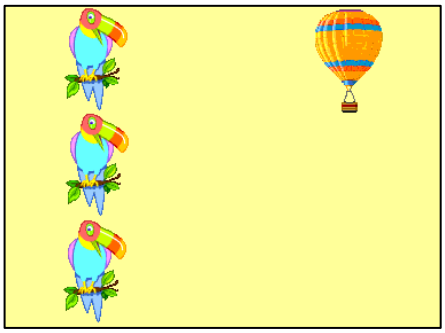
Table 4-B - Table 4-F (one table per performance level) will have the artefact (as created by each student online) in the left column and the analysis of the artefact in the right column. The tables show the characteristics of designs at each of the performance levels.

4.2.1 Performance Level 1

Performance Level 1 indicates a readiness to act. The students categorized at this level react to certain instructions and show a readiness to learn. The students in Performance Level 1 show a basic understanding of the design task. They do not, however, show they have applied the design principles that have been taught in the face-to-face class.

Table 4-B: Analysis of artworks at Performance Level 1

Artefact	Analysis
	The random placements of the objects show a lack of compositional skills. There is an interesting use of the kissing lips as they have been used specifically to frame the alien.
	There is no clear pattern or thought process behind the placement of objects. The approach of the designer is incoherent.

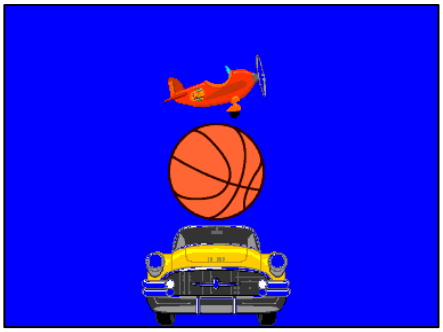
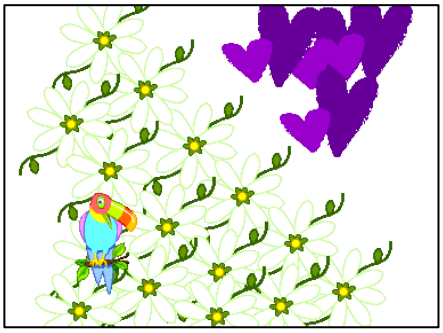
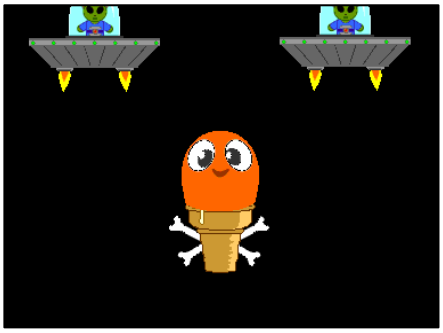
Artefact	Analysis
	Shows no competence in terms of applying design principles. The icons have been placed in a random manner.
	The simple geometric arrangements of the same icon portrays a lack of confidence and the colour choices show no awareness of contrast
	The layout shows no understanding of basic colour and design. The objects have been randomly placed. The arrangement shows no apparent thought process.

Moving beyond Performance Level 1 would require the students to start observing and mimicking what is considered good design, which would entail moving into Performance Level 2.

4.2.2 Performance Level 2

Performance Level 2 speaks about the early stages in learning a complex skill. This includes imitation and trial and error. Thus, through practice, the skill level of the student will improve. The students in this category show that they are able to copy/reproduce good work and can also respond to guidance and teaching.

Table 4-C: Analysis of artwork at Performance Level 2

Artefact	Analysis
	The random placement and overlaying of icons shows a readiness to design but a lack of understanding of elements such as colour and balance. The kissing lips overpower the car. This student still needs clear guidelines.
	Not much input was given to the students with regard to what the final product should look like. This piece shows a clear need for instruction. The unguided learner was unable to develop a coherent design on his/her own.
	This student still needs guidance from the lecturer. Although the flowers in the centre lead the eye through the picture, the largely random placement of unrelated objects demonstrates a lack of understanding of design principles.
	Very basic design with no conceptual framework. The objects seem unrelated and make no visual impact.

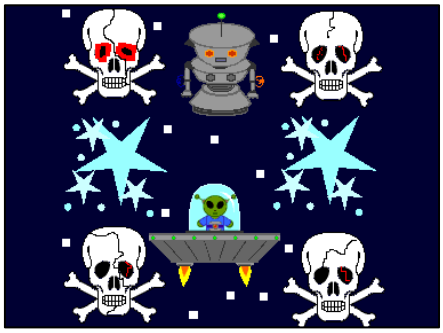
Artefact	Analysis
	This design demonstrates an ability to overlay and create texture. The student has not applied basic design principles effectively.

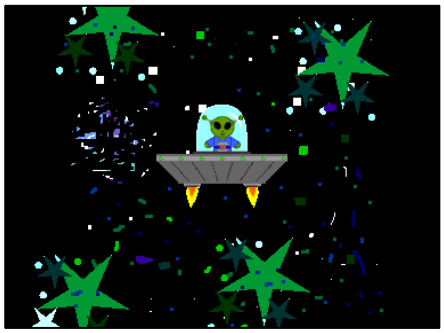
Once students have become confident in their knowledge of design, they move away from mimicry and start to develop knowledge of the application of certain learned skills. This is a move into Performance Level 3.

4.2.3 Performance Level 3

This is the intermediate stage in learning complex skills. Students use their learned skills habitually and can perform with confidence. The following students have shown they are confident and use the tools with care.

Table 4-D: Analysis of the artwork at Performance Level 3

Artefact	Analysis
	The limited use of icons signifies caution. However, the adaptation of some of the skulls demonstrates confidence. Placement of objects emphasizes symmetrical balance and is encouraging.

Artefact	Analysis
	The emphasis on symmetrical placement shows an almost constricting understanding of balance. Contrasting colours show a basic understanding of colour.
	The design demonstrates some understanding of design but still errs on the side of caution with its choice of colours and limited elements. There is an elementary understanding of contrast.
	The repetition of similar objects is the “safe” option. Very clear symmetry and limited use of colour. Has an idea of a focal point.
	Very symmetrical placement shows an almost constricting understanding of balance. Very basic colour choices

When students have mastered Performance Level 3, it means they are confident enough to move into Performance Level 4 where they explore more complex applications of learned skills and knowledge.

4.2.4 Performance Level 4

At this level, students show skilful performance and complex design. These students display competence in applying the basic design principles.

Table 4-E: Analysis of the artwork at Performance Level 4

Artefact	Analysis
	There is an attempt at figure ground application as well as colour contrast. The design is competent and demonstrates an understanding of the tools and their possible uses. Only existing icons have been used.

Performance Level 4 shows an ability to competently apply learned principles. The mastery of this level leads to Performance Level 5, where what has been previously been rote application becomes fluid and can be adapted and tailored by the student to suit his/her design or conceptual requirements.

4.2.5 Performance Level 5

At this level, the students are advanced and can manipulate the available tools to suit their requirements. The work demonstrates the students' creativity and their ability to apply design principles, solve a design problem and manipulate the limited tools available.

Table 4-F: Analysis of the artwork at Performance Level 5

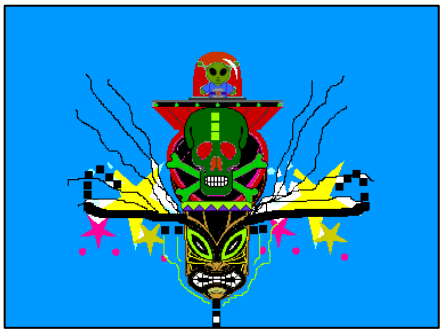
Artefact	Analysis
	The student has an understanding of foreground/background principles. This is apparent in the thoughtful overlapping of objects. The student takes initiative by using the brush tool to create objects not available as icons. The use of colour and strategic placement of objects demonstrate a clear concept and planning.
	The integration of tools and complex arrangement of all the elements show a clear understanding and manipulation of the available resources. Existing graphics have been modified (e.g. the skulls eyes and the extension of the mask) to suit the purpose of the designer.
	Aesthetically the artwork is poor, but a clear picture has been created. The student has used the icons in combination with his/her own illustration to create an artwork.
	The student demonstrates an understanding of visual hierarchy and focal point and has adapted things like the kite, the air balloon and overlapped hearts to create the desired effects. The plane and text has been used to lead the eye. The text and image go together.

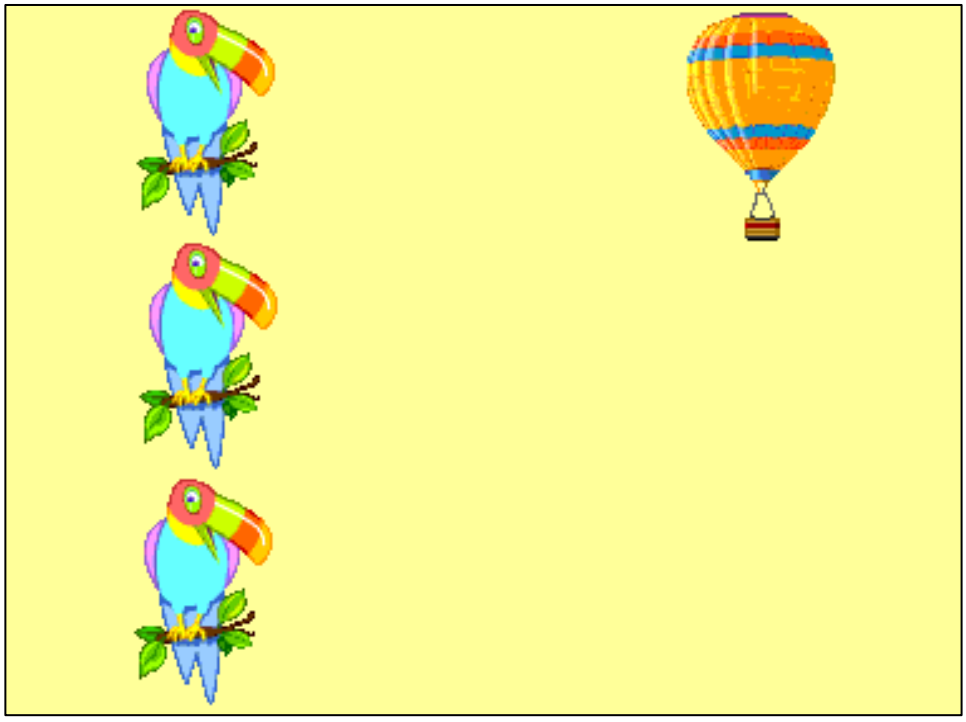
Table 4-B to Table 4-F show five students at Performance Level 1, five at Performance Level 2, five at Performance Level 3, one student at Performance Level 4 and four students at Performance Level 5. The spread of students across these 5 levels demonstrates a cross section of a typical design classroom. The diversity of the group and the tools needed to cater for all levels of ability has always been a challenge in the roll out of design education.

A hierarchical cluster analysis (Appendix J on page 177) with a range of solutions based on Performance levels, VARK and their differences was done. Although cluster analysis is not an exact science, it is a reliable analysis. The analysis using the ward method and Euclidian distance measure produced a five-cluster result, which was compatible with the other data in this study. The next section will demonstrate the characteristic that are typically found in a diverse design classroom and explores the characteristics of five of the student participants. The five participants were randomly chosen from each of the performance levels. The selection of participants was validated by the cluster analysis, as each of them (except for Kelly and Matthew) were situated in a separate cluster.

4.3 Researcher Observations of Learner Performance

In order to describe what the researcher observed and assessed in the Whyville activity, Figure 4.8 – Figure 4.12, were created, which show each respondent's learning preferences. The researcher created tables from each respondent's design in the open-ended digital learning tasks (one per performance level), and answers to the questionnaire in Appendix G on page 165. These tables were then written up as stories, which look at how the three sets of data relate to the researcher's observations and experiences teaching each of the individual students. The researcher also used the Pedagogy of Multiliteracies (Cazden et al., 1996) as discussed in Chapter 2, as an interpretive lens for the stories.

4.3.1 Performance Level 1: Kelly



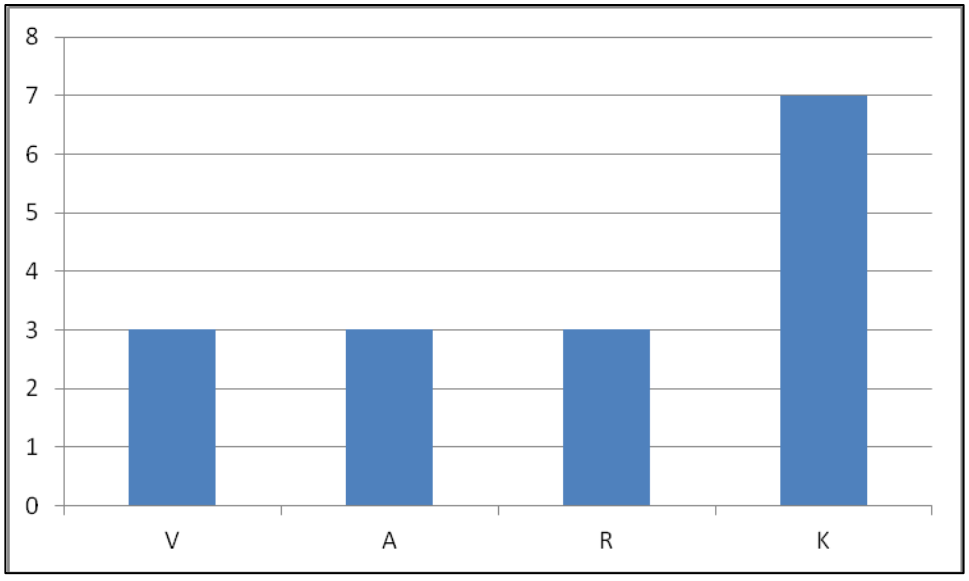


Figure 4.8: Kelly's Learning Preferences

Kelly has a very strong Kinesthetic preference. This is indicated by a seven score for Kinesthetic as opposed to 3 for all the other preferences. The VARK questionnaire has 16 questions and even though Kelly could give multiple answers, she chose only one per question. Kinesthetic people are "connected to reality" (Fleming & Mills, 1992) and this is

probably why she shows such confidence in answering the questions. Kelly learns through simulations, solving real-world problems and likes working in a Situated Practice environment. Because of Kelly's strong Kinesthetic preference, she often forgets to read the instructions carefully. She asks for verbal explanations but is often in such a hurry to get the task done that she does not always listen to all the details of what is being asked or said. During the Whyville task, she seemed rushed going through the task and did the bare minimum by completing it. Because the digital task was open ended, Kelly found it very difficult to do. She needed clear specifications of the problem in order to give the desired result. She reiterated this by strongly agreeing in the questionnaire that the lecturer had to verbally explain in addition to the written instructions. When left to do her own design, she quite clearly did not feel comfortable exploring without definite boundaries. It could be said that because the task was open ended she did not feel as if any real benefit was linked to solving the design problem. There was no evidence that what she was doing was going to have a "real" impact on her studies, for example, because there were no marks awarded for completing the task. This means that because Kelly could not make the link from the real world (or her real world) to what she was doing, she did not value the process of creating the artefact and was only concerned with "getting it done". Even though Kelly agrees that she has performed learning and development tasks in Whyville, she cannot, like the rest of the 91% indicated earlier, imagine it being part of her studies. She would, however, like to have class in an online environment like Whyville.

The order of discourse (Cazden et al., 1996) in graphic design practice would encourage Kelly to function in a much more varied way. Her very limited approach to solving problems is reflected in her artefact and it resonates in the other practical graphic design subjects she was being taught. Having taught Kelly, the researcher knows that she does not often reach the "design" stage in her work. This stage speaks to the re-interpretation, re-representation and re-contextualization of given knowledge (Cazden et al., 1996). Kelly found it difficult to re-apply what she had been taught in class to the online digital task. The iterative meaning making which draws on available design (Cazden et al., 1996), is missing in this instance and Kelly's thinking around and application of the design principles had not been transformed in any significant way. Even though she admits to her design skills being developed, the artefact shows very little evidence thereof. There was also very little evidence to show that any "redesigning" had taken place. Although Kelly responds well to Situated Practice and Overt Instruction she does not seem to progress to the Critical Framing and Transformed Practice levels and this most likely is why she has been categorized in Performance Level 1.

4.3.2 Performance Level 2: Shaun

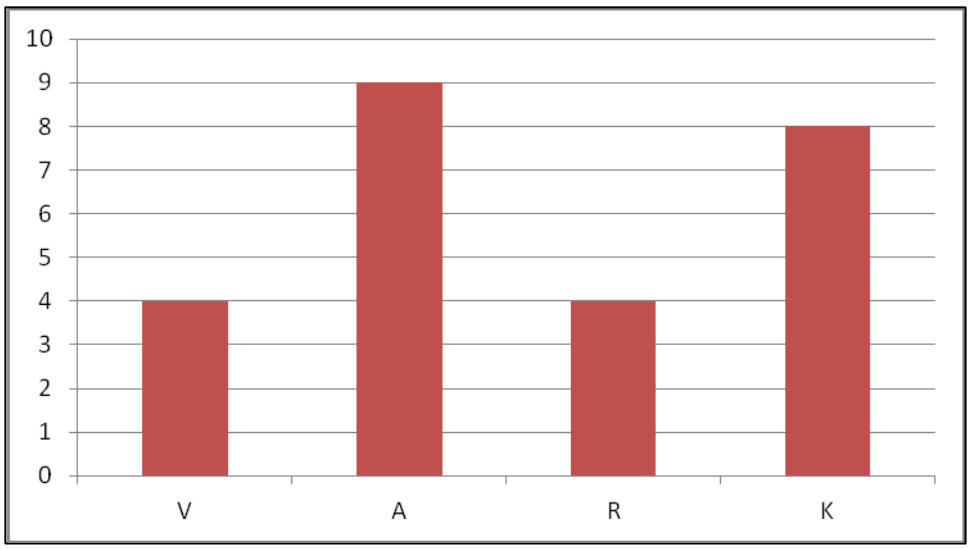


Figure 4.9: Shaun's Learning Preferences

Shaun is a student with a very strong Aural and Kinesthetic preference. This is evident in his score of 9 for Aural and 8 for Kinesthetic for these categories, compared to the 4 he scored for both Visual and Reading and writing. In contrast to Kelly, Shaun chose more than one answer for some VARK questions; these answers indicate his dominant learning preferences.

Shaun confirms his aural preference by strongly agreeing that he discussed the task with classmates and the lecturer concerned. Because Shaun did not read the Whyville brief and generally doesn't read briefs, his low reading and writing preference scores are confirmed. Shaun initially (in the online questionnaire) says that Whyville did not help him learn, but later (in the clickers questionnaire) says Whyville helped develop his skills. These statements are contradictory because these things are not independent of each other. Developing skills are part of the learning process in graphic design. Talking and listening are integral parts of the aural preference. Observing Shaun, it became apparent that his aural preference dominated his learning activities. He was constantly engaged with fellow classmates in discussions about what exactly had to happen next and they solved the problems together. This is confirmation of the performance level at which his artefact was categorized. The difference between Kelly and Shaun's response to the open ended digital task was that because of his Aural and Kinesthetic preference, he had a better idea of what was required of him. He had interacted with others. In the day-to-day classroom situation, the researcher often found Shaun collaboratively solving design problems with his fellow students. This becomes problematic when trying to assess whether Shaun's solution to a design problem is actually his own. One needs to gauge whether Shaun has acquired new understanding through the process of collaborating with his classmates. Shaun seemed able to use the Available Design to move into the Design phase but could not successfully Re-design. Shaun made an attempt at applying the available design but could not yet achieve a successful re-design without the guidance of his lecturer. Shaun seemed to be operating with a foreground of the knowledge he had gained about design but was unsuccessful at critically framing it. He had all the elements, but was unable to "stand back from it and view it critically" enough, which was needed to transform his design. It would appear that Shaun's multimodal preferences marginally advantaged him above Kelly when it came to the design task in Whyville.

4.3.3 Performance Level 3: Matthew

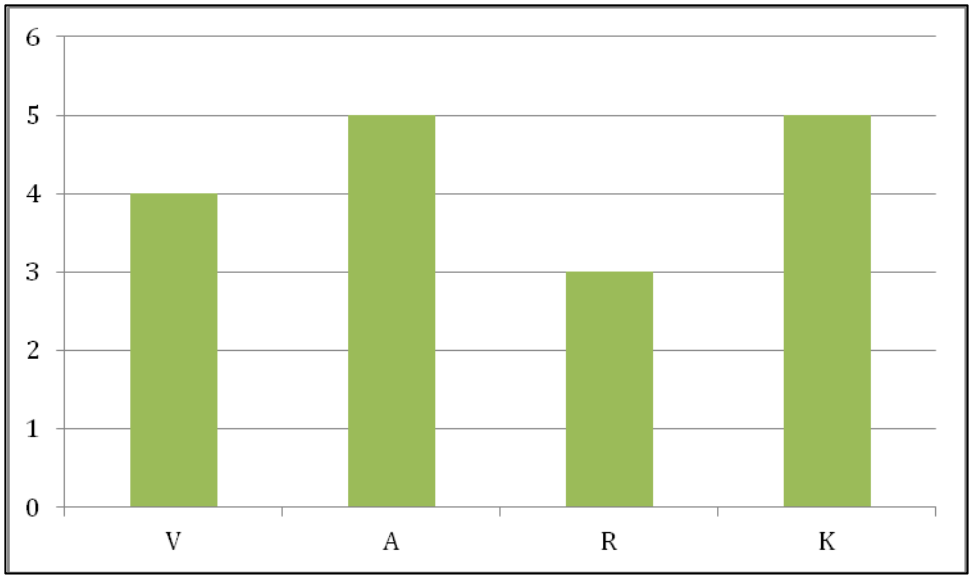


Figure 4.10: Matthew's Learning Preferences

Matthew has similar scores for all the preferences and is a multimodal student. This is indicated by his scores of 4 for Visual, 5 for Aural, 3 for Reading and writing and 5 for Kinesthetic. There is very little difference between these scores, which means that Matthew

prefers them in almost equal quantities. In addition, this indicates that Matthew probably learns most comfortably when he is taught using all of the VARK modes. The highest scores, aural and Kinesthetic, are prevalent throughout the preferences of this group of students. Because of Matthew's multimodal nature, most methods of instruction appeal to him. Having observed Matthew, it is apparent that at different times he chooses different modes of processing information. Matthew indicates that when he studies, he makes notes, but while doing the Whyville task, he solved some of the problems himself, discussed and solved other problems collaboratively and did not need any input from the lecturer. This is something Matthew quite often does in many of his other practical subjects. He attempts to solve a problem independently using existing knowledge; if he does not fully understand how to achieve a competent solution, he will consult a fellow student (whom he perceives as more skilled or knowledgeable) first and only when this is not successful will he approach the lecturer. Matthew can perform basic tasks competently, which is characteristic of Performance Level 3. He demonstrated this in the way he completed the Whyville task and used the available tools. Matthew quite often moves into his "zone of proximal development" (Vygotsky, 1978) because of his social interaction and learning in class.

Matthew indicated that he does not like Whyville because it is not interactive enough. The aural component of the Whyville task was contained in the class discussion and peer-to-peer discussion that was taking place while the students were doing the task. Because it was not a salient part of the Whyville environment, it might be a reason why Matthew says that the Whyville environment is not interactive enough. Additionally, all of Matthew's preferences were not being satisfied so therefore he does not feel he has performed any learning. He did, however, indicate that he could perform learning activities in Whyville. Again, this could be attributed to Matthew's inability to recognize the design task as a learning activity or feeling that it was not challenging enough. As a consequence, he felt he did not gain any new knowledge from the activity. Matthew's task performance and results has shown a move in his thinking. He was able to critically look at what he had done in a graphic design context and realized that this needs some change/improvement. Matthew's critical reflection is what led to collaborative problem solving and a subsequent move into Critical Framing where he is able to recognize where he now stands as a graphic designer. Matthew's design practice has not yet been transformed but he has shown competence and an ability to move from that level into a more complex response to a design problem.

4.3.4 Performance Level 4: Levi

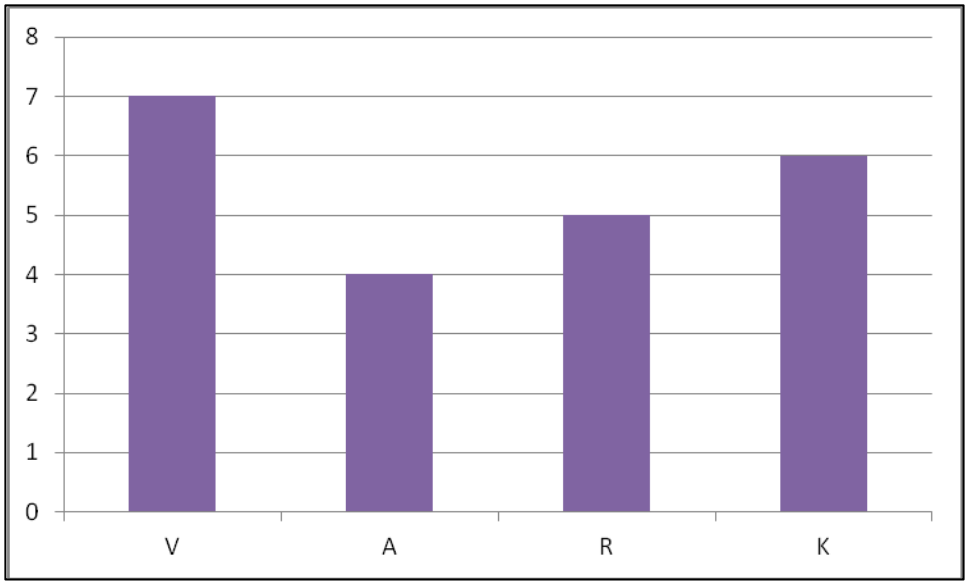


Figure 4.11: Levi's Learning Preferences

Levi is a multimodal student with a strong visual, reading and writing and Kinesthetic preference. He says he learns with pictures and diagrams, which is supported by his high Visual score of 7. Whyville did not appeal to Levi either visually or academically and although

he has a high visual preference, he said the graphics in Whyville were not helpful to him. One of the assumptions the researcher made before the study was conducted was that students with a visual preference would like working in an environment such as Whyville because of its visually stimulating nature. This was not the case with Levi. He prefers traditional face-to-face classes and does not seem to feel that Whyville has benefited him in any way. Levi has a reading and writing score of 5, does not like to take notes, but does read briefs. His aural score of 4 is only 1 mark less than his reading and writing and would explain why Levi also likes to be briefed verbally. In his task result, Levi showed a clear understanding and attempted to apply the design principles he had been taught in class. He used the available design, designs and then produces a re-design or re-application of the knowledge he has. Having observed Levi, he appears capable of critically framing a problem as an individual and could also help other students, such as Matthew, move into their zone of proximal development. Levi is one of a group of students that others would approach for help in solving problems. Although he moves well out of his comfort zone when designing, he has not fully transformed his practices. This is apparent in his use of only existing icons in the Whyville task.

It is possible that Levi would respond very well to Situated Practice because of his Kinesthetic preferences. However, Cazden et al. (1996) makes it clear that Situated Practice as a pedagogy is lacking and Levi would need to move beyond this in order to transform his practices. The preference he has for traditional classes shows his need for Situated Practice. His use of the design principles he has been taught reflects that he has gone beyond habitual application of techniques and forms his own complex application and utilization of available design in order to re-design.

4.3.5 Performance Level 5: Charl

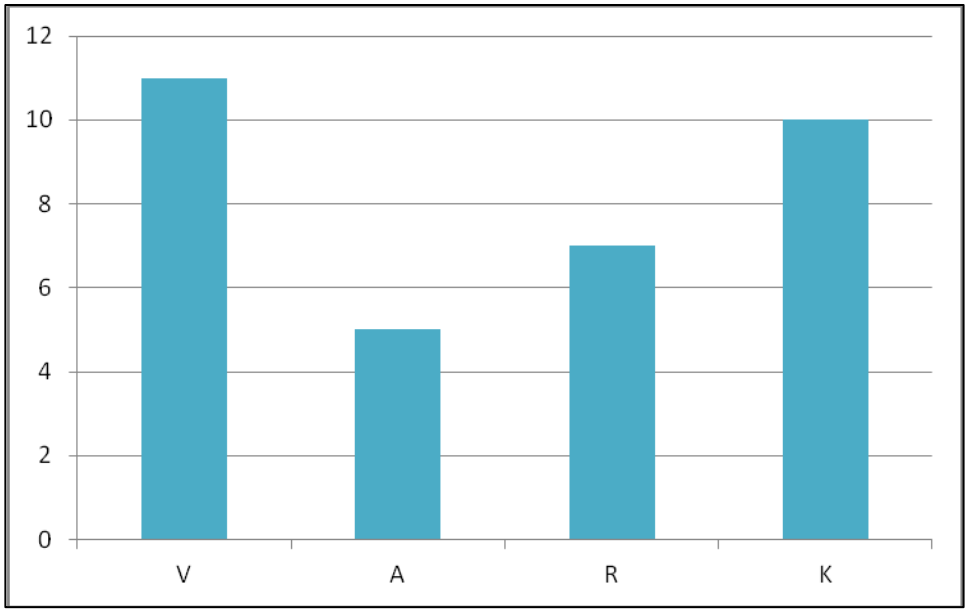


Figure 4.12: Charl's Learning Preferences

Charl is a multimodal student with a very high Visual and Kinesthetic preference. Charl's reading and writing preference score is a 7 but is secondary to the visual (11) and the Kinesthetic (10). With Charl's high visual preference he enjoyed the visuals in Whyville and said they appealed to him. This is in contrast to Levi who had a 7 score for visual and said the visuals did not appeal to him. Charl said the graphics helped him navigate the site and confirmed his high visual score by saying he learns with pictures and diagrams. Charl's low aural score is confirmed by in-class observations that show him not engaging in in-depth dialogue about the tasks he might be busy performing. Charl likes to be given a written brief, to read it, interpret it for himself and then ask questions for reassurance before starting the task. This is confirmed because he required verbal explanation from the lecturer in the Whyville task. Charl works alone most of the time and he makes this clear saying he did not discuss his problems in Whyville with other classmates and they did not solve problems collaboratively; he did, however, tell them what he was doing. The researcher observed that Charl does not discuss his in-class projects with others either. He works alone, does not watch others or replicate what they are doing and confirms in the questionnaire that he finds his own way to solve problems. It was found, while working with Charl, that he is very independent and also, at times, elusive to the work he is busy with. Charl moves with ease through the design and re-design of his knowledge. He is able to take the knowledge he has (available design), transform it and re-design. This all happens with very little lecturer or social interaction. This could be attributed to Charl's very low aural score of 5 in comparison to his other scores. The aural involves discussion, instruction, debate and explanation for which Charl seemingly has very little tolerance.

Charl will succeed, but not be challenged enough, in a Situated Practice environment as he has a very high Kinesthetic score of 10. Overt instruction is an easily achieved stage in Charl's learning. His aural score of 5 would suggest that Overt Instruction might not be his preference, as lectures, discussions, etc. are all part of this stage. Charl is, however, not averse to being taught, and he will do what is required to achieve his goals. Charl quite comfortably critically frames his growing practices as a graphic designer and is able to stand back and analyse what he has done. His ability to correct his mistakes through his own critique leads one to believe that Charl has already started transforming his practice. Charl's level of study does not require him to re-contextualize his design discourse. However, it seems that Charl will soon move into Transformed Practice as he discovers the potential of the design knowledge he has been constructing.

Charl performed at the highest Performance Level in the Whyville task and accomplished a great deal with the limited tools available. This speaks again to his determination and application of learned design skills. Charl likes Whyville but does not think he performed any learning activity. He does not want to perform academic activities in Whyville and seems to prefer face-to-face classes. A student like Charl will perform well irrespective of the method of instruction. This being said, if granted, his preferred method would probably move toward the Transformed practice we desire of all our students.

4.3.6 Comparison of Student Performance Levels

The data that has been presented indicates links between students' learning preferences, their performance in an open ended learning task, their feedback and day-to-day classroom behaviour. The preference and performance data of Kelly, Shaun, Matthew, Levi and Charl show that the experience and processes of design education is multimodal. The students with more than one preference (multimodal) performed at the higher performance levels. When we look at the preferences of those at the lower performance levels, we find fewer predominant learning preferences. The observational data showed that students' in-class behaviour is reflective of their learning preferences and also echoes the accounts they provided of their processes in the questionnaire data.

Figure 4.13 shows a comparison of the five students' (at the different performance levels) learning preferences. Charl has very high scores for all of the preferences while Kelly has low scores for all but one preference.

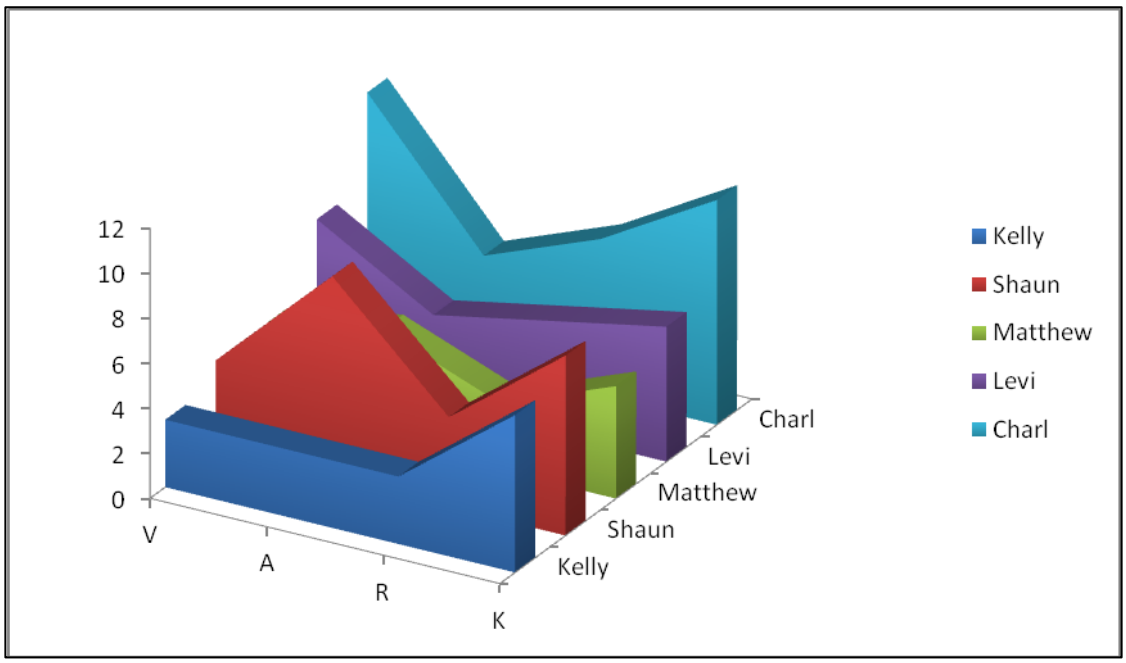


Figure 4.13: Comparison of Learning Preferences

Figure 4.13 shows the differences in learning preferences between Kelly, Shaun, Matthew, Levi and Charl. The figure shows an increase in learning preferences as we go from performance level 1 to performance level 5. The participants with less varied preference scores, e.g. Levi and Charl, performed at the upper levels. Those with the more erratic preferences, e.g. Kelly, performed at the lower levels.

4.4 Conclusion

The questions posed by the researcher at the start of this chapter were:

1. What are the learning preferences amongst a group of design students and how do these influence their learning experience and performance.

2. What do design students do and want when they go online?

3. How do we use all the above in an online learning environment as part of a blended learning approach?

The data revealed that:

There are 9 different categories of learning preferences amongst the group of respondents. The prevalent preference is the Kinesthetic and it is present in 23 of the 28 respondents' preferences. The prevalence of the Kinesthetic strengthens the argument that studio based simulations of real-world situations is crucial to design education. The online environment could strengthen this real world simulation by creating opportunities for collaborative problem solving and meaning making which is a common practice in the world of work. The preferences of students are reflected in their day-to-day practices and is an indication of their expected performance. The students who have multiple preferences performed better in the online task than those with a single preference. It cannot be said with absolute clarity though whether their preferences are the only contributing factor here. The top performing students were able to perform well in the task even though they performed it in an environment that they did not think was suitable for learning, developing design skills or teaching and learning.

> The students' performance in the Whyville task and their responses to the questionnaires were reflective of their day-to-day performance in class. This indicates that performance is not necessarily dictated by the learning environment, but could possibly be attributed to factors not considered in this study. The data, through triangulation, is a fair reflection of the links between performance and preference in this specific group of graphic design students.

The large number of students who liked Whyville's visuals also said it helped them navigate the site, thus proving that the aesthetics of an online environment does play a role in the way they approach the site. If they have to struggle with navigation they are less likely to spend more time than they are required to on the site. When students are online they discuss the problems they are experiencing with each other and also share the solutions they have found. This is an indication of the socially constructed meaning making an online environment like Whyville encourages. Students are much more willing to use Whyville as a social tool. This is important because when they interact socially, it creates a feeling of friendship and community (Bikowski, 2007: 131) that will make collaborative problem solving much easier.

One can deduce from the aforementioned data that the "hybridity" (Cazden et al., 1996) of a multimodal student is what makes them successful in their design studies. Being able to

"articulate in new ways" (Cazden et al., 1996) and "create new conventions" (Cazden et al., 1996) could be the answer to the eternal question of what creativity in design is. If this transformation of the definition of creativity in design is to take place, it would mean a shift in our approaches to design education. It would require a move from the exclusive use of studio-based instruction to a blended multimodal stance that stimulates all aspects of the creative student, engages him/her in a multi-layered way and challenges the previous norms of design education.

This blended multimodal stance should take into consideration that:

- The visual appeal of the online learning environment does not help the top performers, as they will do what needs to be done in order to perform well.

- The visual and Kinesthetic nature of the learning design could help the academically weaker student engage more in a learning environment where peer learning can take place. It could also give rise to possible collaborative problem solving efforts which lead to students moving into their Zone of Proximal Development (Vygotsky, 1978:86) and developing a sense of being (Reid & Solomonides, 2007).

- The benefits of an online learning environment like Whyville are not linked to improving performance but rather to engagement, collaborative problem solving and simulating the collaborative environments often found in the world of work.

The next Chapter will discuss the influence of the findings in this chapter on the design of an online learning environment for design students. It will make recommendations and list factors to consider.

5 Chapter 5: Discussion, Conclusion and Recommendations

This chapter will summarise the research, discuss the findings as reported in Chapter 4, draw conclusions and make recommendations for further research and the design of blended learning materials for a design curriculum using Merrill's phases for effective instruction as a primary framework with Jonassen et al.'s major skills as support.

5.1 Summary

The problem the research explored was that the current studio based approach in design education is not enough to keep the "new age" design students' attention and that a blended learning environment is needed to satisfy the need for student engagement. Easily accessible information is crucial and design education must cater for the multiple learning preferences present in the design classroom.

The research asked what the considerations were when designing the online component of a blended learning environment to enhance the learning experience of design students? The sub questions were:

- What are the learning preferences amongst a group of graphic design students?
- How do graphic design students' interact with online learning environments?
- How do students perform in an open ended online task?

These questions intended to establish:

- The learning preferences in a specific group of graphic design students and see if there are any predominant preferences,
- Whether the web-based learning environment enriches the learning experience and whether students gain understanding of the dynamics of the intervention
- Whether there are links between learning preferences, online performance and in-class performance and how we can use these to design blended learning materials.

The changing face of design education (as discussed in Chapter 1) demands that educators relook at the both the teaching and evaluation of design. Design education and students should focus not only on the artefact but should include the process of constructing design

knowledge as an integral part of design education and evaluation. The concept of constructivism informs design practice but it is the constructionist theory that really fills the void that has existed in design education for so long. In order to adequately design learning materials for blended design education one needs to be aware of whom the students are. The concept of learning preferences is only one of many vehicles that can be used to assess the instructional preferences of a specific group of students. These learning preferences should be used as guidelines only in ones approach to learning design.

In addition to learning preference analysis it is suggested that students' current online activities and behaviours be looked at to see whether there are patterns of behaviour amongst students and whether these can be used as informing factors when designing online educational environments.

Bloom's taxonomies suggest three facets for learning. The cognitive, affective and psychomotor domains are said to work together to form a complex experience of knowledge construction. The three domains are seen as working hand in hand to make concepts in education tangible.

In chapter 2 the problem-based approach to learning is discussed as suggested by Merrill 2002. This has five phases, which presents a problem, activates existing knowledge, demonstrates new knowledge, encourages the application of the new knowledge and then finally should integrate the new knowledge into the learner's world. Jonassen 1998 describes 5 skills students need to construct knowledge. These include project management, research, organisation, presentation and reflection. Merrill and Jonassen are both referring to particular skills/attributes needed to successfully construct knowledge in an educational environment.

Vygotsky 1978 shows the importance of social learning. The zone of proximal development is an important concept to be considered when designing learning materials. It suggests that when knowledge construction takes place with a person more skilled than the student, the level of knowledge is higher than if it had been constructed individually. This motivates the design of learning materials that encourage this rich knowledge building experience.

The dissemination of information is increasingly important in an information rich age. Current students have access to information sometimes far beyond their level of comprehension. The task of educators is to teach students how to process information. It is no longer about giving them information because they can find this anywhere. The key is to successfully equip them to organise, rationalise and internalise the information. Students should be able to successfully organise specific ideas/concepts in a specific manner. Instead of merely providing information, we should leave it more to the students to find it, interpret it and then reconstruct it into bites of information, which they understand.

Digital learning tools or online learning environments provide students with these opportunities to search for, find and reconstruct knowledge. The collaborative nature of some online environments also provides opportunities for the construction of knowledge and movement into the zone of proximal development previously discussed.

In order to ensure that students visit these online environments as discussed in Chapter 2, one has to create a sense of community. Discovering common factors among users often encourages this sense. When students know that there are others like them in this online environment they feel part of it and this encourages them to move from the periphery of the community to the core. The tasks in such environments are often completed individually but are inevitably influenced in some way (whether apparent or not) by the existing community. Organisational learning is typical in a school or university. Here knowledge is shared and one member of the community learns from the experiences of other members.

Knowledge is shared and students build substantial knowledge as members of these learning communities.

The studio approach to teaching design links to Vygotsky's concept of the Zone of proximal development. It encourages problem solving with the input of a more skilled educator. It is assumed that the feedback/input of the educator helps the student to build the design knowledge necessary in order to complete a task or produce an artefact. It is said in chapter 2 though that being able to design is not enough. Students have to be able to think like designers. They have to be able to solve a myriad of design problems and be equipped with the skills to do so. It is no longer about being able to design for a specific problem but to be able to solve problems in order to design effectively. The input of an individual at a higher level of knowledge than the students is important in developing their individual ways of seeing. Students have to develop their own appreciative systems and need to learn to "see" as designers. As they come into contact with others who have already developed their "seeing" they will start to build knowledge that relates to design.

Simulating the world of work is an important part of the sometimes-vocational design education environment. As the world of work has become increasingly digital it is crucial that this facet be integrated into design education. A blended learning environment is a perfect conduit for this. It uses online classrooms to enhance studio-based teaching. It provides opportunities for anytime anyplace learning and eliminates the geographical difficulties experienced by some students. The blended learning environment can drastically change student teacher ratio issues and provides easy feedback scenarios where everyone can benefit from feedback.

Within these online environments one has to keep in mind how people learn and encourage more independent and active learning. The curriculum needs to be kept up to date and

consider what it is people need to learn. Where people learn has drastically changed and so has when. Students should not be limited to learning during class time.

The context of learning should be made clear to students. They must be shown how the knowledge they are constructing fits into their "real world" situations as designers. How would the knowledge they have built be applied in the world of work?

So the research would want to see how one designs a learning environment that:

- Incorporates collaborative problem solving (Vygotsky, 1978)
- Encourages the building of design knowledge (Schon and Wiggins 1992)
- Helps students move from the periphery of the community of practice to the core (Wenger 1998)
- Simulates the world of work (Jonassen et. Al 1998)
- Considers the individual learning preferences of students and engages them on multiple levels (Cazden et al 1996)

The research aimed to see how an online learning environment intended for design students could be devised to encourage student engagement. The important issues included predominant learning preferences within a specific group of graphic design students, the analysis of their interaction with an existing online environment in terms of social and academic engagement, and ways in which the learning preferences should contribute to the design of an online environment for these students. The methods of research (Chapter 3) were geared toward establishing the considerations when designing learning materials for this blended design education environment.

Students had to complete a Visual, Aural, Reading and Writing and Kinesthetic (VARK) questionnaire to establish what their learning preferences were. They had to complete an open ended learning task to see what their online practices were. The open-ended task was

completed in Whyville, an online learning environment created for teens and pre-teens. Its goal is to engage its users in learning about a broad range of topics, from science and business to art and geography. As a simulation based virtual world, Whyville's users engage in games and role-play The process as well as the artefact produced for this task was analysed to see whether there is a link between performance in class and online and the individual learning preferences of students. Chapter 3 closely discussed the limitations of the research design and the methodology it employed the Analysis, Design, Development, Implementation and Evaluation model. The design, development and implementation looked at the research in terms of Gagne's nine events of instruction and the evaluation looked at the overall process and considered the validity, reliability and consistency of data.

Chapter 4 examined the learning preferences of a particular group of ECP graphic design students at CPUT. In addition this chapter examined how these students experienced and acted in an online learning environment, the artefacts they produced using this online learning tool, their in-class performance, how they performed in an open-ended learning task and how the analysis of all these things can inform the design of the online component of a blended learning environment. The chapter concluded with a discussion of the interaction between learning preferences, performance, instructional design and blended design education.

The following section will attempt to discuss the data presented in Chapter 4.

5.2 Discussion

5.2.1 Multimodal Learning Styles

One group of graphic design students could contain students who perform at different levels (as was found with the online task) and have their own preferences when it comes to the intake of information. In current design education practices, these students are all given the same assignment, in the same format, with the same marking criteria and outcomes. This practice needs to be reviewed as it has become apparent that we cannot continue to treat

students in the creative disciplines as carbon copies of each other. We should be able to disseminate information in more than one format or media. For example briefs can be made available as podcasts, in written format, or as videos.

The results of the VARK questionnaire and the performance level analysis in the previous chapter show that the students with multimodal preferences performed better in the online task than those with a strong single preference. The deduction could be made that the multimodal student is more "creative". One of the definitions of creativity is being able to come up with many different solutions to the same problem. If this is the case, then it could be that the multimodal students are more likely to come up with a myriad of solutions to a single problem because they look at it from so many different angles.

Although there are many differences between the students present in the design classroom, the research also found some similar preferences. The common denominator in this specific group of students was the Kinesthetic preference. 23 out of 28 respondents had this preference in some measure or another. This means that real world simulations should form part of the curriculum. This does not necessarily mean changing the content of the curriculum but it could mean a change in the approach and presentation of learning materials and information.

The results in the previous chapter also showed that the students could not recognize the academic value of an online environment like Whyville. They also could not distinguish the learning activities that took place in this online environment. However, students are often unable to distinguish actual learning activities. This is not necessarily a bad thing. When learning activities are not salient they become integrated and therefore learning takes place seamlessly.

In addition, students could not make the link between the world of work and the problems they were being asked to solve in Whyville. Accordingly, they are still lingering on the periphery of the community of practice. It is essential that students are able to recognise their progression in terms of skill level and design knowledge, as this is ultimately what gives them a sense of being as a designer. They need to build confidence, happiness in their field, develop imagination and gain self-knowledge. All these will allow them to function at the core of their community of practice and find their place in the professional world.

One way to encourage the development of skills and design knowledge is through collaborative problem solving. Students explore and find solutions as individuals but also share the knowledge and meaning they have made with each other. This aspect of design education is incredibly important, as it is one of the cornerstones of the running of a design agency. If people were not able to work collaboratively together and solve a design problem, they would not be able to achieve much. One cannot totally dismiss the role of the lecturer in helping students make meaning, develop skills and construct knowledge, as it is a very important role. However, there needs to be a careful balance between the lecturer's input and the knowledge that students construct collaboratively.

There are students who perform well at tasks irrespective of the method of delivery. These students, like Charl, who was discussed in the previous chapter, are able to adapt and perform to the best of their abilities in any task. One must consider whether these students, if afforded the opportunity, will perform even better and transform their practices if learning and problem solving could take place in their preferred method.

5.3 Implications for Instructional Design

This section will deal with the implications of the findings with regards to the design of learning materials as part of a blended learning environment. It will look at what factors should be considered in the design of these learning materials.

The learning environment or the student's' learning preference does not necessarily dictate their performance. There are many other factors that could influence the performance of the student that are not being discussed in this study. The data examined in this study showed that students with multiple learning preferences performed better in the set task and is a fair reflection of the links between performance and preference in this specific group of graphic design students.

One of the assumptions the researcher made before the study was conducted was that students with a visual preference would like working in an environment such as Whyville because of its visually stimulating nature. This was not so in the case of Levi (who performed in level 4) as he did not feel that Whyville helped him at all. The data revealed that the students in the lower performance levels, however, benefited from the visuals and graphics. Including visual and Kinesthetic elements in the design of the learning environment could help the academically weaker student engage more in a learning environment where peer learning and possible collaborative problem solving can take place. These collaborative peer-

to-peer interactions could lead students into their Zone of Proximal Development (Vygotsky, 1978:86) and assist them in developing a sense of being (Reid & Solomonides, 2007).

A move needs to be made from the studio-based only instruction we are employing to a blended multimodal stance that stimulates all aspects of the creative student. The approach should engage him/her in a multi-layered way and challenge the current norm of design education. The advantages of an online learning environment like Whyville are not linked to performance but rather to engagement, collaborative problem solving and simulating the collaborative environments often found in the world of work.

The next section will discuss factors to consider when designing an online learning environment for design students. These will be looked at in terms of Merrill's phases for effective instruction with Jonassen et al.'s major skills as support.

5.3.1 Merrill's Phases for Effective Instruction (2002:45)

Merrill's phases for effective instruction (2002:44) as depicted in Figure 5.1 suggests five principles for instruction:

- Learning is promoted when learners are engaged in solving real-world problems.
- Learning is promoted when existing knowledge is activated as a foundation for new knowledge.
- Learning is promoted when new knowledge is demonstrated to the learner.
- Learning is promoted when the learner applies new knowledge.
- Learning is promoted when new knowledge is integrated into the learner's world.

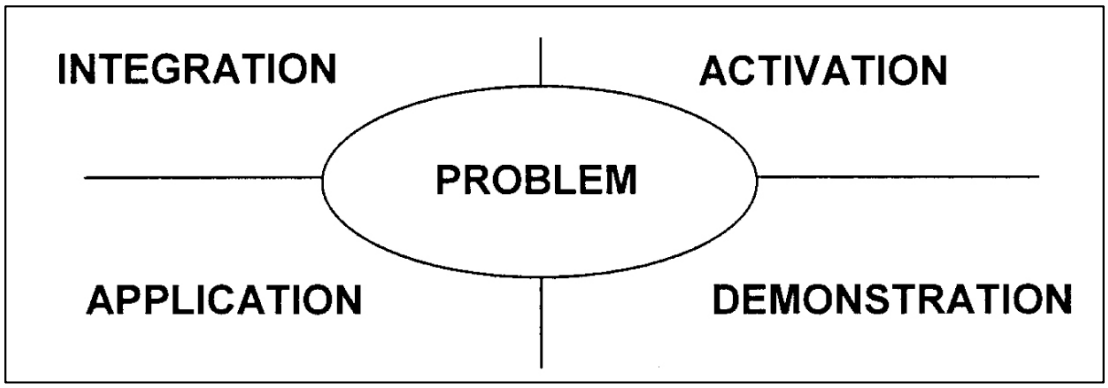


Figure 5.1: Diagrammatic representation of Merrill's phases for effective instruction as a problem centred approach.

In Chapter 2, Jonassen et al.'s major skills were equated with Merrill's phases for effective instruction (2002:45) as follows:

Table 5-A: Comparison of Jonassen et al.'s major thinking skills with Merrill's phases for effective instruction

JONASSEN ET AL	MERRILL
Project management	Problem
Research	Activation
Organization and representation	Demonstration
Presentation	Application
Reflection	Integration

The practical implications of Merrill's phases of effective instruction can be implemented practically in the way we approach student learning.

5.3.1.1 Problem

Project management is a big part of problem solving and therefore Jonassen et al. deem project management skills necessary for students to engage in solving the real world problems the design curriculum presents. It has always been the goal of design education to simulate the real world and to provide students with the skills they need to survive in industry. The learning of design should take into consideration the integrated processes one follows before you arrive at a solution to a design problem. This process is as important as the solution you provide and should be acknowledged in the design of any learning materials for design students. These learning materials should pose problems that are real to the world of design. The activation of existing knowledge allows students to acquaint new knowledge using their existing knowledge as reference point. Before this happens though, this existing knowledge has to be activated.

5.3.1.2 Activation

Once students have been presented with the problem, the process of problem solving begins. At this point, the lecturer needs to activate students' existing knowledge. Often at

the start of a new project students are briefed and then sent off to do research on the relevant topic. What happens in the briefing and research process is exactly what Merrill and Jonassen are suggesting. Students' existing knowledge is being activated and used to gain an understanding of a new knowledge set. The lecturer/briefer might probe the students to see what they already know about the topic, or alternatively will make comparisons, and use students' existing knowledge to introduce the new knowledge. E.g. you could use the process of getting dressed to explain the concept of layers in Photoshop. Each student should leave the briefing with at least one reference point that he/she can use in his/her pursuit of new knowledge. Once students have pursued their new knowledge it needs to be contextualized. Demonstrating the application of, or showing examples of the applied knowledge, provides this context.

5.3.1.3 Demonstration

Once students have delved into their own knowledge sets and researched, they have an idea of the topic and someone in the know can now demonstrate the previous applications of this type of knowledge to them. This is an important part of the learning process as it contextualizes the knowledge. They can somehow give it a place amongst their existing knowledge. Demonstration includes showing examples and modelling behaviour. These already existing representations of the knowledge will help students develop their own representations. From the demonstrations, students make derivations and will next attempt to apply it in their context. Learning materials should be provided that show students the context of design knowledge they are expected to acquire. These references should be clear and made available to students in different formats catering for the Visual, Aural, Reading and Writing and Kinesthetic preferences.

5.3.1.4 Application

The students should practice implementing their new knowledge in a specific scenario. They should then present their suggested solutions to a given problem to their lecturer. The lecturer gives feedback and suggestions for improvement and they can then adjust their solutions and again present a solution that has been refined and more accurately shows the application of the new knowledge they are supposed to have gained. Trial and error is part of this process and causes students to construct their own knowledge based on the reflective experience they had.

This part of the knowledge building process could very easily take place online. This stage of the knowledge building process is the ideal time for the implementation of the collaborative online environment. The environment designed for this purpose should make provision for both the vertical, horizontal and diagonal language exchange that could take place. The lecturer and peers should give feedback. This way, students can benefit from both sets of feedback, thus receiving both rich peer and authoritative feedback. The nature of this feedback structure can be seen in Figure 5.2.

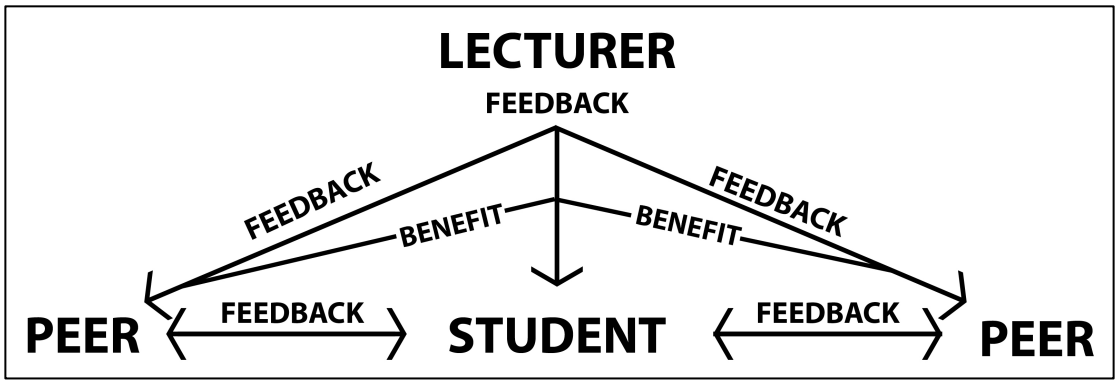


Figure 5.2: Feedback structure in online environment (Morris, 2011)

The kind of feedback structure in the online environment will drastically reduce the time spent on giving feedback to individual students. The suggested structure perpetuates the notion of the horizontal and vertical exchange that takes place in a community of practice (Wenger, 1998:2). With typical feedback, the knowledge exchange would only be vertical, from lecturer to student. In the online environment, both vertical and horizontal exchange is happening simultaneously. The classroom then becomes a place where richer intellectual communication is taking place because feedback has already taken place online. After having gone through the process of applying the knowledge, receiving feedback and then refining and finally submitting, students must be able to integrate their newly built knowledge into their practices.

5.3.1.5 Integration

If students reflect on the process of design they have gone through and are successful at internalizing the new knowledge, they should be able to integrate this new knowledge into their daily practices as design students. This means they are able to build new knowledge on these experiences that have now become existing knowledge. Figure 5.3 shows the

knowledge building process students should go through based on Merrill's phases of effective instruction.

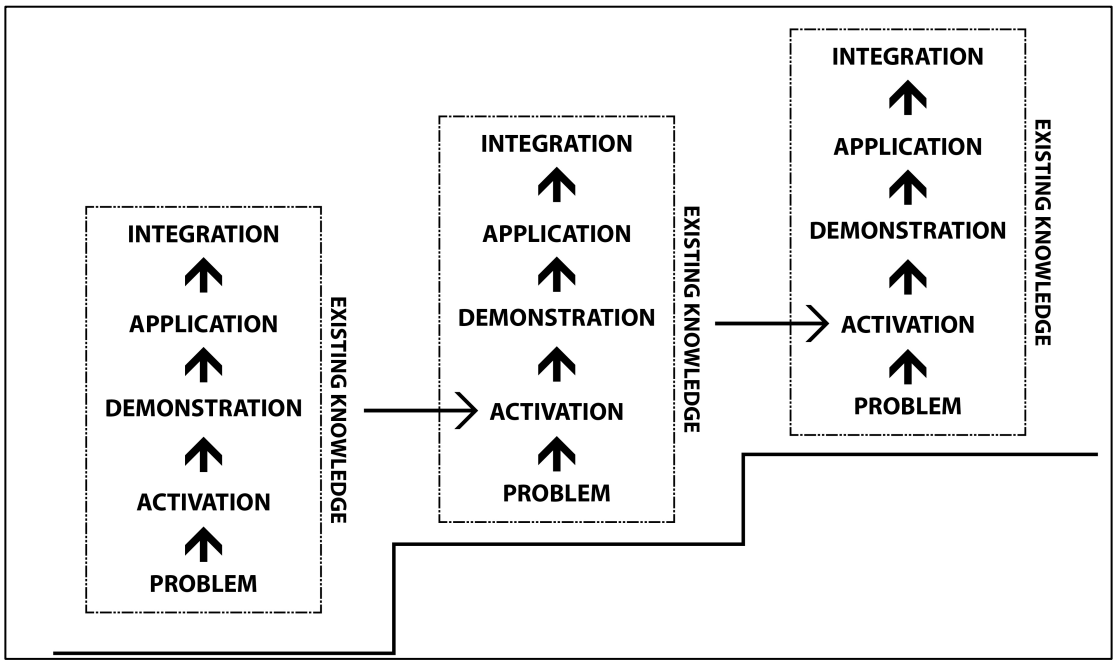


Figure 5.3: The knowledge building process adapted from Merrill's phases of effective instruction (Morris, 2011)

The transfer of existing knowledge from one context/problem to the next has always been a problem for design students. They tend to compartmentalize knowledge and cannot make the link between a current design problem and the problems they have solved in the past. This lack of transfer highlights a need for the design curriculum to include very explicit teaching of transfer. This will enable students to transfer existing knowledge to a higher-level problem and reach higher-level outcomes than in the previous problem. This process will then continue with each project/design task the student completes and so the student will build up a body of knowledge regarding his field of study. The study presented here does not provide any advice on how this transfer should be taught but recommends it as a field of further research.

5.4 Recommendations for further research

This research concluded that because there are different learning preferences among groups of design students, a blended learning environment is necessary in order for design education to move forward and be inclusive. The new generation design curriculum needs

to stimulate at many different levels using multiple ways and media. This multimodal stance in design education will afford students the opportunity to become reflective knowledge builders who are able to solve problems collaboratively and transfer existing knowledge to new contexts. Before we can reach this utopian stage in our design curriculum though we have to ask:

- What balance of studio and online interaction would serve a blended graphic design curriculum best?
- How does one teach the transfer of existing knowledge to encourage the knowledge building process suggested in Figure 5.3?
- What are the factors to consider when designing an interface for an online environment for graphic design students?
- How can a blended design curriculum help students move from the periphery of their community of practice to the core?

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Appendix A: The VARK questionnaire

The VARK Questionnnaire (Version 7.0)

How Do I Learn Best?

Choose the answer which best explains your preference and circle the letter(s) next to it.
Please circle more than one if a single answer does not match your perception.
Leave blank any question that does not apply.

1. You are helping someone who wants to go to your airport, town centre or railway station. You would:
    a. go with her.
    b. tell her the directions.
    c. write down the directions.
    d. draw, or give her a map.
2. You are not sure whether a word should be spelled `dependent' or `dependant'. You would:
    a. see the words in your mind and choose by the way they look.
    b. think about how each word sounds and choose one.
    c. find it in a dictionary.
    d. write both words on paper and choose one.
3. You are planning a holiday for a group. You want some feedback from them about the plan. You would:
    a. describe some of the highlights.
    b. use a map or website to show them the places.
    c. give them a copy of the printed itinerary.
    d. phone, text or email them.
4. You are going to cook something as a special treat for your family. You would:
    a. cook something you know without the need for instructions.
    b. ask friends for suggestions.
    c. look through the cookbook for ideas from the pictures.
    d. use a cookbook where you know there is a good recipe.
5. A group of tourists want to learn about the parks or wildlife reserves in your area. You would:
    a. talk about, or arrange a talk for them about parks or wildlife reserves.
    b. show them internet pictures, photographs or picture books.
    c. take them to a park or wildlife reserve and walk with them.
    d. give them a book or pamphlets about the parks or wildlife reserves.
6. You are about to purchase a digital camera or mobile phone. Other than price, what would most influence your decision?
    a. Trying or testing it.
    b. Reading the details about its features.
    c. It is a modern design and looks good.
    d. The salesperson telling me about its features.
7. Remember a time when you learned how to do something new. Try to avoid choosing a physical skill, eg. riding a bike. You learned best by:
    a. watching a demonstration.
    b. listening to somebody explaining it and asking questions.
    c. diagrams and charts - visual clues.
    d. written instructions – e.g. a manual or textbook.

8. You have a problem with your knee. You would prefer that the doctor:
    a. gave you a web address or something to read about it.
    b. used a plastic model of a knee to show what was wrong.
    c. described what was wrong.
    d. showed you a diagram of what was wrong.
9. You want to learn a new program, skill or game on a computer. You would:
    a. read the written instructions that came with the program.
    b. talk with people who know about the program.
    c. use the controls or keyboard.
    d. follow the diagrams in the book that came with it.
10. I like websites that have:
    a. things I can click on, shift or try.
    b. interesting design and visual features.
    c. interesting written descriptions, lists and explanations.
    d. audio channels where I can hear music, radio programs or interviews.
11. Other than price, what would most influence your decision to buy a new non-fiction book?
    a. The way it looks is appealing.
    b. Quickly reading parts of it.
    c. A friend talks about it and recommends it.
    d. It has real-life stories, experiences and examples.
12. You are using a book, CD or website to learn how to take photos with your new digital camera. You would like to have:
    a. a chance to ask questions and talk about the camera and its features.
    b. clear written instructions with lists and bullet points about what to do.
    c. diagrams showing the camera and what each part does.
    d. many examples of good and poor photos and how to improve them.
13. Do you prefer a teacher or a presenter who uses:
    a. demonstrations, models or practical sessions.
    b. question and answer, talk, group discussion, or guest speakers.
    c. handouts, books, or readings.
    d. diagrams, charts or graphs.
14. You have finished a competition or test and would like some feedback. You would like to have feedback:
    a. using examples from what you have done.
    b. using a written description of your results.
    c. from somebody who talks it through with you.
    d. using graphs showing what you had achieved.
15. You are going to choose food at a restaurant or cafe. You would:
    a. choose something that you have had there before.
    b. listen to the waiter or ask friends to recommend choices.
    c. choose from the descriptions in the menu.
    d. look at what others are eating or look at pictures of each dish.
16. You have to make an important speech at a conference or special occasion. You would:
    a. make diagrams or get graphs to help explain things.
    b. write a few key words and practice saying your speech over and over.
    c. write out your speech and learn from reading it over several times.
    d. gather many examples and stories to make the talk real and practical.

VARK

visual aural read/write kinesthetic

The VARK Questionnaire Scoring Chart

Use the following scoring chart to find the VARK category that each of your answers corresponds to. Circle the letters that correspond to your answers

e.g. If you answered b and c for question 3, circle V and R in the question 3 row.

Question	a category	b category	c category	d category
3	K	V	R	A

Scoring Chart

Question	**a** category	**b** category	**c** category	**d** category
1	K	A	R	V
2	V	A	R	K
3	K	V	R	A
4	K	A	V	R
5	A	V	K	R
6	K	R	V	A
7	K	A	V	R
8	R	K	A	V
9	R	A	K	V
10	K	V	R	A
11	V	R	A	K
12	A	R	V	K
13	K	A	R	V
14	K	R	A	V
15	K	A	R	V
16	V	A	R	K

Calculating your scores

Count the number of each of the VARK letters you have circled to get your score for each VARK category.

Total number of **V**s circled =	
Total number of **A**s circled =	
Total number of **R**s circled =	
Total number of **K**s circled =	

Calculating your preferences

Use the VARK spreadsheet (which can be purchased from the www.vark-learn.com web site) to work out your VARK learning preferences.

Appendix B: Online Survey Monkey Questionnaire

Whyville Evaluation **Exit this survey**

1. Whyville Evaluation

100%

∗1. Please fill in the following details:

Name:

Email Address:

Phone Number:

Please answer the following questions by clicking either yes or no.

∗2. The Whyville environment appeals to me:

	Yes	No
Visually	○	○
Academically	○	○
Socially	○	○

Are there any other things in Whyville that appeal to you

∗3. In Whyville I:

	Yes	No
Chatted with my friends	○	○
Played games	○	○
Performed learning activities	○	○
Went shopping	○	○
Performed other activities	○	○

Please specify which other activities you performed

***4. My activities in Whyville helped me to:**

	Yes	No
Develop as a designer	○	○
Communicate with my fellow students	○	○
Reach classmates in other locations	○	○
Develop my computer skills	○	○
Learn about the world of work	○	○

In what other ways did Whyville help you?

***5. In Whyville:**

	Yes	No
The graphics made me want to find out more	○	○
I could easily move from location to location	○	○
I could find what I needed	○	○
It was easy to understand what I needed to do	○	○

What worked well for you in Whyville?

***6. I could not use Whyville effectively because:**

	Yes	No
I did not register and could not log in	○	○
The internet was too slow	○	○
I did not know what to do	○	○
I needed assistance and could not find any	○	○

What did not work for you in Whyville?

***7. I could use Whyville for:**

	Yes	No
Online group meetings during group work	○	○
To communicate with my lecturer	○	○
To discuss homework with classmates	○	○
To chat socially and meet new people	○	○

What else do you think you can use Whyville for?

***8. Do you think Whyville can be used as a learning tool?**

- ○ Yes
- ○ No

Please give a reason for the answer above

***9. I have access to the internet and a computer at**

	Yes	No
Home/Where I stay	○	○
University	○	○
Internet cafe	○	○
Other	○	○

Other (please specify)

Appendix C: The Clickers Questionnaire

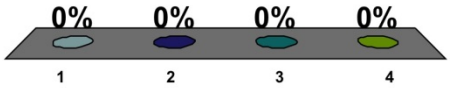
Whyville Questionnaire

I am:

1. Male
2. Female

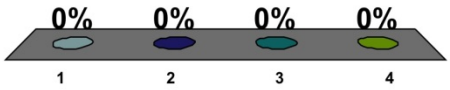
Whyville can be used in my studies

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



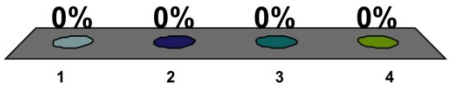
Whyville appeals to me visually

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



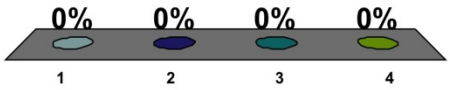
I used Whyville's chatrooms

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



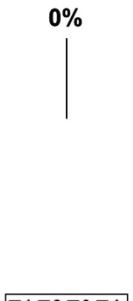
I performed learning activities in Whyville

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



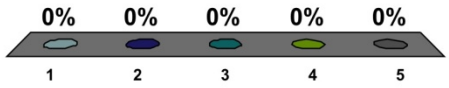
Whyville helped me learn

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



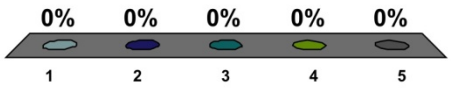
I like Whyville because

1. It has good visuals
2. I can chat with friends
3. I can perform learning activities
4. I like online interactive environments
5. I don't like Whyville



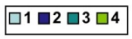
I don't like Whyville because

1. It is not interactive enough
2. I don't like online interactive environments
3. Requires too much work
4. I prefer normal classes
5. I like Whyville



Whyville helped me develop design skills

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

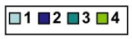


My activities in Whyville helped develop my communication skills

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

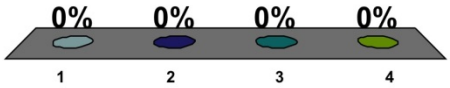
My classmates and I discussed the problems we had and helped each other solve them

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



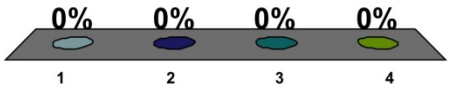
The lecturer had to verbally explain to me what to do

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



I read the instructions I was given

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

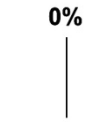


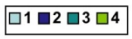
I watched others and did what they were doing

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

I found my own way to solve problems

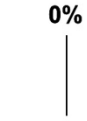
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

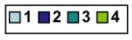




I discussed what I was doing with my fellow students

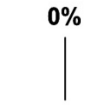
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

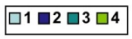




I would use Whyville socially

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



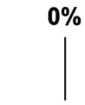


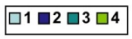
In Whyville I had to solve problems

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

The Whyville graphics helped me find what I was looking for

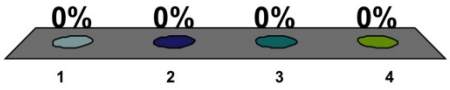
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree





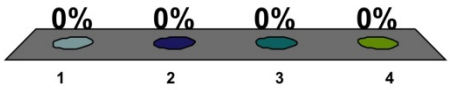
I would like to have classes in an online environment like Whyville

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



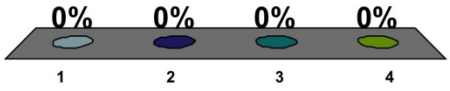
I learn with pictures and diagrams

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



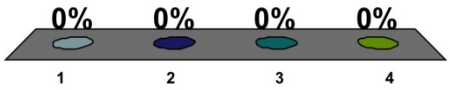
I like verbal briefs/lessons

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



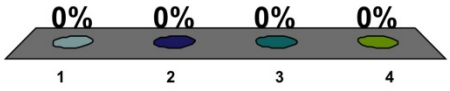
I like reading the brief

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



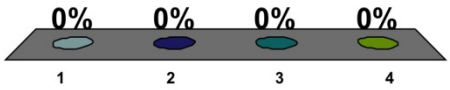
I like taking notes

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



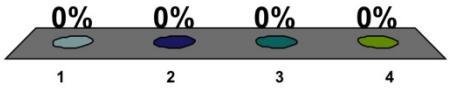
I learn by doing a task

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



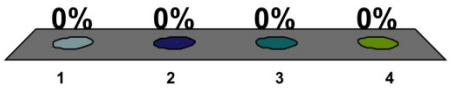
I listen first then write

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



I write while I listen

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

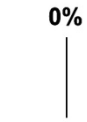


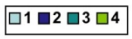
I speak out loud before doing something

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

In class I discuss my projects with others

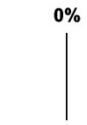
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree





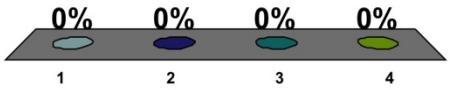
When I study I

1. Make notes
2. Draw Diagrams
3. Read out loud
4. Try and recall what I did in class
5. All of the above



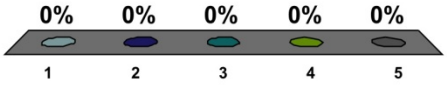
How do you access the internet most?

1. Home Computer
2. Cellular Phone
3. Internet Café
4. At University



I have computer access

1. At home
2. At University
3. At a friend's house
4. At the Internet café
5. All of the above



My activities in Whyville helped develop my computer skills

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree

Appendix D: Results of the Online Questionnaire

2. The Whyville environment appeals to me: Create Chart | Download

	Yes	No	Response Count
Visually	**91.7% (11)**	8.3% (1)	12
Academically	**58.3% (7)**	41.7% (5)	12
Socially	**91.7% (11)**	8.3% (1)	12
Show replies Are there any other things in Whyville that appeal to you			5
		answered question	**12**
		skipped question	**0**

3. In Whyville I: Create Chart | Download

	Yes	No	Response Count
Chatted with my friends	**66.7% (8)**	33.3% (4)	12
Played games	**50.0% (6)**	**50.0% (6)**	12
Performed learning activities	41.7% (5)	**58.3% (7)**	12
Went shopping	25.0% (3)	**75.0% (9)**	12
Performed other activities	**75.0% (9)**	25.0% (3)	12

4. My activities in Whyville helped me to: Create Chart | Download

	Yes	No	Response Count
Develop as a designer	**75.0% (9)**	25.0% (3)	12
Communicate with my fellow students	**75.0% (9)**	25.0% (3)	12
Reach classmates in other locations	41.7% (5)	**58.3% (7)**	12
Develop my computer skills	**83.3% (10)**	16.7% (2)	12
Learn about the world of work	33.3% (4)	**66.7% (8)**	12
Hide replies In what other ways did Whyville help you?			4

1. to reach people	Thu, Oct 29, 2009 10:19 AM	Find...
2. more time	Thu, Oct 29, 2009 10:07 AM	Find...
3. think laterally.	Thu, Oct 29, 2009 10:01 AM	Find...
4. Not really	Thu, Oct 29, 2009 9:47 AM	Find...

	answered question	**12**
	skipped question	**0**

5. In Whyville: Create Chart | Download

	Yes	No	Response Count
The graphics made me want to find out more	**75.0% (9)**	25.0% (3)	12
I could easily move from location to location	**83.3% (10)**	16.7% (2)	12
I could find what I needed	**75.0% (9)**	25.0% (3)	12
It was easy to understand what I needed to do	**75.0% (9)**	25.0% (3)	12
		Hide replies What worked well for you in Whyville?	4

1. doing my image	Thu, Oct 29, 2009 10:19 AM	Find...
2. the movements	Thu, Oct 29, 2009 10:07 AM	Find...
3. the wallpapers	Thu, Oct 29, 2009 10:01 AM	Find...
4. everything	Thu, Oct 29, 2009 9:29 AM	Find...

	answered question	**12**
	skipped question	**0**

6. I could not use Whyville effectively because: Create Chart | Download

	Yes	No	Response Count
I did not register and could not log in	16.7% (2)	**83.3% (10)**	12
The internet was too slow	**91.7% (11)**	8.3% (1)	12
I did not know what to do	16.7% (2)	**83.3% (10)**	12
I needed assistance and could not find any	8.3% (1)	**91.7% (11)**	12
		Hide replies What did not work for you in Whyville?	4

1. nothing	Thu, Oct 29, 2009 10:19 AM	Find...
2. the passwords	Thu, Oct 29, 2009 10:07 AM	Find...
3. plenty of things.	Thu, Oct 29, 2009 10:01 AM	Find...
4. the internet was the result that it was difficult to move from one destination to the following one.	Thu, Oct 29, 2009 9:47 AM	Find...

	answered question	**12**

7. I could use Whyville for: Create Chart | Download

	Yes	No	Response Count
Online group meetings during group work	**58.3% (7)**	41.7% (5)	12
To communicate with my lecturer	**75.0% (9)**	25.0% (3)	12
To discuss homework with classmates	**66.7% (8)**	33.3% (4)	12
To chat socially and meet new people	**75.0% (9)**	25.0% (3)	12
		Hide replies What else do you think you can use Whyville for?	4

1. nothing	Thu, Oct 29, 2009 10:19 AM	Find...
2. have none	Thu, Oct 29, 2009 10:07 AM	Find...
3. making wallpapers.	Thu, Oct 29, 2009 10:01 AM	Find...
4. learning and discovering new things in the deswign world.	Thu, Oct 29, 2009 9:47 AM	Find...

8. Do you think Whyville can be used as a learning tool? Create Chart | Download

	Response Percent	Response Count
Yes	100.0%	12
No	0.0%	0
Hide replies Please give a reason for the answer above		6

1. it can help us with our design techniques,and for us to communicate	Thu, Oct 29, 2009 10:19 AM	Find...
2. one can be connected in groups and work.	Thu, Oct 29, 2009 10:07 AM	Find...
3. u can learn to think creatively.	Thu, Oct 29, 2009 10:01 AM	Find...
4. no	Thu, Oct 29, 2009 9:57 AM	Find...
5. T are many activities to do and doing things in whyville can keep you busy.	Thu, Oct 29, 2009 9:47 AM	Find...
6. it appeals to all young groups and makes learning fun	Thu, Oct 29, 2009 9:29 AM	Find...

answered question	12
skipped question	0

9. I have access to the internet and a computer at Create Chart | Download

	Yes	No	Response Count
Home/Where I stay	25.0% (3)	**75.0% (9)**	12
University	**100.0% (12)**	0.0% (0)	12
Internet cafe	41.7% (5)	**58.3% (7)**	12
Other	25.0% (3)	**75.0% (9)**	12
Hide replies Other (please specify)			2

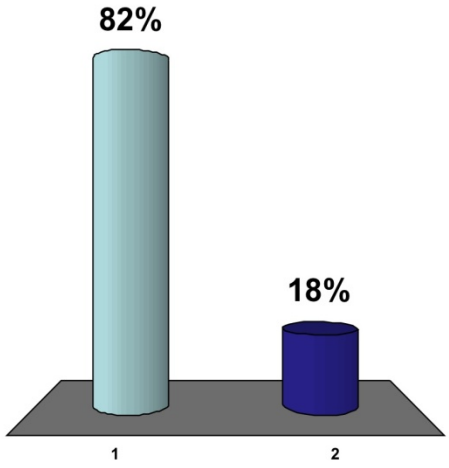
1. friend	Thu, Oct 29, 2009 10:19 AM	Find...
2. just have a computer no internet	Thu, Oct 29, 2009 10:07 AM	Find...

answered question	12
skipped question	0

Appendix E: Results of the Clickers Questionnaire

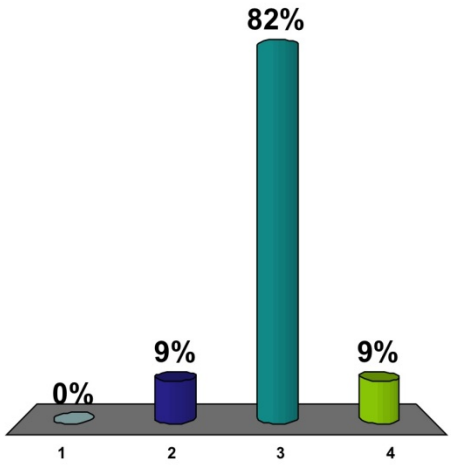
I am:

1. Male
2. Female



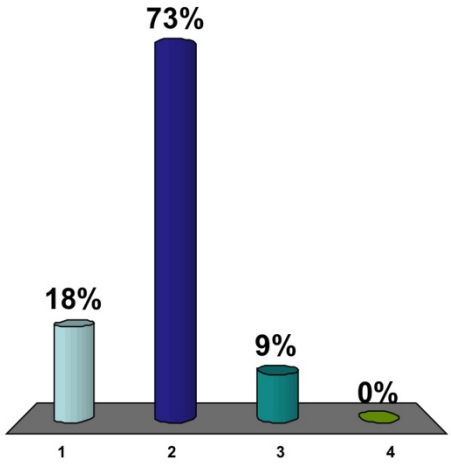
Whyville can be used in my studies

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



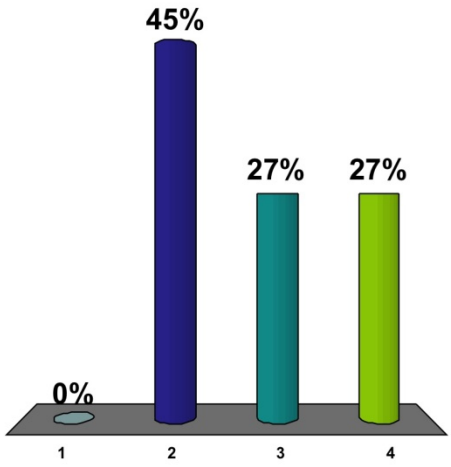
Whyville appeals to me visually

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



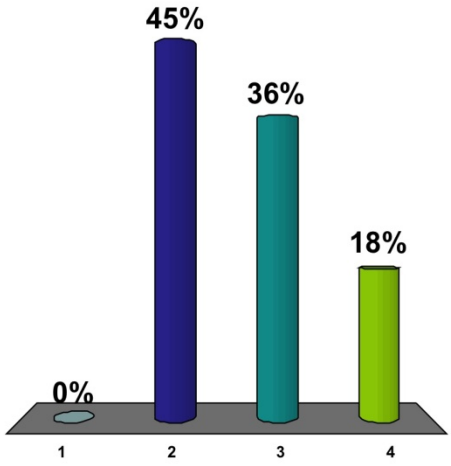
I used Whyville's chatrooms

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



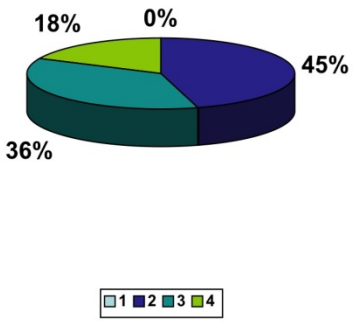
I performed learning activities in Whyville

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



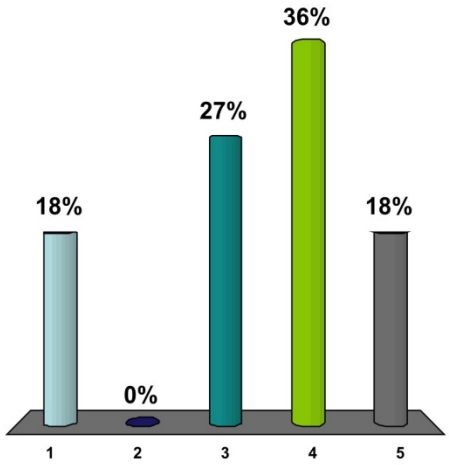
Whyville helped me learn

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



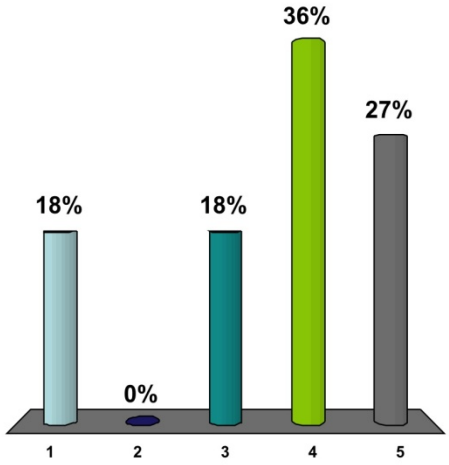
I like Whyville because

1. It has good visuals
2. I can chat with friends
3. I can perform learning activities
4. I like online interactive environments
5. I don't like Whyville



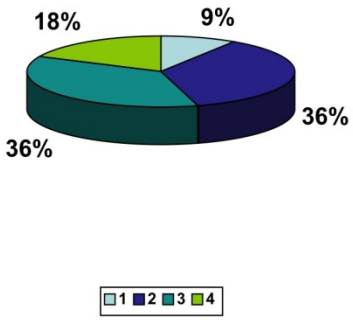
I don’t like Whyville because

1. It is not interactive enough
2. I don’t like online interactive environments
3. Requires too much work
4. I prefer normal classes
5. I like Whyville



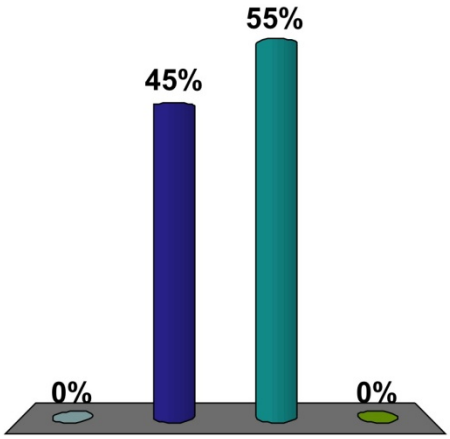
Whyville helped me develop design skills

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



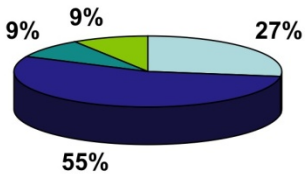
My activities in Whyville helped develop my communication skills

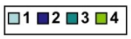
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



My classmates and I discussed the problems we had and helped each other solve them

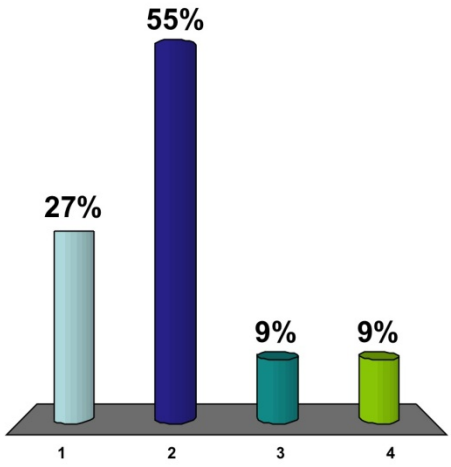
1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree





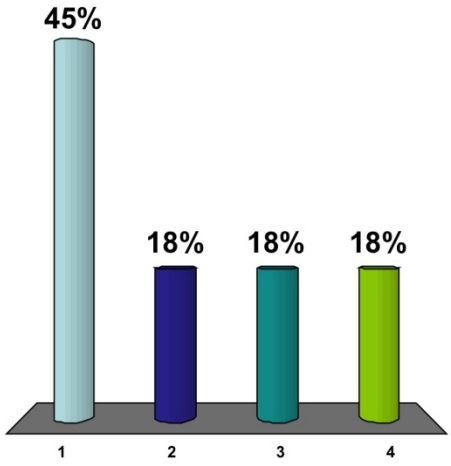
The lecturer had to verbally explain to me what to do

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



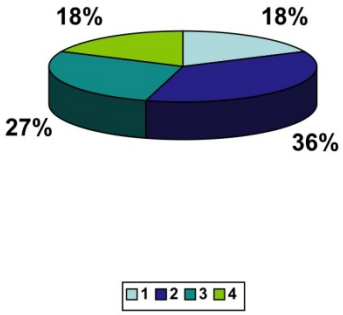
I read the instructions I was given

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



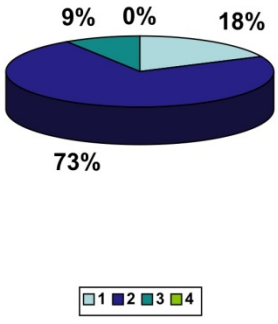
I watched others and did what they were doing

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



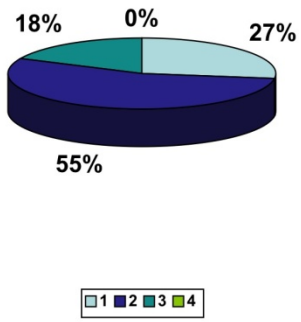
I found my own way to solve problems

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



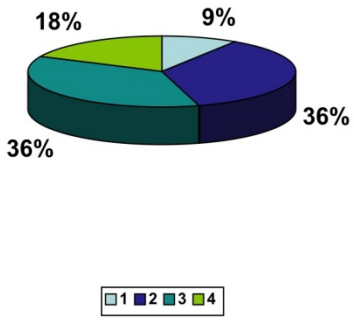
I discussed what I was doing with my fellow students

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



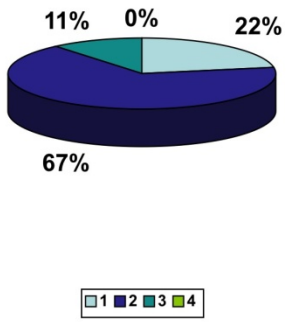
My activities in Whyville helped develop my computer skills

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



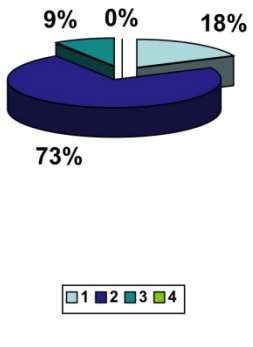
In Whyville I had to solve problems

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



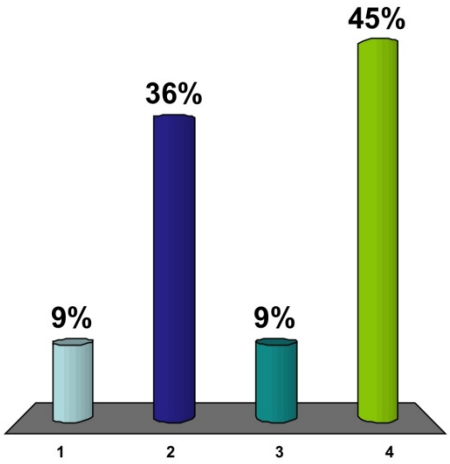
The Whyville graphics helped me find what I was looking for

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



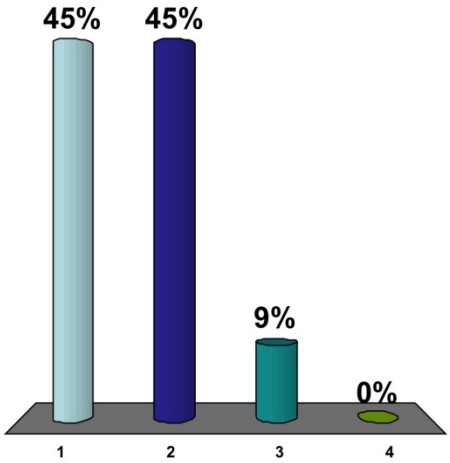
I would like to have classes in an online environment like Whyville

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



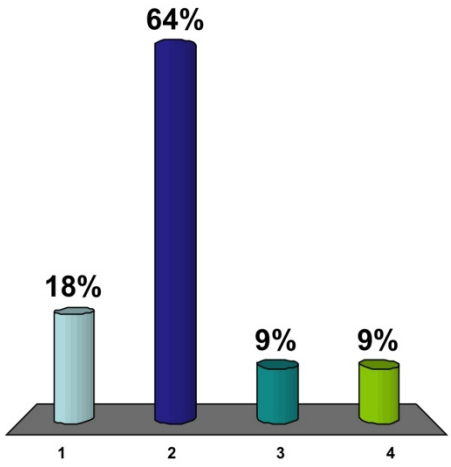
I learn with pictures and diagrams

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



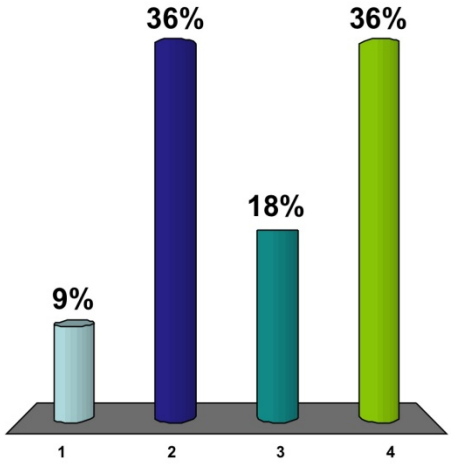
I like verbal briefs/lessons

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



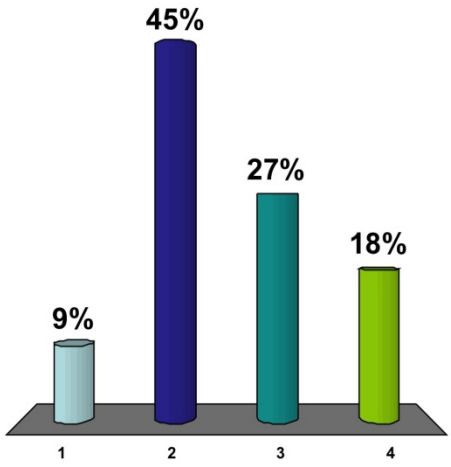
I like reading the brief

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



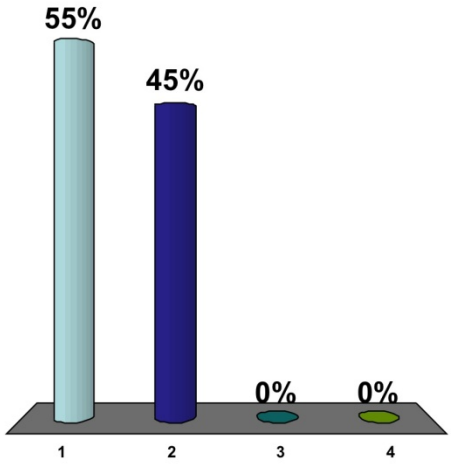
I like taking notes

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



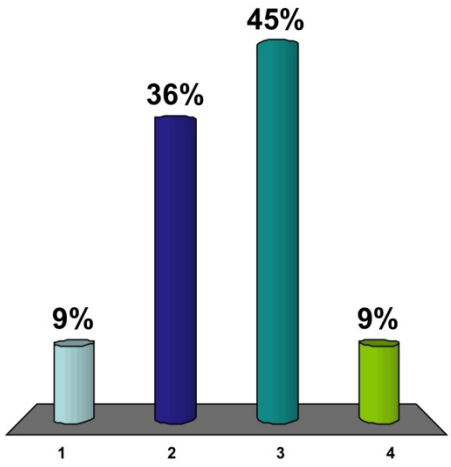
I learn by doing a task

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



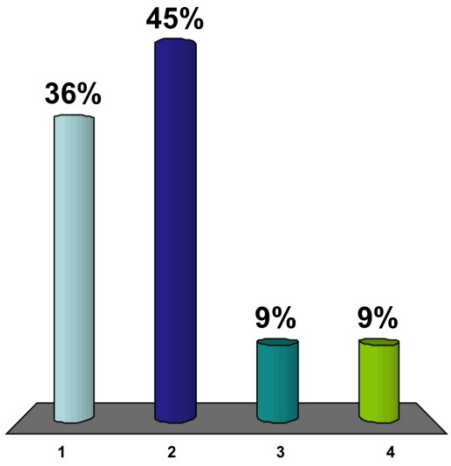
I listen first then write

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



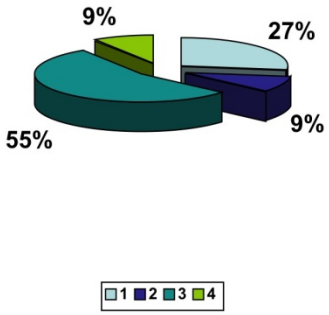
I write while I listen

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



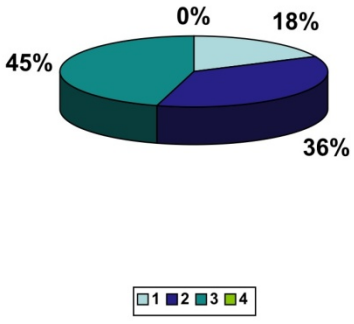
I speak out loud before doing something

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



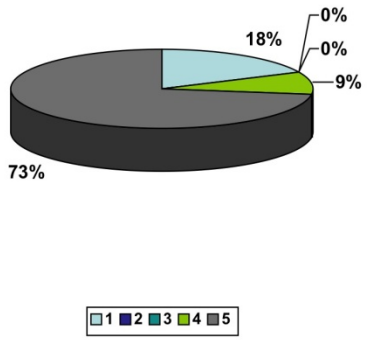
In class I discuss my projects with others

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



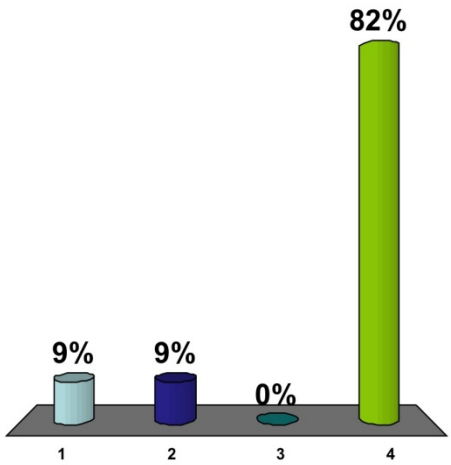
When I study I

1. Make notes
2. Draw Diagrams
3. Read out loud
4. Try and recall what I did in class
5. All of the above



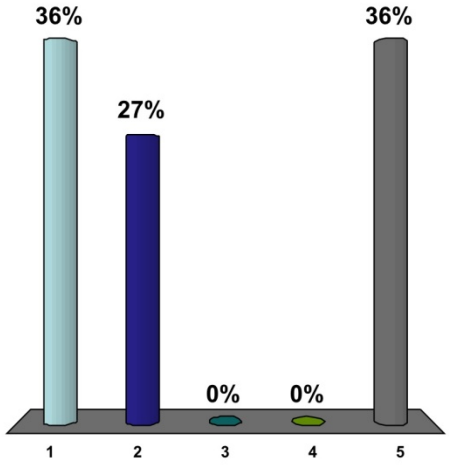
How do you access the internet most?

1. Home Computer
2. Cellular Phone
3. Internet Café
4. At University



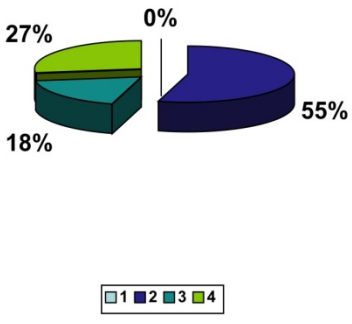
I have computer access

1. At home
2. At University
3. At a friend's house
4. At the Internet café
5. All of the above



I would use Whyville socially

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



Appendix F: Results of the VARK Questionnaire

Appendix F contains the data gathered from the 28 participants who completed the VARK questionnaire. The 8 columns on the left hand side of the table shows the number of participants, their gender, names, the number of response they indicated in each of the VARK categories and the total amount of responses for each participant. The VARK categories for which each participant scored the highest are highlighted in green.

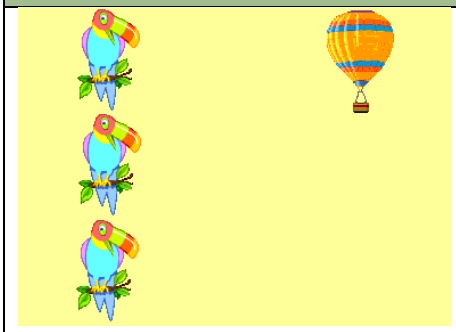
	GEN	PARTICIPANT	V	A	R	K	RESPONSES	CALCULATION	PREFERENCE	ELIMINATORS
1	F	P1	8	4	9	7	28	9-4=5	VRK	A
2	M	P2	9	3	3	7	22	9-3=6	VK	AR
3	F	P3	1	8	3	5	17	8-3=5	A	VRK
4	M	P6	2	8	3	3	16	8-2=6	A	VRK
5	F	P7	4	10	4	7	25	10-4=6	AK	VR
6	M	CHARL	4	9	4	8	25	9-4=5	AK	VR
7	M	P9	6	11	4	7	28	11-4=7	A	VRK
8	M	P28	2	13	6	8	29	13-4=9	A	VRK
9	M	P12	8	8	11	10	37	11-5=6	VARK	
10	F	KAREN	3	3	3	7	16	7-2=5	K	VAR
11	M	P13	3	4	9	12	28	12-4=8	RK	VA
12	M	P14	1	7	7	9	24	9-4=5	ARK	V
13	M	P15	4	6	5	8	23	8-4=4	ARK	V
14	F	P16	2	6	3	9	20	9-3=6	K	VAR
15	M	P17	2	5	7	10	24	10-4=6	RK	VA
16	M	P18	4	6	4	7	21	7-3=4	AK	VR

	GEN	PARTICIPANT	V	A	R	K	RESPONSES	CALCULATION	PREFERENCE	ELIMINATORS
17	F	P19	1	4	6	7	18	7-3=4	RK	VA
18	M	P20	3	2	4	7	16	7-2=5	K	VAR
19	M	P21	3	3	4	7	17	7-3=4	K	VAR
20	M	P22	2	6	4	8	20	8-3=5	AK	VR
21	M	STEVEN	4	5	3	5	17	5-3=2	VARK	
22	M	P23	2	2	6	6	16	6-2=4	RK	VA
23	M	P24	6	3	9	9	27	9-4=5	VRK	A
24	M	P25	9	8	6	9	32	9-5=4	VARK	
25	M	P26	1	5	5	5	16	5-2=3	ARK	V
26	M	JOHN	11	5	7	10	33	11-5=6	VRK	A
27	M	KEVIN	7	4	5	6	22	7-3=4	VRK	A
28	M	P27	9	5	7	3	24	9-4=5	VR	AK
		AVERAGE	4.3	5.8	5.4	7.4				

Appendix G: Tabularization of wallpaper designs and questionnaire responses

The top left row of each table shows the respondents wallpaper design and their learning preference scores. In the top right hand row we see the Performance Level at which the wallpaper design was classified. The rest of the table shows the responses to the Whyville questionnaire.

Table G-1: Kelly' Responses

RESPONDENT: Kelly	Responses
	PL1 Design shows no understanding of basic colour and design.
2) I am:	Female
3) Whyville appeals to me visually	Agree
4) Whyville can be used in my studies	Disagree
5) I would use Whyville socially	Agree
6) I used Whyville's chatrooms	Agree
7) I performed learning activities in Whyville	Agree
8) Whyville helped me learn	Agree
9) I like Whyville because	I like online interactive environments
10) I don't like Whyville because	I like Whyville
11) Whyville helped me develop design skills	Agree
12) My activities in Whyville helped develop my communication skills	Agree
13) My classmates and I discussed the problems we had and helped each other solve them	Agree
14) The lecturer had to verbally explain to me what to do	Strongly Agree
15) I read the instructions I was given	Agree

RESPONDENT: Kelly	Responses
16) I watched others and did what they were doing	Disagree
17) I found my own way to solve problems	Agree
18) I discussed what I was doing with my fellow students	Agree
19) My activities in Whyville helped develop my computer skills	Strongly Agree
20) In Whyville I had to solve problems	-
21) The Whyville graphics helped me find what I was looking for	Agree
22) I would like to have classes in an online environment like Whyville	Agree
23) I learn with pictures and diagrams	Disagree
24) I like verbal briefs/lessons	Agree
25) I like reading the brief	Agree
26) I like taking notes	Strongly Disagree
27) I learn by doing a task	Strongly Agree
28) I listen first then write	Strongly Disagree
29) I write while I listen	Strongly Agree
30) I speak out loud before doing something	Strongly Disagree
31) In class I discuss my projects with others	Disagree
32) When I study I	Make notes
33) How do you access the internet most?	At University
34) I have computer access	All of the above

Table G-2: Shaun's responses

Shaun	Responses
 **AK** 4 9 4 8	PL2 The random placement and overlaying of icons shows a readiness to design but a lack of understanding of elements such as colour and balance. The kissing lips overpower the car. This student still needs clear guidelines
2) I am:	Male
3) Whyville appeals to me visually	Agree
4) Whyville can be used in my studies	Agree
5) I would use Whyville socially	Agree
6) I used Whyville's chatrooms	Agree
7) I performed learning activities in Whyville	Disagree
8) Whyville helped me learn	Disagree
9) I like Whyville because	I like online interactive environments
10) I don't like Whyville because	Requires too much work
11) Whyville helped me develop design skills	Agree
12) My activities in Whyville helped develop my communication skills	Disagree
13) My classmates and I discussed the problems we had and helped each other solve them	Strongly Agree
14) The lecturer had to verbally explain to me what to do	Strongly Agree
15) I read the instructions I was given	Disagree
16) I watched others and did what they were doing	Agree
17) I found my own way to solve problems	Agree
18) I discussed what I was doing with my fellow students	Agree
19) My activities in Whyville helped develop my computer skills	Agree
20) In Whyville I had to solve problems	-
21) The Whyville graphics helped me find what I was looking for	Agree

Shaun	Responses
22) I would like to have classes in an online environment like Whyville	Agree
23) I learn with pictures and diagrams	Strongly Agree
24) I like verbal briefs/lessons	Agree
25) I like reading the brief	Strongly Disagree
26) I like taking notes	Disagree
27) I learn by doing a task	Agree
28) I listen first then write	Agree
29) I write while I listen	Agree
30) I speak out loud before doing something	Disagree
31) In class I discuss my projects with others	Strongly Agree
32) When I study I	All of the above
33) How do you access the internet most?	At University
34) I have computer access	All of the above

Table G-3: Matthew's responses

Matthew	Responses
 **VARK** 4 5 3 5	PL3 The repetition of similar objects is the "safe" option. Very clear symmetry and limited use of colour. Has an idea of a focal point.
2) I am:	Male
3) Whyville appeals to me visually	Strongly Agree
4) Whyville can be used in my studies	Disagree
5) I would use Whyville socially	Disagree
6) I used Whyville's chatrooms	Disagree
7) I performed learning activities in Whyville	Disagree

Matthew	Responses
8) Whyville helped me learn	Agree
9) I like Whyville because	I can perform learning activities
10) I don't like Whyville because	It is not interactive enough
11) Whyville helped me develop design skills	Agree
12) My activities in Whyville helped develop my communication skills	Agree
13) My classmates and I discussed the problems we had and helped each other solve them	Agree
14) The lecturer had to verbally explain to me what to do	Strongly Disagree
15) I read the instructions I was given	Disagree
16) I watched others and did what they were doing	Strongly Agree
17) I found my own way to solve problems	Agree
18) I discussed what I was doing with my fellow students	Agree
19) My activities in Whyville helped develop my computer skills	Agree
20) In Whyville I had to solve problems	Agree
21) The Whyville graphics helped me find what I was looking for	Agree
22) I would like to have classes in an online environment like Whyville	Agree
23) I learn with pictures and diagrams	Agree
24) I like verbal briefs/lessons	Agree
25) I like reading the brief	Agree
26) I like taking notes	Strongly Agree
27) I learn by doing a task	Agree
28) I listen first then write	Disagree
29) I write while I listen	Strongly Agree
30) I speak out loud before doing something	Disagree
31) In class I discuss my projects with others	Agree
32) When I study I	Make notes
33) How do you access the internet most?	At University
34) I have computer access	At home

Table G-4: Levi's responsesTable B

Levi	Responses
 **VRK** 7 4 5 6	PL4 There is an attempt at figure ground application as well as colour contrast. The design shows competence and an understanding of the tools and their possible use. Only uses existing icons (no adaptation)
2) I am:	Male
3) Whyville appeals to me visually	Disagree
4) Whyville can be used in my studies	Disagree
5) I would use Whyville socially	Strongly Disagree
6) I used Whyville's chatrooms	Strongly Disagree
7) I performed learning activities in Whyville	Strongly Disagree
8) Whyville helped me learn	Strongly Disagree
9) I like Whyville because	I don't like Whyville
10) I don't like Whyville because	I prefer normal classes
11) Whyville helped me develop design skills	Strongly Disagree
12) My activities in Whyville helped develop my communication skills	Disagree
13) My classmates and I discussed the problems we had and helped each other solve them	Agree
14) The lecturer had to verbally explain to me what to do	Agree
15) I read the instructions I was given	Strongly Agree
16) I watched others and did what they were doing	Agree
17) I found my own way to solve problems	Disagree
18) I discussed what I was doing with my fellow students	Strongly Agree
19) My activities in Whyville helped develop my computer skills	Disagree
20) In Whyville I had to solve problems	Strongly Agree
21) The Whyville graphics helped me find what I was looking for	Disagree
22) I would like to have classes in an online environment like Whyville	Strongly Disagree

Levi	Responses
23) I learn with pictures and diagrams	Strongly Agree
24) I like verbal briefs/lessons	Agree
25) I like reading the brief	Agree
26) I like taking notes	Strongly Disagree
27) I learn by doing a task	Strongly Agree
28) I listen first then write	Agree
29) I write while I listen	Strongly Disagree
30) I speak out loud before doing something	Disagree
31) In class I discuss my projects with others	Strongly Agree
32) When I study I	All of the above
33) How do you access the internet most?	At University
34) I have computer access	All of the above

Table G-5: Charl's responses

Charl	Responses
 **VRK** 11 5 7 10	PL5 The design shows understanding of foreground/background principles through the thoughtful overlapping of objects. The student has shown initiative by using the brush tool to create objects not available as icons. The use of colour and strategic placement of objects shows clear conceptualization and design planning.
2) I am:	Male
3) Whyville appeals to me visually	Agree
4) Whyville can be used in my studies	Strongly Disagree
5) I would use Whyville socially	Strongly Disagree
6) I used Whyville's chatrooms	Agree
7) I performed learning activities in Whyville	Disagree

Charl	Responses
8) Whyville helped me learn	Agree
9) I like Whyville because	I can perform learning activities
10) I don't like Whyville because	I like Whyville
11) Whyville helped me develop design skills	Strongly Disagree
12) My activities in Whyville helped develop my communication skills	Disagree
13) My classmates and I discussed the problems we had and helped each other solve them	Strongly Disagree
14) The lecturer had to verbally explain to me what to do	Agree
15) I read the instructions I was given	Strongly Agree
16) I watched others and did what they were doing	Strongly Disagree
17) I found my own way to solve problems	Strongly Agree
18) I discussed what I was doing with my fellow students	Agree
19) My activities in Whyville helped develop my computer skills	Strongly Disagree
20) In Whyville I had to solve problems	Strongly Agree
21) The Whyville graphics helped me find what I was looking for	Agree
22) I would like to have classes in an online environment like Whyville	Strongly Disagree
23) I learn with pictures and diagrams	Strongly Agree
24) I like verbal briefs/lessons	Strongly Disagree
25) I like reading the brief	Strongly Disagree
26) I like taking notes	Disagree
27) I learn by doing a task	Strongly Agree
28) I listen first then write	Disagree
29) I write while I listen	Agree
30) I speak out loud before doing something	Strongly Agree
31) In class I discuss my projects with others	Disagree
32) When I study I	All of the above
33) How do you access the internet most?	At University
34) I have computer access	At University

Appendix H: Wallpaper design brief: 29 October 2009

You have been spending quite some time getting to know the Whyville environment and navigation. Now that you are familiar with Whyville complete the following task:

1. **Log in using you username and password**
2. **Navigate your way to the Dell Plaza**

3. **Go inside Dell Plaza**

4. **Under the design kiosk click on the wallpaper maker or click the "design wallpaper link below the window**

5. **Using the tools available in the wallpaper maker create a wallpaper for your computer's desktop.**

6. **Save you wallpaper design as a JPEG and email to morrisa@cput.ac.za by 12 noon.**

Remember the basic design principles and elements you were taught in class and try to apply these to your design

Criteria to keep in mind:

Composition, Design Elements, Design Principles, Concept (thought process). Use the available tools to realize your concept

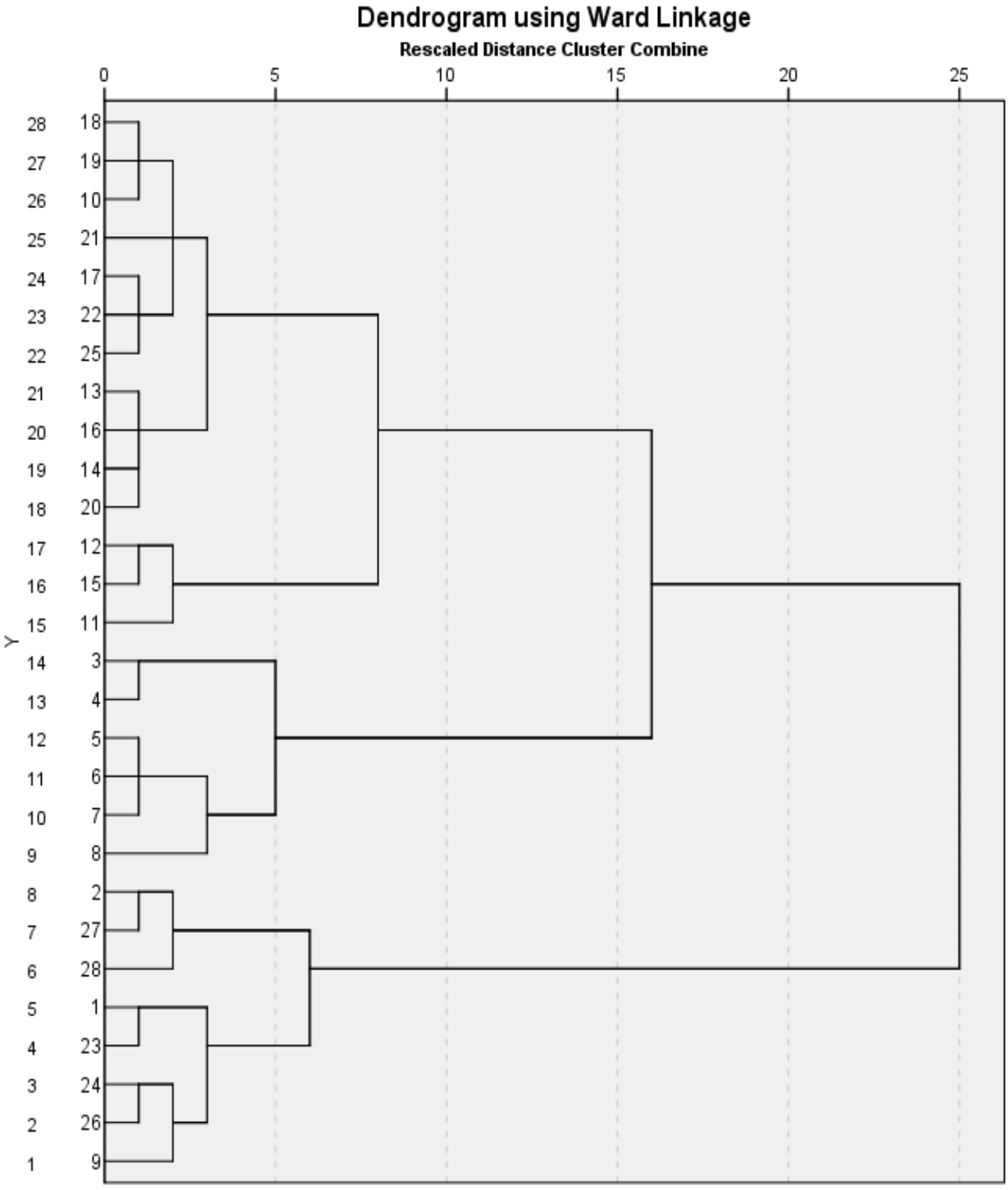
Appendix I: Wallpaper evaluation rubric

Performance Level = PL

	Composition	**Design Elements/Principles**	**Concept (thought process)**	**Use of available tools**
PL 1	The icons etc. are randomly placed. No visual hierarchy	Not balanced Poor colour choices	No visible concept	Poor use of available tools. No creative interpretation of icons
PL 2	Attempts to arrange icons sensibly. No visual hierarchy	Poor colour choices Attempted balance	Evidence of concept can be seen but it is unsuccessfully executed.	Can use available tools. No creative interpretation of available icons
PL 3	Succeeds at basic composition. Attempts to create visual hierarchy	Largely symmetrical balance Succeeds at creating contrast using colour	Evidence of concept with semi-successful execution.	Average use of available tools. Uses available icons appropriately.
PL 4	Shows understanding of complex compositions. Limited use of fore- and background. Visual Hierarchy present.	Symmetrical/Asymmetrical balance. Uses contrast to create a focal point.	Concept is clearly visible	Good use of available tools Adapts and uses available icons appropriately.
PL 5	Complex Compositions. Clear visual hierarchy. Figure-ground awareness.	Complex symmetrical/ asymmetrical balance created. Use of colour and contrast to create visual interest/focal point	Innovative idea/concept	Uses available tools to create desired objects/designs. Adapts and re-interprets available icons to suit personal preference.

Appendix J: Cluster Analysis

NO	GENDER	Gender Code	NAME	Name1	V	A	R	K	TOTAL	V11	Theirdiff	Diff	RESULT	ELIMATORS	PERFORMAN CELEVEL	ClusterGroups
1	F	2	P1	NADIA	8	4	9	7	28	9-4=5	5	5	RVK	A	5	1
9	M	1	P12	KEELAN	8	8	11	10	37	11-5=6	6	3	VARK		1	1
23	M	1	P24	MICHAEL	6	3	9	9	27	9-4=5	5	6	VRK	A		1
24	M	1	P25	SHAUN	9	8	6	9	32	9-5=4	4	3	VARK		3	1
26	M	1	CALEB	JEAN	11	5	7	10	33	11-5=6	6	6	VRK	A	5	1
2	M	1	P2	JODY	9	3	3	7	22	9-3=6	6	6	VK	AR		2
27	M	1	LEVI	KEENAN	7	4	5	6	22	7-3=4	4	3	VRK	A	4	2
28	M	1	P27	CENVYN	9	5	7	3	24	9-4=5	5	6	VR	AK		2
3	F	2	P3	ZAMIKHAYA	1	8	3	5	17	8-3=5	5	7	A	VRK		3
4	M	1	P6	MALE2	2	8	3	3	16	8-2=6	6	6	A	VRK	2	3
5	F	2	P7	YAMKELA	4	10	4	7	25	10-4=6	6	6	AK	VR		3
6	M	1	SHAUN	JASON	4	9	4	8	25	9-4=5	5	5	AK	VR	2	3
7	M	1	P9	DARREN	6	11	4	7	28	11-4=7	7	7	A	VRK		3
8	M	1	P28	NEVALLIAN	2	13	6	8	29	13-4=9	9	11	A	VRK	2	3
10	F	2	KELLY	STACEY	3	3	3	7	16	7-2=5	5	4	K	VAR	1	4
13	M	1	P15	GHAZEEM	4	6	5	8	23	8-4=4	4	4	ARK	V	3	4
14	F	2	P16	SIYANDA	2	6	3	9	20	9-3=6	6	7	K	VAR	3	4
16	M	1	P18	MALE3	4	6	4	7	21	7-3=4	4	3	AK	VR		4
17	F	2	P19	ZANELE	1	4	6	7	18	7-3=4	4	6	RK	VA	5	4
18	M	1	P20	MAJOLA	3	2	4	7	16	7-2=5	5	5	K	VAR	1	4
19	M	1	P21	MALE1	3	3	4	7	17	7-3=4	4	4	K	VAR	1	4
20	M	1	P22	ATHENKOSI	2	6	4	8	20	8-3=5	5	6	AK	VR		4
21	M	1	MATTHEW	GERARD	4	5	3	5	17	5-3=2	2	2	VARK		3	4
22	M	1	P23	IDOLAN	2	2	6	6	16	6-2=4	4	4	RK	VA	5	4
25	M	1	P26	CHESWIN	1	5	5	5	16	5-2=3	3	4	ARK	V	2	4
11	M	1	P13	SERGIO	3	4	9	12	28	12-4=8	8	9	RK	VA	1	5
12	M	1	P14	CLAUDE	1	7	7	9	24	9-4=5	5	8	ARK	V	2	5
15	M	1	P17	DARRYL	2	5	7	10	24	10-4=6	6	8	RK	VA		5


Dendrogram using Ward Linkage
Rescaled Distance Cluster Combine
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27 19
26 10
25 21
24 17
23 22
22 25
21 13
20 16
19 14
18 20
17 12
16 15
15 11
14 3
13 4
12 5
11 6
10 7
9 8
8 2
7 27
6 28
5 1
4 23
3 24
2 26
1 9

Appendix K: Inter-rater reliability based on Krippendorff's Alpha

Number	rater 1	rater 2	rater 3			
1	3	3	3		File size:	140 bytes
2	2	1	2		N coders:	3
3	3	5	3		N cases:	20
4	3	3	3		N decisions:	60
5	1	2	3		**Krippendorff's alpha (ordinal)**	0.533
6	5	5	4		Fair Level of agreement.	
7	2	2	3			
8	2	3	1			
9	5	4	2			
10	1	2	2			
11	4	3	2			
12	5	3	3			
13	2	1	2			
14	2	3	2			
15	1	2	3			
16	3	2	3			
17	3	3	3			
18	1	1	2			
19	5	4	3			
20	1	1	2			