Creative Geeks? Investigating Creativity Support Systems for Information Technology Students

by

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Creativity remains an elusive skill yet desired in many professions. In the literature various approaches suggest ways in which we can increase a person’s creative potential, however the surrounding environment as a contributor to creative potential has not been of focus. Additionally, the continued and rapid rate of technology consumption impacts upon the surrounding environment, and thus on creativity. An avenue of literature called “Creativity Support Systems” or (CSS) has emerged, which aids in addressing the demands of greater creative and technical fluency of people from the surrounding environment. A CSS is a purpose designed and built environment for a group of users, which relies upon a number of elements such as people, places and technology to be successful.

This study addressed the notion of CSS, and determined from an in-situ action research perspective, what factors can be conducive to a more creative educational milieu. The focus of investigation into creativity were students who studied a Bachelor of Information Technology (Games Design and Development) within a learning environment of an Australian Tertiary Institution, Deakin University. The specific aim addressed was to demonstrate that if based on the facilitation of certain creativity factors, a technology-enhanced, purpose built learning environment can enhance creative potential.

The results of this study highlighted the diverse nature of creativity, and substantiated the need for a CSS to be specifically developed for the target audience. Within the games students’ situation, it was found that within the framework of CSS, social factors such as: supervisory arrangements, diversity, experience and skills, work group supports, team work (collaboration), and community, were critical to the development of creativity. An outcome of this study was a CSS Model which reflects the nature of creativity, however can be generalised for the use of determining creative needs in other situations.
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Publications


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1. Introduction

The perception that video games are an isolating activity, solely the domain of children and teenagers, is no longer accurate. Reports from a national random survey of 1606 households indicated that 79% of people have a device for playing video games (Brand 2007 pg. 4). Of the 3,386 individuals examined, 35% were parents and 8% seniors and the average age of a game player reported in this survey was 28 (Brand 2007 pg.1). In 2006, Australians spent $925M on computer games software, and by 2007 this figure had risen by 43% to $1.3B (Brand 2009 pg. 9). The latest figures, covering the 2007/08 financial year, indicate sales exceeding $1.6B (Brand 2009 pg. 8). The global video game economy in 2009 had revenue of $10.5 billion (ERSB 2011). Australians thus spent over AU$4M per day on computer game software with retail sales showing sustained compound growth. The uptake of gaming technologies in Australian households, in addition to the diversity of ages engaged in gaming, was clear evidence of the importance that Australians place on video games as a significant leisure activity.

The considerable growth in domestic consumption of video games software, coupled with a recognised skills shortage within the games sector of the Information Technology (IT) industry, has led to over 40 Australian tertiary institutions offering specialised courses in video game development. The development of multimedia and games degrees has been driven by recognition of the strength and importance of creative industries in the economy, and local community (Lemmon, Bidwell, Hopper, Gaskett, Holdsworth, Musumeic 2007 pg.44). As Yee et al. stated, “given the tremendous cultural and commercial impact of video games, many computer science students have a great interest in video games and aspire to join the industry” (Yee et al. 2007 pg. 28). The students within these courses need to be technologically astute as well as constantly creative to be able to learn and invent effective games. Yet, in Australia it remains difficult to gain an entry-level position within the video game industry (Brand 2009 pg.17, Insight-Economics 2006 pg.8, Lemmon et al. 2007 pg.45, Shaffer 2005 pg.106, Yee et al. 2007 pg.29), with current positions in the industry headcounted to 931 (Brow 2011).
The industry requires graduates with skills such as creative thinking, time management, team work, motivation and the ability to deal with communication, scope change and game development practices (Blumenthal et al. 2003 pg.8, Insight-Economics 2006 pg. 5, Tantalas 2006, Torus 2006). The current number one challenge faced by the games industry is that of a creative skills shortage (Insight-Economics 2006, Brand 2009, Treffinger 2007). Example of these creative skills includes: evaluation and analysis skills, critical thinking, problem solving strategies, organisation and reference skills, synthesis, application, creativity, decision-making given incomplete information, and communication skills through a variety of modes. Games design and development study programs need to provide dynamic, creative and technologically advanced degrees in order to meet these “creative skills” demands of employers in digital games industry (Parberry, Kazemzadeh, Roden 2006 pg. 510, Shaffer 2005 pg. 105). To nurture this process it is essential that, learning systems need to provide a “creativity support system” or (CSS). University level teaching in engineering and IT tends to regard creativity with an indifferent, and often hostile, attitude (Cropley and Cropley 2000 pg.208). However, as Yee, Sturman and Feiner (2007) stated, “universities often lack the curriculum and expertise in video game technology and design needed to train students” (Yee et al. 2007 pg. 28). A major difficulty in educating graduates in the games design and development field is the discrepancy in the relationship between creativity and IT.

Creativity, as an attribute, is present in everyone and can occur every day. Students who study games are often more comfortable dealing with numerical bits and bytes, therefore creative flair can be difficult to learn (Blumenthal et al. 2003 pg. 8). It has been argued that IT can ensure that people are more creative, more often, enabling them to successfully cope with a wider variety of challenges and even merge domains (Shneiderman 2002 pg. 116). Video games are one form of IT that can enable people to use computers, and engage imagination within the electronic domain. It has been argued that video games create new social and cultural worlds that help us learn by integrating thinking, social interaction, and technology, within a medium a game player cares about (Shaffer et al. 2005 pg. 105, Estey, Gooch and Gooch 2009 pg 71). Blumenthal et al.
(2003 pg. 8) asserted that courses such as Game Design and Development can be supplemental at supporting creativity, and conversely necessitates this skill to be effective. However Blumenthal et al. (2003 pg. 6) argued that there are difficulties in support, evaluation and quality of such cross discipline creative studies.

Creativity, in conjunction with the design and application of IT, is often referred to as a creativity support system (CSS) or creativity support tool. Within the discipline of human-computer interaction, the challenge is to understand the ways in which technology can enhance a person's creative potential (Candy et al. 2002). Research into CSS has focussed on two broad areas:

1. Computational creativity (also known as Artificial Intelligence)

2. Designing computers to aid human’s natural creative abilities

Boden (2004 pg. 6) and Hoorn (2002 pg. 186) detail that ingenuity is manifested via two ways: in computation or though uses of computation. The latter is the idea behind a CSS and how IT augments creativity by supporting the user rather than attempting to emulate creativity, and is the basis of this study. This study does not seek to explore simulations of creativity through aspects of artificial intelligence, but rather this study supports a games students’ natural creativity through the understanding of a CSS. This study focused on students’ whom were in the Bachelor of Information Technology (Games Design and Development) degree at Deakin University, Australia. The degree in which they were enrolled emerges from a more traditional computer science background: Bachelor of Information Technology (Computer Science and Software Development). For completeness, the following outlines clearly the overall research aim and subsequent research questions that were addressed in this study.
1.1 Research Aim

The aim of this study was:

To demonstrate if based on the facilitation of certain creativity factors, a technology-enhanced, purpose built learning environment can be conducive to enhancing creative potential.

1.1.1 Research Questions

To address the aim of this study, the following research questions were explored:

1. What is the creative potential within the students who study games?

2. What creative skills are expected of games students by the relevant employing industry?

3. How can the current learning environment for games students at Deakin University be enhanced to facilitate and encourage the creative skills of the games students to increase creative potential?

To investigate the research questions of this study the approach of action research was employed.

1.2 Research Approach

The methodology adopted for this study was that of action research, which has the desire to “bring about changes in an educational society” (Pasmore 2001 pg. 39). Action research is practical based, pragmatic, epistemologically sound and socially viable (Levin and Greenwood 2001 pg. 105, 2008 pg. 212). Reason and Bradbury concur that “action research is a practice for the systematic development of knowing and knowledge, but based in a rather different form from traditional academic research, it has different purposes, is based in different relationships, and has different ways of conceiving knowledge and its relation to practice” (Reason and Bradbury 2008 pg.2).
Action research studies help to solve a problem within a situation, however it also forces researchers to think, not only about what knowledge they have generated that can be fed back into the setting (local knowledge), but also what knowledge they have generated that is transferable to other settings. In this study, the purpose of an action research approach was to help the games students with their creativity, in addition addressing the research question and knowledge domain of CSS.

1.3 Contributions

This study explored the problem situation of creativity within the games students of Deakin University. Not only did this study aid in facilitating creativity with the games students it also tested factors in-situ to determine the contribution of environment on creative skills.

Action research enabled a duel contribution of the results of this study, firstly addressing creativity for the game students and secondly contribution towards the scholarly literature on CSS. To utilise an action research perspective a detailed understanding of how to negotiate the problem situation was required for the achievement of improving the conditions for participants, as well as undertaking worthwhile research. Within such a methodological framework, emphasis was not merely on the description, understanding and explanation of the group behaviour, nor on the knowledge produced or the research inquiry employed in gathering the data, but rather, on who determined the research agenda in the first place. Influence from many stakeholders was a consideration of this study (as to be discussed in Chapter 3). A conclusion from this study determined that a collaborative and “democratic” approach to determination of the research agenda, allowed for a meaningful investigation into addressing the problem of the situation.

The CSS in this study was firmly focused on the supportive aspects of the creative environment, and not the development of software or hardware incorporating creativity (i.e. creativity support tools). This approach in unique in the literature, and subsequently has provided many avenues for future research, particularly within educational settings.
Within the games students’ situation, it was found that within the framework of CSS, social factors such as: supervisory arrangements, diversity, experience and skills, work group supports, team work (collaboration), and community, were critical to the development of creativity. This contribution enabled a specific CSS to be provided for the games students, and allowed an in-depth investigation into a CSS to occur. The focus of investigation into a group such as the games students is considerably important in the teaching of Science and IT. This study could be viewed in negative contrast because of its specific nature, however any paradigmatic response cannot hope to be either definitive or comprehensive and a generic solution was inappropriate for the learning environments of the students in this study, as such an approach would not address the specific creativity needs. An attempt to generalise the results has been presented in Figure 5.6 “Model of the CSS”, to serve as potential for application in future research.

### 1.4 Thesis Structure

To address the aim of this study, this thesis is structured as follows:

- Chapter 2; Literature review – presentation on creativity and CSS.
- Chapter 3; Research inquiry - specifically defines the imperative behind the action research approach of this study.
- Chapter 4; Research problem – details the specific action research project under investigation.
- Chapter 5; Results and Discussion - elaborate upon the results and discuss the specific CSS needs of the games students.
- Chapter 6; Conclusions – presents the overall finding of this study.
2. Literature Review

The topic of CSS is still relatively unexplored and varied in its definitions, presenting inherent difficulties in examining the topic. To broaden our knowledge the literature on CSS is presented, where varied approaches to investigating creativity were explored. Additionally, the various topics that comprise an investigation into creativity will be addressed, along with the factors that might comprise creativity within people and the aspects of gaining knowledge and relevant learning pedagogies for University level students.

2.1 Creativity

To date, creativity research has predominantly focused on addressing the question: What is creativity? The discipline of psychology has experienced resurgence in creativity research after Gilford’s 1950’s address at the American Psychology Association, which highlighted the importance, yet lucid, idea of creativity (Craft 2001). From the literature, it is clear that any one definitive explanation is inadequate. Whilst definitions of creativity abound, such descriptions are inevitably imbued with a domain-specific focus. Furthermore, some research reveals a scepticism which disregards the occurrence of creativity, if not on an eminent level (like that evident in well-known theorists such as Einstein or Freud).


Piirto defined creativity as:

“The personality, the process and the product within a domain in interaction with genetic influences and with optimal environmental influences of home, school, community and culture, gender, and chance. Creativity is a basic human need to make new” (Piirto 2004 pg. 37).
Definitions of creativity often include words such as “novel”, “new” or “useful”, and are generally related to the imagination of an individual. However, this study argued that creativity can be novel and useful on both a personal and/or societal level. As Piirto (2004) suggests above, the notion of personal ingenuity as distinct from social creativity is also blurred, as there are inevitably societal influences that impact on an individual’s creative output. Boden (2004 pg.2) defined this in terms of Historical (H) creativity and Psychological (P) creativity. According to Boden (2004), H creativity is any creative act that is original (ie as far as it is known, no one has previously achieved it) while P creativity comprises of an idea that is contextually new to the person who comes up with it, but has actually originated previously in history. In addition to Boden (2004) the differences in creative acts have been defined by other authors (Csikszentmihalyi 1996, deBono 1992, Edwards 2000), as shown in Table 2.1.

<table>
<thead>
<tr>
<th>Boden</th>
<th>(H)istorical</th>
<th>(P)sychological</th>
</tr>
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<tbody>
<tr>
<td>Edwards</td>
<td>Eminent</td>
<td>Everyday</td>
</tr>
<tr>
<td>Csikszentmihalyi</td>
<td>Cultural</td>
<td>Personal</td>
</tr>
<tr>
<td>deBono</td>
<td>Specific</td>
<td>Everyday</td>
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</table>

Creativity of an Historical, Eminent, Cultural and Specific nature, were once associated with humanity’s elite intellectual and artistic personages (Boden 2004) where it was associated with great inventors and perceived as a quality only exhibited by a few gifted people. However this romantic/idealist view is no longer predominant. Creativity has been shown to manifest in many disciplines such as psychology, art, science and technology in its extensive investigations since the 1950’s (American Psychological Association, 2006). Creativity does not present as sporadic moment of revelation in a person’s life, it is a phenomenon that exist’s in a wide variety of activities and settings that are “less the heroic acts of creativity, across a person’s entire life span (i.e. “everyday creativity”” (Do and Gross 2007 pg. 27, Edwards 2000 pg.222, Ripple 1989
Knowledge of the domain (or discipline) where the creative act is undertaken may also be a factor in creativity, and the change in the domain is the determining feature in the historicity of the act. Csikszentmihalyi's (1996 pg. 27) stance was that ingenuity cannot be achieved without sufficient knowledge of the discipline and further, that historical creativity cannot occur across multiple domains. It is safe to assume that creativity occurs within each domain in a similar fashion, however it does not need to be historical to be creative (Do and Gross 2007 pg. 28). Everyday creativity similarly requires domain knowledge, but not to the extent of historical creativity, and can span multiple disciplines. Furthermore, it can be described as a process required for solving particular problems that are not clearly defined and have not previously been encountered by the problem solver (Jones 1993). As, Jones stated:

“Creativity is not a special gift enjoyed by a few but is a common ability possessed by most people which can be developed or suppressed as a result of their individual experiences” (Jones 1993 pg. 135).

Many everyday creative activities produce results that are neither original nor novel, however the focus is not on an outcome that fulfils these criterion but rather, on the development and emergence of ideas. Furthermore, a person’s potential for creativity in the production of novel and original ideas is influenced by environmental factors such as: society, culture, family, friends, mentors and peers. In everyday creativity this is an issue, as its manifestations are often on a small or personal level. Thurstone (1952) and Maslow (1968) argued that the idea formulated during everyday creativity processes are to be considered “creative” if the thinker suddenly reaches the solution, and that the act is “novel” to the thinker (Torrance 1988). Most of us can think of someone we know who is creative, even though they may not have been recognised in historical proportions. As Ripple (1989 pg. 189) argued: “[we] identify and rate creative people through our judgments of them based on informal observations and assessments in the course of our daily interactions”. To overcome the issue of novelty and usefulness of a creative act, individuals need to maintain an internal balance between that which is considered novel and what is useful. As described by Fischer and Nakakoji (1997 pg. 22), something may be extremely novel yet may not be useful, or vice versa, hence it is up to the inventor in this case to decide upon the balance of usefulness to novelty.
In relation to psychological research, creativity is defined as a learned process, rather than a spiritual one, in which individuals are bestowed with creative talent from birth, and is not considered the sole domain of the “artiste”. Research into the study of creativity has been remarkably varied and includes: mystical, pragmatic, psychodynamic, psychometric, psychoanalytic, cognitive, social/personality, behaviourist, humanistic and confluence approaches (Craft 2001). From the 1950’s, the approach to stimulate creativity, rather than just observe, also became more apparent. Epstein (1996 pg. 42) remarks that creativity is within everyone’s reach, with no exceptions, and that four crucial components (person, process, product and environment) determine each creative act.

2.1.1 Creative Person

A creative person is an individual who produces ideas, products, and artefacts or performs tasks that are deemed original or imaginative. A person is usually deemed creative based on their innovative products or output (Amabile 1996, Cropley 1999), however, there are certain “skills” that all creative people tend to possess. Runco and Bahleda (1989 pg. 97) and Ripple (1989 pg. 195) defined such skills as: intrinsic motivation (a concern with work and achievement), intuition, self confidence, intellectual and aesthetic values, theoretical thinking, attraction to complexity, independence of judgement, high energy, a wide range of interests, tolerance for ambiguity and the ability to resolve conflicts. Most creativity involves these characteristics but the list is neither exclusive nor definitive. Goff (1998) defines four strengths that characterise a creative person:

- Fluency: The generation of multiple ideas, alternatives or solutions (e.g. brainstorming (Goff 1998 pg. 14)).
- Flexibility: The ability to abandon old ways of thinking and initiate different directions. Techniques to enhance or initiate flexibility include SCAMPER (Goff 1998 pg. 17) and Provocation (deBono 1992 pg. 145).
- Originality: Involves divergence from that which is perceived as the obvious and commonplace by breaking away from habitual thinking. An
important feature of originality is being comfortable in a minority. Original ideas are infrequent and often a large number of ideas are produced (such as in the brainstorming technique) before an original idea is produced (Goff 1998 p19).

- Elaboration: The ability to embellish ideas with detail (Goff 1998 pg. 22).

These traits are present in each creative person and their combination manifests into artistic skills that others see (such as a creative idea, result or product).

A creative idea is a form of thinking and a skill that indicates the process of creativity. Thinking is “to form or conceive in the mind, have in the mind, as an idea, conception or the like” (Delbridge and Bernard 2003 pg. 1218). For thinking to be creative, the person must believe the idea is new and novel having never occurred before in their mind. Creative thinking is an ability of the individual to invent new and useful concepts based on previous knowledge. This type of thinking varies for individuals, and is neither easily measurable, nor clearly defined. A plethora of literature exists on creative thinking (Boden 2004, Edwards 2000, Koestler 1969 to name only a few) with the view of Koestler (1969) highly regarded. Koestler, as described in Warr and O’Neill (2005 pg.119), refered to creative thinking as a bio-sociative process, whereby an individual deliberately connects previously unrelated, thoughts to produce an idea (Warr and O'Neill 2005 pg.120). Boden (2004 pg. 40) similarly described three forms of creative thinking: unfamiliar combination of known ideas, exploring conceptual space or transforming conceptual space.

Creative thinking is sometimes referred to as divergent thinking, and is best described as being the opposite of logical (or convergent) thinking, the latter of which requires minimal effort as these ideas are usually generated based on past experiences (Boulden 2002). Divergent thinking is considered an essential technique of creativity, however “true” creativity involves interaction of the “four P’s”: person, process, product and “press” (referred to as environment in the literature and this study). The cognitive science research into creative thinking focused on the natural abilities of the brain and
according to Heerwagen (2002 pg. 1), “creativity is an adaptive feature of normal
cognitive functioning that evolved to aid problem solving under conditions of
uncertainty”

Treffinger focused on the development of creative thinking, and asserts that “the power of
efforts to nurture creativity arises from our ability to help individuals recognize,
develop, and realise their unique strengths and talents, to learn, and to be creatively
productive in their own way” (Treffinger 1993 pg.20). This development focuses on
processes and techniques to bring about creative ideas, that people will more readily
utilise their creative skills, although the discussion on the creative person and creative
thinking is only the beginning in the definition of that which constitutes creativity.

2.1.2 Creative Process

The creative process focuses on the phases of creativity (including creative thinking)
(Do and Gross 2007 pg. 28, Richards 1999 pg. 733, Ripple 1989 pg. 189, Candy and
Edmonds 2002a pg. 91). The research into creative process models has been conducted
in disciplines such as psychology, art and technology. One of the first models of the
creative process was proffered by Wallas (1926), who described four phases:
Preparation, Incubation, Illumination and Verification. Since then, numerous creative
process models have emerged and been defined with the same or similar characteristics.
According to Warr and O’Neill (2005 pg.120), the most generic creative process model
consists of idea generation, problem preparation and idea evaluation (Figure 2.1).
Figure 2.1 Generic Creative Process Model (Adapted from Warr and O’Neill 2005 pg. 120)

Candy and Edmonds (2002a) similarly proposed the steps of Exploration, Generation and Evaluation in their creative process model. Warr and O’Neill (2005 pg. 120) suggested that more current models have moved away from proposing unconscious stages of incubation and illumination, towards a more conscious and deliberate generation of ideas that constitute the process. The need for purposeful generation of ideas is particularly relevant in business where ingenuity is a highly desirable asset, and thus creativity training has emerged as a key factor in business management (Cropley and Cropley 2000 pg. 208). DeBono (1992) is highly respected in training for creativity within organisations as he offers many effective techniques for the deliberate formulation of innovative ideas. Treffinger (1993) has also emerged as a notable researcher in creative problem solving, who investigated creativity in relation to identifying the problem and solving it. Shneiderman (2000) produced a definition on the process of creativity in relation to the use of IT to aid inventiveness. Shneiderman’s (2000) creative process model consisted of four stages: Collect (learn from previous works stored in libraries, the web, and other sources), Relate (consult with peers and mentors at early, middle and late stages), Create (explore, compose and evaluate possible solutions), and Donate (disseminate the results and contribute to libraries, the web and other sources). Urban and Jellen (1996) have attempted to establish an innovative process model from the inventor’s perspective by combining seemingly opposite positions of creativity. This computational representation is premised on the more complex view that creativity is a combination of “procedural structures of interacting cognitive and personal components of the creative individual as well as the mutual dependencies of person and environment during the whole process of creative
acting” (Urban and Jellen 1996 pg.7). Figure 2.2 highlights Urban and Jellen’s “components model of creativity”.

According to Urban and Jellen (1996 pg.7), the model is built from six interactive factors that function concurrently for, and in, the creative process. The first three components focus on the cognitive components of this system, with the last three focusing on the personality components of the model of creativity. These constituents are:
1. Divergent thinking and acting

2. General knowledge and thinking base

3. Specific knowledge base and area specific skills

4. Focusing and task commitment

5. Motivation and motives

6. Openness and tolerance of ambiguity

Urban and Jellen’s (1996) components model of creativity can be applied to many fields as it also caters for creativity on individual, group or local levels, and in societal, historical or global dimensions.

Other creativity models exhibit similar aspects to Urban and Jellen (1996), such as Turvey’s (2006) model of the creative process which focused on educational contexts (Figure 2.3).

Figure 2.3 Theoretical Model of Creativity adapted by Turvey (2006 pg. 311)
The model illustrated in Figure 2.3 focuses upon two key processes often identified at the core of creative process; “exploration” and “fashioning”, which are strongly based upon influences from a learning community. These two processes are affected by elements of social, intentionality and personal identity that all emerge from learners within a learning community context. Turvey describes the model as providing the learner with “an ability to explore and investigate in order to uncover new knowledge, combined with the ability to then apply this in new or different contexts” (Turvey 2006 pg. 313).

The selected models mentioned can not adequately represent the plethora of literature on the creative process. Yet, despite the abundance of literature on the topic, there remains no clear definition of the creative process, and therefore one definitive model cannot be utilised for this study. However, of all the creative process models investigated, the stages that appear consistently throughout the literature include: Compiling Relevant Information, Generating Ideas, Exploring, Preparation, Development, Generation (Production) and Evaluation. These elements are necessarily generic, do not apply to every creative individual and certainly do not always occur in a linear order. Whilst a definition of the creative process is difficult to obtain on a global (macro) scale, a clearer understanding on a local (micro) scale is certainly achievable, the latter of which is focussed on in this study as an example of a local scale inquiry into creativity (discussed further in Chapter 4).

2.1.3 Creative Product

The previous two sections explored the concepts of the creative person and process. The culmination of these factors often results in a creative product, which is not necessarily confined to a physical artefact such as a book or invention. Instead, it may be an idea, theory or design. Piirto (2004 pg. 33) argued that creativity should not be defined by construction, as a product may be defined as many things. For example, the literature on children and their apparent creative talent does not assess children based solely on their creative product. In these situations children are rated as creative premised on their perceived potential. If creativity is defined by the product of a person’s life, then in the
case of a child, there would be little in the way of concrete artefacts to judge (Piirto 2004 pg. 34).

As previously discussed, the predominant criterion used to judge the creative product is its degree of novelty and usefulness (Boden 2004 pg.2). As Jackson and Messick (1965) stated, the first step to achieving a creative product is to achieve a certain amount of novelty and usefulness within the product. In the context of this study, novelty offers the viewer of the product a sense of surprise, a feeling that the product is new and unique. Even if the product is not innovative in a historical sense, as described by Boden (2004), it is still significant for the individual. In addition, Bruch (1988) and Csikszentmihalyi (1996) certified that creative products are the result of influences from the environment surrounding a person as they undertake a creative endeavour, which is the focus of this study.

2.1.4 Creative Environment

In any creative act, the “press” as Richards (1999 pp 733) referred to it, influences the creative person (Csikszentmihalyi 1996 pg. 128, Warr and O'Neil 2005) and the resultant product. Csikszentmihalyi (1996 pg. 127) remarked that the act of creativity is not something that simply happens in a person’s head, it is something that occurs due to interaction between a person’s thoughts and a socio-cultural context. In addition, the creative process within each individual is driven by conditions within the environment (Do and Gross 2007 pg. 28) and exposure to congenial surroundings is a crucial factor in the emergence of creativity (Harrington 1999 pg. 323, Epstein 1996 pg. 41). Fischer (2005) stated that creativity occurs in the relationship between an individual and a society, and also between an individual and his or her technical environment. These environments can include the physical environment of tools and resources, as well the social environment within which the creative person works (Amabile 1996 et al. pg. 1154). In the literature, many different names are associated with a creative setting such as “press”, “social climate”, “milieu”, “setting” or “context” and this study will refer to it as “creative environment”. Craft (2001 pg. 9) argued that more recent research into creativity has focused on the social psychological frameworks which recognise the
importance of social structures to facilitate creativity. However, as there is a call for more extensive research into the effects of a creative environment on a person's ingenuity and accomplishments (Isaken and Lauer 2002 pg. 74, Ekvall 1999 pg. 404, Craft 2001 pg. 28, McCoy and Evans 2002 pg. 409).

A survey of the literature reveals that previous research has tended to focus on aspects of creativity such as person, process and product, yet appear to neglect the substantial and significant role of the environment. However, as described by Csikszentmihalyi:

“It is easier to enhance creativity by changing conditions in the environment than by trying to make people think more creatively” (Csikszentmihalyi 1996 pg. 1).

The importance of the environment as a key aspect to enhancing creativity was offered here to highlight the void in current research on this topic.

The research that has been conducted into creative environments has shown, varying results. As Keller-Mathers and Murdock (1999 pg. 87) asserted, deliberate development of an environment that supports ideas, provides freedom of thought, and seeks opportunities to take risks has been shown to be important in enhancing creative achievement. Within an education setting, Cropley and Cropley (2000 pg. 209) investigated a tertiary engineering uni which instigated creativity counselling, creativity lectures and creative assessment tasks in a purpose designed environment, with positive results noted. The purpose-built environment of studio-based learning by Blashki (2002) supported IT students during the 1990s in their creativity and student-oriented learning by a provision of a functional and aesthetic environment. The educational setting of a studio environment provided students with the practical subjects that established closer connections between experience, knowledge and practice (Blashki 2000).

Recent attention to supporting creativity in organisations has accentuated the importance of the creative environment (Ekvall 1999 pg. 404), particularly in areas including: behaviours, attitudes and feelings associated with the creative environment, and research into principles and practices (such as leadership, reward systems and promotion
strategies) of creative environments. However, in this investigation, culture is not being investigated as an influence on creativity. Culture, as defined by Ekvall (1999 pg. 406), consists of deeply rooted, partly preconscious beliefs and assumptions which exert influence on the environment through values and norms, thus the creative environment emerges from the culture and does not require autonomous investigation.

2.2 Information Technology and Creativity: New Media

IT such as computer systems and the Internet are being used in unique ways to aid creative endeavours (Candy and Hori 2003, Eales 2004, Pepperell 2002) and this is often described as “New Media”. It is the unique use of the “old” technologies that make it aptly named new, rather than an innovative technological advancement. Overall, the applications of IT for social and cultural purposes create new media (Padula and Reggiori 1999), along with fresh forms of communication and collaboration (Padula and Reggiori 1999). As Padula and Reggiori (1999) described, new media as a tendency to make use of technology in forms such as reservoirs of collective memory (such as the Internet) that connect the world of experts with that of non-experts. Shneiderman (2002) suggested the goal of IT was to ensure people are more creative, increasingly enabling them to successfully cope with a wider variety of challenges and even merge domains. However, the importance of IT in the creative environment has not been a predominant research area, with few critical works on the subject (Candy et al. 2004, Edmonds and Turner 2003, Padula and Reggiori 1999). Of the four components of creativity (person, process, product and environment), the areas of creative process and product have been afforded the most attention (Candy and Edmonds 2002b, Greene 2002, Hoorn 2002, Shneiderman 2002). Naturally, the components of creativity all work within, and place demands upon, one another. There is a dearth of literature on IT and creative environments. However the potential for creativity to flourish in settings equipped with IT is becoming paramount (Harrington 1999).

IT such as technical networks allow for distribution and exchange of the products of creative expression along social networks, which often blurs the boundaries between producers and consumers, while it stimulates critical reflection and discussion across the
community (Foth 2006: Gilchrist 2004). Hilliges, Terrenghi, Boring, Kim, Richter and Butz (2007) highlighted that appropriate socio-technical settings can amplify the outcome of a group of people by both, augmenting individual creativity and multiplying (rather than simply summing up), individual output. However, Hilliges et al. (2007) continued to argue that in face to face, collaborative, creative problem-solving, technology is very often absent or shut down as it is considered disruptive to communication and the creative flow of ideas. The types of IT that can help to provide creativity included: computer networks (including the Internet), computer and video gaming, desktop software, artificial creativity and ambient creativity.

2.2.1 Computer Networks: The Internet

The Internet as a medium for the facilitation of creativity is endless. As Padula and Reggiori (1999) stated, new media such as the Internet has significant social and cultural applications. As Foth suggested, “with the emergence of social software such as discussion boards, community network and electronic mailing lists the Internet follows a very people-centred trend as a platform that allows humans to create and sustain interactive social networks” (Foth 2006 pg. 216). With the wealth of information available, coupled with the ability to engage in discussion with others all over the world, the Internet is an integral medium to the facilitation of creativity.

Foth (2006) stated that computer networks have become a significant topic of interest in many areas of society such as science, the economy and the community. The application of computer networks covers many areas: social and technical networks, networking processes, and the design of networked applications (Foth 2006). In addition, Foth suggested that “technology and networks, especially the Internet, have become part of everyday life” (Foth 2006 pg. 205). The Internet became prevalent in 1991 and can be defined as: a worldwide communications system; a publicly accessible network of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol (IP) (Delbridge and Bernard 2003).

Our utilisations of the Internet are limitless with the viewing information and using resources through an intricate web of hyperlinks. The Internet, mobile phones and other
networking technologies have afforded communication patterns that have changed the character and quality of community interactions and engagements (Foth 2006). The main issue with referring to “the Internet” when discussing its use, is that what we physically see when using the Internet is the technology of the world wide web (WWW) (i.e. the Internet is the facilitator for the WWW). In addition to this definition, many mainstream slang terms for the Internet exist: cyberspace, the net, the web, and online. Furthermore the term “information superhighway” was coined by the “baby boomers” for the Internet. While all these terms have different meanings in a technological sense they all mean the one thing: computer networks facilitate the connection of people with people. Accordingly, for the purposes of this study, the use of the term “the Internet” will be used.

2.2.2 Computer and Video Gaming

A video game may be defined as: an electronic game played on a display screen and/or; a game that involves interaction with a user interface to generate visual feedback on a video device. The Australian Government classifies a video game as:

“A computer program and any associated data capable of generating a display on a computer monitor, television screen, liquid crystal display or similar medium that allows the playing of an interactive game” (Australian Government 2008 pg. 6)

Video games may have a reward system, such as a score, that is based on the accomplishment of tasks set within the game (Delbridge and Bernard 2003 pg. 1306). Computer and video games have the potential to promote creativity, as they facilitate strategic thinking and social discourse between the creative people playing the game (Brand 2007). As an entertainment and educational medium video games have continually growing in demand for a number of decades (Brand 2003, 2007, 2009, Insight-Economics 2006). Industry demand for a professional video games industry has also increased, with the number of video games companies in Australia now exceeding 122 (Souri 2011).

2.2.3 Video Games Industry
According to Blumenthal et al. (2003 pg. 49) the game industry is a direct outcome of the rise of IT Creative Practices (ITCP). Games design and development would not be possible without the support of IT, yet their convergence has resulted in something new which has been greatly supported by the public. In Australia, 79% of households have computer and video gaming technology with 95% of the technology for the use of personal computer games (Brand 2007). Modern video games have an emphasis on social gaming with strategy being the most popular gaming genre in 2007 (Brand 2007). Video games are important, not only because of their viability as a career path, but because of the implications they have for personal, social, cultural and intellectual issues (Shaffer et al. 2005).

The development of multimedia/game degrees has been driven by recognition of the strength and importance of creative industries in the economy and local community (Lemmon et al. 2007 pg. 44). This growth is reflected in Universities with the adoption of ITCP in streams such as Games Design and Development. Initially computer science as a domain was reticent to welcome Information Communication Technology Practice (ICTP) such as games development, as the potential for ICTP to add to the domain of computer science was not clear. Additionally, computer science exists within the traditional scientific positivist paradigm, and the perceived unstructured nature of creativity was considered anathema to such a pragmatic approach. Naturally ITCP will continue to increase in complexity as the area develops.

The number one current industry challenge in the games industry is a skills shortage (Brand 2007, 2009, Insight-Economics 2006). The industry requires graduates to have skills such as creative thinking, time management, team work, motivation and the ability to deal with communication, and game development practices (Bowtell and Nichol 2010, Tantalas 2006, Torus 2006, Insight-Economics 2006, Blumenthal et al. 2003). Bowtell and Nichol (2010) note the need for educational games to have a focus on team work, to build “interdisciplinary” skills within students. For games students to excel in the evolving area of ITCP, they need to possess these skills to build their creativity and reflective attributes. Schön’s definition of a “reflective practitioner” fits appropriately
within the required repertoire of skills of the games students, by asserting that they display competence in unique, uncertain and conflicting situations (Schön, 1987 pg. 22). These traits are similar to those held by creative people such as tolerance for ambiguity and the ability to resolve conflicts. Professional artistry in being a reflective practitioner is not only confined to traditional fields such as art, education or social work, but may also be present in science and technology. Practitioners often refer to someone’s skills as “art”, particularly if the person is unusually adept at handling situations of uncertainty, uniqueness and conflict. The industry of games development required students to be technically and creativity component in order for them to be effective contributors (Bowtell and Nichol 2010, Brand 2003, 2007, 2009, Insight-Economics 2006). The skills learnt through use of technology in a CSS extend further than video games, encompassing other components such as desktop software.

2.2.4 Desktop Software

Desktop software can be defined as any program used on a personal computer, including word processing tools, database tools, web authoring programs, graphical creation tools, programming (development) environment and email programs. Studies have been conducted into the ways in which current desktop programs aid creativity (Candy et al. 2004, Edmonds and Turner 2003, Padula and Reggiori 1999). The COSTART project, conducted at Creativity and Cognition Studios (Candy et al. 2004), required technologists trained in human computer interaction to work with artists in an attempt to assess their use of desktop software such as 2D and 3D software and programming constructs. Previous studies only highlight a small sector of the ways in which desktop software can aid creative people.

2.2.5 Artificial Creativity and Ambient Environments

Artificial creativity lies within the realm of artificial intelligence (AI) which is defined as: decision making computers that exhibit intelligence via an artificial (man-made, non-natural, manufactured) entity (Delbridge and Bernard 2003). Boden believed in the potential for computers to be creative (Boden 2004), however in this research we
believed that people used IT as a way to support their creative skills, rather than the technology producing creativity.

Ambient intelligence (AmI) embeds intelligent intuitive interfaces into everyday objects. Although AmI currently exists only as a concept, much research is being undertaken in an effort to expand our provision of an information society (Harper et al. 2008, European Commission 2002). The ISTAG (European Commission 2002) report, “Scenarios for Ambient Intelligence”, outlines possibilities including ambient intelligence contexts for computer supported pedagogic techniques. It is interesting to note that the socio-political aims of AmI are driven by humanistic concerns, rather than technically determined ones (European Commission 2002). Furthermore, the conceptual foundation of AmI is to build on community-enhancing potential through offering opportunities for groups to develop their own applications (European Commission 2002). AmI is important to this study, as it involves creative environments rather than attempting to isolate creativity in one person or one desktop program.

2.3 Creativity Support Systems

Within the realm of human computer interaction, the challenge is to understand the ways in which technology can enhance a person's creative potential (Candy et al. 2002 pg. 96). As previously discussed, the use of IT in ways that support people socially and culturally is often referred to as New Media. Although there are elements of this in a CSS, for simplicity in this project, the use of IT and creativity was referred to as a CSS. In a creativity support system, the IT assists and augments creativity by supporting the user rather than attempting to emulate creativity (the domain of artificial intelligence as discussed in Section 2.3.4) (Boden 2004 pg. 7, Hoorn 2002 pg. 186).

Edmonds and Turner (2003), in their study of CSS for artists, discuss the importance of a creative environment in supporting digital artists and define their CSS as “an environment in which to create art” (Edmonds and Turner 2003 pg.45). Edmonds and Turner (2003 pg. 46) argue that in their CSS the technology becomes the creation, not the artwork where the creation of the artwork is left up to the artist. Therefore, the
technology creates the environment and needs to be technologically supported. Similarly, the tools used to maintain group/collective creativity requires support to facilitate creative endeavours such as brainstorming. Paulus (1999 pg. 780) argued that when groups use computer-based exchanges for the process of ideas such as electronic brainstorming software (as compared to paper based), their performance improves significantly, resulting in a broader variety of ideas. In addition, with the use of the Internet and the construction of online communities to discuss various topics (as opposed to direct brainstorming), research suggests that the influence of marginal opinions in groups indicates that persistent minorities may have a significant impact on the belief systems of those holding the majority perspective (Paulus 1999 pg. 780).

It is important to note that research into CSS has branched out into two broad areas:

1. Computational creativity (also known as Artificial Intelligence)

2. Designing computers to aid human’s natural creative abilities

The role of CSS is not necessarily about emulation of human creativity as in Artificial Intelligence, but rather can support the four components (referred to in section 2.1) of creativity. This design can be considered more natural to build the creative process. This “natural” design is difficult to articulate, given the varying creative processes and creative people which need to be supported.

Eales (2005 pg. 10) argued that the need for CSS goes beyond individual acts to collaborative creativity, and as Paulus (1999 pg. 782) noted, collaborative creativity can be aided by the use of computers. Candy et al. (2002 pg. 97) argued that by understanding the factors that influence collaborative creativity we may devise ways to promote and enhance creativity and to build a foundation for the development of computer based tools and systems that augment the creative process. Collaborative CSS literature is minimal, particularly with regard to creative environments.
CSS only recently appeared in the literature, with the most notable study by Candy and Edmonds (2002b pg. 96), which explained and discussed the COSTART project, which focussed on collaboration between artists and technologists, in an attempt to co-define creativity support systems (Candy and Edmonds 2002b). From this study, Candy (1997 pg. 9), and others (Greene 2002, Shneiderman 2002), have identified key characteristics of CSS including:

1. **Knowledge evaluation and extension:** The assessment and expansion of domain knowledge and the process of acquiring and evaluating different types of knowledge and relating it to new concepts under consideration. In a technologically influenced CSS this may relate to informal notes and images, in addition to formal rules and strategies in the computer system.

2. **Visualisation:** Involves working with visual data such as images, drawings, sketches, diagrams, charts, graphical objects that are specific to the domain. Visualisation can take the form of expressing ideas and concepts through sketching, annotation and examining multiple or alternative views of the same data, all of which varies according to the domain of interest.

3. **Collaboration:** Working with others directly or indirectly is integral to the continued production of creative processes and thus, creative products.

Greene (2002 pg. 102 - 104) also defined some characteristics of CSS:

1. **Support pain-free exploration and experimentation:** This simply refers to an easy way to undo and/or redo parts of one's work. Any mistakes made while using the CSS should not be penalised and there should be meaningful rewards for success. A sense of control within the CSS needs to be maintained, with relevant feedback for one’s actions.
2. **Support engagement with content to promote active learning and discovery:** Content of a CSS must be engaging, and also provide relevant feedback. However, during the learning process the system should neither constrain nor constrict exploratory activities.

3. **Support search, retrieval and classification:** In a CSS it should be easy to learn that which has been searched, retrieved, found and classified previously in the system. What the user of the CSS learns thus influences further generations of users of the system, establishing what works and what doesn’t when it comes to finding information and using resources of the CSS. In addition it should also be easy to store, classify, relate and retrieve things.

4. **Support collaboration:** A CSS should have the ability to exchange ideas in a timely manner, enable multidisciplinary teams to work, provide a mechanism for exposure of one’s work, and enable critique and feedback, and possibly a venue for competition and reward.

5. **Support iteration:** In the design of any tool, and specifically information tools, the design of the artefact should incorporate multiple iterations. This also applies to the users of the system, as a tool should support many and various different types of users who evolve over time and thus need support systems that accommodate their changing needs. A tool should support the ability to throw away or save as desired.

6. **Support and, perhaps, encourage instructive mistakes:** Often errors or mistakes in a system are perceived as detrimental to the user, however sometimes a mistake may aid a user’s learning. If a task is challenging, “a system should support the user in ways that lead to instructive ‘wrong’ answers, obviating distracting mistakes by building in aids like automatic string completion and logic that precludes
irrelevant inconsistencies so that attention may be focused on the act of learning and/or creating” (Greene 2002 pg. 103).

7. **Support the domain specific actions that require completion:** Such activities should be enabled in ways that are easily discovered, usable, and appropriately functional.

Within Shneiderman’s (2000 pg. 118) framework of the creative process of collect, relate, create and donate, eight characteristics of CSS are defined:

1. **Searching and browsing digital libraries:** Using the power of the Internet to gather information from digital libraries worldwide.

2. **Consulting with peers and mentors:** Finding people with shared interests and knowledge in your area is one of the “greatest gifts” (Shneiderman’s 2000 pg.118). Email and the Internet have ensured this is a lot easier.

3. **Visualising data and processes:** From the information gathering referred to in step 1, the CSS processes the data, and often will present it visually for the creative person.

4. **Thinking by free association:** This includes liberating the mind to create free associations. CSS often include brainstorming programs such as Idea Fisher or Mind Map.

5. **Exploring solutions (“what-if” tools):** Due to the faster processing and easier manipulation of data, CSS offer creative people avenues to explore their ideas beyond paper and pencil.
6. **Composing artefacts and performances:** These CSS allow the creative person to collate the data and compose their ideas. A simple example of a CSS to compose artefacts is a word processor.

7. **Reviewing and replaying session history:** Reflecting on work is a central notion in creativity. CSS should allow review of work done.

8. **Disseminating results:** Distributing the idea into the wider world.

These characteristics presented by Shneiderman’s (2000) demonstrate research into individual creativity, which has a specific focus on one “tool”. However, CSS requires a holistic view with the provision of a diverse range of tools to help creativity. Furthermore, these characteristics are specifically focussed on the creative person, process and product rather than the creative environment. Other researchers such as Treffinger (1993) have also noted that there is minimal critical work on CSS focussing on the environment, and in particular, on collaborative CSS. However some existing approaches such as Amabile et al. (1996), Ekvall (1999), Garrison et al. (2000), Isaksen et al. (2001), Isaksen and Lauer (2002), Keller-Mathers and Murdock (1999), Mathisen and Einasen (2004), Schöns (1987) have explored dimensions of CSS that may be identified as conducive to creativity. These criteria included:

1. **Freedom:** In an environment that supports freedom, people are given independence and control in determining and defining their work (Isaksen and Lauer 2002 pg. 80). The initiative to acquire and share information is apparent, and the direction of everyday activities is left up to the individuals. If there is too much control and restraint the environment inevitably becomes tedious.

2. **Challenge:** People who experience a high degree of challenge in their environment are intrinsically motivated to make contributions (Amabile et al. 1996 pg. 1154, Isaksen and Lauer 2002 pg. 80). Not only does the work challenge the creative person, it also endows their activities with
joy, meaningfulness and energy to invest in creative endeavours (Mathisen and Einasen 2004 pg.116). The creative person requires a sense of involvement and increased challenge for a satisfactory work environment (Ekvall 1999 pg. 40)

3. **Reflection**: Reflection is a skill of cognitive processing and as Dewey (1933 pg. 171) suggests, comprises 5 phases: suggestion, intellectualisation, hypothesizing, reasoning, and testing hypothesis in action. In this study, the author utilises “reflection” as a term that describes ability within each individual that may require support and nurturing before it can be observed.

4. **Conflict/interpersonal dynamics**: Conflict in the environment contributes both physical and social factors. Social factors may include personal, interpersonal or emotional conflict (Isaksen and Lauer 2002 pg. 80). This type of conflict differs from that of idea or debate dimensions (discussed next). When the level of conflict is high, groups and individuals may dislike each other, and the climate can become a “war zone” (Amabile et al. 1996 pg. 1156, Isaksen et al. 2001 pg. 175). However, when the level of conflict is kept to a minimum a team has the ability to work together without major conflicts.

5. **Debate**: In any environment debate over ideas are common. Debates often begin because of clashing viewpoints, ideas and differing experiences and knowledge (Craft 2001 pg. 21, Isaksen and Lauer 2002 pg. 81). In an environment of high debate, voices of creative people should be heard and ideas should be enthusiastically put forward.

6. **Risk taking**: Risk taking is defined as “exposure to the chance of injury or loss; a hazard or dangerous chance” (Delbridge and Bernard 2003). As supported by Ekvall (1999 pg. 407) risk taking is a mentality required for innovation, however risk taking is not reckless act, and
individuals need to determine the level of risk for themselves and their organisation. In terms of a creativity support system, deliberate development of an environment that supports ideas, provides freedom of thought, and seeks opportunities to take risks has shown to be conducive to creative achievement (Ekvall 1999 pg. 407, Craft 2001 pg. 21, Isaksen and Lauer 2002 pg. 80).

7. **Idea support:** In a supportive environment, ideas and suggestions are received in a considerate way and as alternatives to the current problem (Isaksen and Lauer 2002 pg. 81). Teachers, peers and mentors should be encouraging and receptive to the diversity of responses. The environment should be both constructive and positive (Ekvall 1999 pg. 406, Isaksen et al. 2001 pg. 175, Garrison et al. 2000 pg. 89).

8. **Tolerance for uncertainty and ambiguity:** Every creative environment should be capable of sustaining uncertainty and ambiguity (Ekvall 1999 pg. 406, Isaksen et al. 2001 pg. 175). Creative people often take risks with uncertain creative ideas, and the environment needs to support this.

9. **Trust and openness:** The environment should ensure creative people feel safe, as creative ideas are more eagerly expressed (Ekvall 1999 pg. 406, Isaksen et al. 2001 pg. 175, Isaksen and Lauer 2002 pg. 80). Ideas should not be ridiculed or seen as an indication of failure. The environment should build a climate of mental and emotional trust for students (Craft 2001).

10. **Idea time:** The environment should allow for a certain amount of time to elaborate on ideas (Ekvall 1999 pg. 406, Craft 2001 pg. 20, Isaksen et al. 2001 pg. 175). In times when ideas are in plentiful supply, the environment should be supportive so the creative person can discuss and test the ideas (Isaksen and Lauer 2002 pg. 80).

12. **Sufficient resources**: A creative environment should have sufficient resources for the creative person (Amabile *et al.* 1996 pg. 1159, Craft 2001 pg. 20). Physical items such as pens, paper or paint should be available, as well as access to knowledge such as books, journals and various media.

13. **Supervisory arrangements**: A creative person can often benefit from having a non-intrusive supervisor or facilitator within their creative environment (Amabile *et al.* 1996 pg. 1160, Ekvall 1999 pg. 409, Garrison *et al.* 2000 pg. 96). Also known as a role model, it has been asserted by Craft (2001 pg. 18) that provision of such mentors can have a profound effect on a learner in fostering their creativity. This role model is not exclusive to an authority figure however, and may occur within peers (Craft 2001).

14. **Work group supports**: A creative person will also benefit from support within a work group or with colleagues, as they offer the creative person important new ideas, feedback on ideas or help with resources (Amabile *et al.* 1996 pg. 1160, Ekvall 1999 pg. 406, Isaksen *et al.* 2001 pg. 175, Garrison *et al.* 2000 pg. 89).

15. **Leadership**: In any team or group there is often a manager who leads by example, encouraging new ideas and sharing best practices. Leaders
often provide clear guidance and support keeping everyone working
together and moving forward (Ekvall 1999 pg. 409).

16. **Status quo**: Maintaining a level of democracy and decorum within a
community of people while minimising conflict and improving
communication (Ekvall 1999 pg. 409). Other definitions refer to status
quo as the level to which one follows stated rules and attempts to avoid
risk.

17. **Political issues**: Political issues refer to the level of power within a
community, and the degree to which democracy is maintained (Amabile

18. **Motivation and energy**: Motivation is a central “skill” required in the
creativity support system. Teams that work hard together enjoy
contributing in the accomplishments made as a part of the team
(Amabile et al. 1996 pg. 1159)

19. **Focus, direction and goals**: In addition to leadership within teams and
groups, the most creative teams have clear and common goals. However
this does not mean tightly constrained, routine and overly structured
tasks and goals as these will stifle creativity. (Ekvall 1999 pg. 409,
Garrison et al. 2000 pg. 89).

20. **Diversity of skills and experience**: The most creative teams are those
that use the diversity of people’s skills to an advantage. Inadequate skill
sets or teams unable to utilise their diversity of skills will stifle
creativity (Ekvall 1999 pg. 406).

These combined elements illustrate efforts to articulate the ways in which specific tool
situations (in addition to environment) and collective creativity circumstances situations
might be important in supporting creativity and the creative person. In addition to
creativity factors in this study, learning aspects are also of key importance having a significant impact on their ingenuity and the creativity factors employed.

2.4 Education and Learning of Games Students

Sheard and Carbone (2004 pg. 291) and Blumenthal et al. (2003 pg. 151) argued that the student population demand a greater variety of courses to study, in order to provide them with an employment opportunity that is less than traditional, such as Games Design and Development. Shaffer defined a need to provide dynamic and technologically advanced degrees to meet the demands of employers in industry (Shaffer 2005 pg. 106). Blumenthal et al. (2003 pg. 51) disputed this claim, attesting that Universities tend to focus on established areas of study and that cross discipline programs that do exist, vary widely in terms of institutional support received, effectiveness and quality. Yee et al. (2007) stated, “universities often lack the curriculum and expertise in video game technology and design needed to train students” (Yee et al. 2007 pg. 28). Furthermore, Yee et al. (2007 pg. 28) emphasises that game development had unique goals and processes to that of traditional software development, as the process required a close relationship to understand user (player) psychology. This translates into educational programs on games, which adapt to a focus on the user of such technologies. In addition, a lack of expertise in video game technology at Universities is reminiscent of situations within industry involving the constant struggle to meet technological change/advancement (Yee 2007, Shaffer 2005, Lemmon et al. 2007, Tantalas 2006, Torus 2006). As Sheard and Carbone (2004 pg. 291) argued, the IT discipline readily experiences this problem of rapidly changing technology which necessitates the continual upgrade of computer equipment, software along with new teaching techniques and resources, which results in courses being restructured more readily than in other disciplines. University level teaching in IT regards creativity with an indifferent, and often hostile, attitude (Cropley and Cropley 2000 pg. 208). However, as Shaffer et al. (2005 pg. 111) pointed out, we need to view video games as a way of bridging the gap between creativity and technology. Doing so will ensure that graduates gain entry into the games design and development industries without a traditionally required education
in computer science. As, the current status of the games industry in Australia indicates that it is difficult to gain an entry-level position within video game development (Brand 2007, 2009, Insight-Economics 2006, Yee 2007, Shaffer 2005, Lemmon et al. 2007). By providing more appropriate tertiary education, with provision of more specific streams of educational programs, graduates are most likely to succeed in gaining appropriate qualifications to enter the industry.

2.4.1 Technical Scientific Rationalism

Technical/scientific rationalism has a significant role in the training of scholars. In education, computer science students are embedded within a technical/scientific rationalist paradigm; they are taught to be instrumental problem solvers who select the technical means best suited to particular purposes (Schön 1987 pg. 23). However, outside of the University, the world of computer science is not necessarily aligned with the technical rationalist mode of solving problems. When a situation is uncertain or new, problem solving may not always be appropriately undertaken by applying theories or techniques from existing knowledge. Furthermore, as Schön (1987 pg. 9) argued, it is difficult to find clear and self-consistent ends to guide the technical selection of means, as they rarely comprise of value conflict situations. There is symmetry between Schön’s (1987) view on technical rationalism and that of creativity, in that the need to determine multiple solutions to deal with a problem situation is required, using creative skills such as intrinsic motivation, self-confidence, independence of judgement, a wide range of interest and tolerance of ambiguity.

Schön (1987) asserts that the problems of real world practice do not present themselves to practitioners as well formed structures. Real world problem solving often involves uncertainty, new and value conflict issues and as Schön emphasises, “escapes the canons of technical rationality” (Schön 1987 pg. 5). Technical rationality is based on the use of prior knowledge to construct a solution, which is fortunately losing dominance as Universities and industries are beginning to express dissatisfaction with the professional curriculum, asserting that it does not prepare students for the intermediate zone of professional practice (Schön 1987 pg. 8).
Levin and Martin (2007) along with Garrison et al. (2000) contest that adult education theory emphasises the need for learners to be self directed and autonomous in order for the educational process to build on experience, while the content is to be relevant and practical (Levin and Martin 2007 pg. 219, Garrison 2000 pg. 64). Being independent is, as Garrison highlights, “a role with high responsibilities and higher standards that is more closely mated to life outside the classroom” (Garrison et al. 2000 pg. 64). As Davis concluded that, “Universities are being forced to review many of the core assumptions that have long underpinned their pedagogic theory and practice” (Davis et al. 2006 pg. 232). It was important to consider some characteristics of the types of learners largely involved in the study of games at Deakin University.

2.4.2 Generation Y

“Generation Y” or the “Net Generation” (Oblinger and Oblinger 2005a), and include those born in the 1980s or currently aged between 12 and 27 (approximately). “Net Gen students are social and team oriented, comfortable with multitasking, and generally positive in their outlook, and have a hands-on, “let’s build it” approach - all encouraged by the IT resources at their disposal” (Oblinger 2006 pg. 12)

Labels such as Generation Y are used to describe the desire for connectivity constantly to one another, either by mobile phone or Internet technologies (Guest 2005 pg. 373). In addition, as Beavis (2005 pg. 2) highlights, Generation Y have a “digital culture” and this is in fact one of the significant ways they connect with knowledge, through social and collaborative technologies. The notion of “being online” as separate from “real life” is not highly acknowledged by Generation Y, as this presence is merely part of their normal everyday life. Other generic traits that could be attributed to the Generation Y include: networked peer-to-peer communication, flexibility, spontaneity, experiential behaviours, engaged through experience, immediacies, sociable, collective team players, structural, and learn through visual and kinaesthetic representations of information (Heath 2006, Novak 2008, Oblinger and Oblinger 2005a). Knowledge within the Net Generation is considered interdisciplinary and team generated, which all evolves from application of problems within a real world context (Knight, Knight and Teghe 2006 pg. 36)
29), thus the generation is considered to be a product of the contemporary environment. As Oblinger and Oblinger (2005b) suggested, our experiences and the environment around us shape how we think, behave, and act. For the Net Generation, technologies such as the Internet were an increasing part of their environment as they grew up and this affects all aspects of a Net Generation student’s life, particularly their learning style. Universities need to accommodate this learning style and consequently, as Dawson et al. (2006) assert, universities are attempting to provide a competitive, quality educative experience to an increasingly culturally, educationally and economically diverse student cohort. However, much more can be done to connect university education to the Net Generation. One way to do this is via creativity, and the provision of a CSS. Craft (2001) argued that creating a climate for creativity is essential to “educate a generation of young people who need to visualize new solutions to the problems of today and tomorrow’s work force, social fabric and environment” (Craft 2001 pg. 28). A coupling element was that of administration of immersive educational activities.

### 2.4.3 Immersive Learning

Immersive learning claims to implement engaging and interactive learning activities that foster high levels of reflection and creativity, as seen in Figure 5 (Blashki et al. 2007 pg. 3). This learning pedagogy is relatively under-utilised and unknown in traditional university education settings and this absence is noticeable in the teaching and learning of computer science students. Social influences and the impact of the environment are as influential in the underlying philosophy of immersive learning, as they are in creativity. For example, the context in which the learning process takes place is essential to the achievement of the application of a successful immersive learning similarly, so too the creative environment under consideration in this study. As Turvey stated “learning concerns both the intra and interpersonal as participants learn within the authentic context of their community” (Turvey 2006 pg. 311).

Immersive learning aims to employ a learner-centred approach that supports students to participate directly and implement engaging and interactive learning activities. It is defined as an educational philosophy within the social and situational learning paradigm. The holistic perspective of immersive learning is a combination of the precepts of
behaviourism and constructivism: combining both theoretical and practical aspects, facilitated through philosophies, social and situational learning, along with learner-centred perspectives. Within the immersive learning pedagogy, the development of an “environment” in which to undertake the study is seminal. This provides a space for exploratory play, rather than a teaching space. This student-centred environment, emphasises active and interactive learning, and epitomises the central tenet of a constructivist approach, where the student comes to know and understand the world, not by the transmission from one (the teacher) to another (the student), but rather by interacting with it (Blashki et al. 2007 pg. 4). The underlying philosophy of immersive learning emerged from, and was inspired by, a number of seminal theoretical approaches including: Piaget’s constructivist theories that view learners as active participants in the construction of knowledge (Newby et al. 2000, Savin-Baden 2000), Papert’s constructionist approach that focuses on social engagement among learners in sense making activities (Harel and Papert 1991); Vygotsky’s emphasis on building social cultural activities to achieve effective learning (Newby et al. 2000, Vygotsky 1978), and Maslow’s (1968 pg. 2) assertion that humans “naturally” need to learn and strive to increase their intelligence. In addition, the immersive learning model builds self-regulated learning that places the student in control. The American Psychological Association’s (APA) (2006) learner-centred principles acknowledged the student’s active role and, Bandura’s (2001) social cognitive theory perceived learning as a three-way interaction among the environment, personal factors, and behaviour (Ainley and Patrick 2006, Bandura 2001, Bonk and Cunningham 1998). The role student’s play within the environment is one of independence and interdependence and the reliance on self, as well as peers and mentors. In addition, Vygotsky (1978 pg. 33) highlights the importance of discourse in the learning process, and support for this can be found in theories viewing the development of thought as a mediated social discourse (Schrire 2005 pg. 50). In dialogic learning, as Schrire (2005 pg. 51) continued, individual understanding is mediated by social discourse.
As shown in Figure 2.5 the four learning elements occur within each student. However, these elements are also influenced by the context (or learning environment), facilitating agents (i.e. teachers and teaching material) and the rest of the world (Blashki et al. 2007 pg. 4).

1. Agency: Described as the user’s active control over the learning and playing process (Blashki et al. 2007 pg. 4).

2. Risk/creativity: Creativity and risk comprise of the ability to move beyond expected and experiential boundaries of stasis and safety required in order to overcome habits (Blashki et al. 2007 pg. 4).

3. Engagement: The ability to attract and sustain the user’s/student’s prolonged interest (Blashki et al. 2007 pg. 4).
4. Immersion: The active involvement of physical, emotional and cognitive processes and concentration (Blashki et al. 2007 pg. 4).

The immersive learning model holds symmetry with learning models described by Turvey (2006). Turvey described learning as “not being concerned with the imparting of abstract and arbitrary fact dictated by an extrinsic curriculum, but is concerned with development and growth of an individual’s identity in relation to the wider community” (Turvey 2006 pg. 311). Immersive learning is an educational practice that encourages students to engage in critical reflection of their individual learning experiences that, in turn, may lead to transformation of their values, attitudes, and emotional reactions to any future learning (Blashki et al. 2007 pg. 5). Additionally, a significant corollary of establishing environments in this study was the concomitant creation of a unique learning environment characterised by “play”.

Play is integral to each of the four components of: Immersion, Engagement, Risk/Creativity and Agency as defined by Blashki et al. (2007 pg. 4). For example, play allows the student to exert great agency over their learning, as it allows for a safe place for self expression (Lemmon et al. 2007 pg. 44). As addressed by Blashki et al. (2007), Lemmon et al. (2007) and Kennewell and Morgan (2006), play is an important characteristic of human behaviour that, given the right stimulation, can nourish and encourage engaged learning. Moyles (1989) has identified play as an essential component of a child’s development, and is a key element of effective learning. In addition, there is a direct relationship between play and learning in young children (Blashki 2000, Kennewell and Morgan 2006). Play can be categorised by the following components: voluntary, no extrinsic goals, focused on activity rather than the final product, pace dictated by the learner, low risk, highly engaging, and contributes to the players procedural and conceptual knowledge (Kennewell and Morgan 2006). Unfortunately the notion of play is largely disregarded within adult learning, where it is overtaken by a model premised on transmitted factual accounts of learning. Play in the environment is important and engages learners in formal institutional settings.
As Blashki et al. (2007), Harper (1997), McLoughlin (1995), Schrire (2005) and Tam (2000) discuss, an environment premise on immersive learning aims to create a climate that encourages students to willingly and actively take responsibility for their own learning process. Immersive learning model also addressed the implementation of creativity in learning and, in addition, as Turvey (2006) emphasises in Figure 2.3 in his creative process model, the elements of social and community. The student is consequently autonomous and effectively exerts more control over their intellectual development than in subjects driven by the specifics of syllabus requirements (Blashki et al. 2007 pg. 6). The intellectual structures are built by the learner, rather than taught or imposed by a teacher, yet should not imply that they are built from “nothing”. Such an environment aims to support the student as they contemplate, articulate, design and construct their own intellectual structures, drawing upon their surrounding environment and their experientially gained knowledge. Craft (2001 pg. 12) argued that such approaches to education, which facilitates creativity, will help to build a social conscious and an entrepreneurial culture, which students require to help them negotiate the fluctuating working climate. The environment thus places the learner in a qualitatively new kind of relationship to knowledge (Blashki et al. 2007 pg. 6).

Immersive learning offers the opportunity to build and support a student’s creativity because of a number of distinguishing features such as: student independence, construction of knowledge through practice, reflection, integrated discipline, and self reflective assessment, as described below:

- **Student independence**: refers to the degree to which the student can function autonomously within the classroom setting, with minimal direction from the teaching staff. In a traditional classroom situation, student independence is constrained if not minimal during the student’s time in the situation. Furthermore, most tasks undertaken afford some independence, however often this is for a constrained period of time, or out of school hours. In an immersive learning situation there is a flexible degree of student independence based on the needs of the student. A student can strongly rely on a teacher for support, or sporadically...
require support. In addition, the student decides the amount of time they are in the situation (Harada et al. 2003 pg. 69, Bruffee 1999 pg. 50).

- **Construction of knowledge through practice**: refers to the degree to which students can apply theory to practice within a classroom setting. In a traditional classroom situation there is minimal time to engage with the learning in a practical sense, with the majority of learning occurring on a theoretical level. In an immersive learning situation, in addition to theoretical learning, there are strong elements of the practical application of tasks within the immersive learning situation. Knowledge is constructed not only from collaboration with teachers, but also from interaction with peers and those from other areas of education and industry (Harada et al. 2003 pg. 67, Bruffee 1999 pg. 3, Schön’s 1987 pg. 25).

- **Reflection**: refers to the degree to which the students reflect in, and on, action when undertaking tasks within the classroom situation. In a traditional classroom situation, time to reflect is minimal as the transmission of learning continues constantly. In the immersive classroom situation reflection upon tasks is encouraged and facilitated through the use of the physical learning environment by the students. In addition, tasks conducted in practice require reflection upon during, and after, they have occurred, otherwise the process of learning is not achieved in either a theoretical or practical sense (Harada et al. 2003 pg. 67, Bruffee 1999 pg. 51, Schön’s 1987 pg. 26, Dewey 1938, deBono’s 1992 pg. 162, Nichol and Blashki 2007 pg. 2).

- **Integrated Discipline**: Refers to the degree to which students are able to interact with students from different year levels or discipline. In addition, it is the degree to which students and staff from other levels and areas of the educational institution participate within the one environment towards a common goal. The traditional classroom situation does not easily facilitate collaboration of an integrated
discipline because of the transmission form of communication with students, and the minimal time to indulge with other parties. In an immersive learning situation the discipline is integrated in that students will work on large scale projects that incorporate students and clients within a more practical and genuine working experience. In addition, projects will often be divided between different cohorts of students, to bring a greater team dynamic to the situation (Harada et al. 2003 pg. 67, Bruffee 1999 pg. 5, Schön’s 1987 pg. 40, Nichol and Blashki 2007 pg. 7).

- **Self Reflective Assessment:** In addition to the factor of reflection, self-reflective assessment is also an important factor in a learning environment. Self-reflective assessment is the degree to which students can critically appraise their own work, and the work of other students, to provide constructive feedback. In traditional classroom situations the learning continues in such a manner, that reflection upon past assessment is minimal. In the immersive learning situation, self-reflective assessment is implicit due to the action of working in practice in the environment. Constant review of past work by students themselves, as well as others in the environment, forces an internal mode of self-reflection within each student. In addition, the presentation of evaluation within the immersive learning situation is performed in a more public and frequent form, thus self reflection is required for improvement (Harada et al. 2003 pg. 67, Schön’s 1987 pg. 40, Blashki 2000 pg. 958, Nichol and Blashki 2007 pg. 4).

Immersive learning is a relatively new educational mechanism, however its elements can be contrasted with other existing educational pedagogies, particularly those from the cognitive domain.
2.4.4 Existing Learning Pedagogies in Information Technology

To build a successful educational experience a relevant pedagogy has to be established. A traditional form of education that often dictates University education is that of behaviourism. Behaviourism is considered a more traditional approach to teaching; i.e. the “teacher” controls the dissemination of information to students (Skinner, 1974). Behaviourist teaching methods are commonly referred to as “skill and drill” or “drill and practice” (Gance, 2002) and provide the repetition required to effectively reinforce response patterns (Skinner, 1974). Behaviourist educational models are generally referred to as “teacher-centred” (Skinner, 1984). Alternative forms of University education particularly that focused on the practical application of skills, is constructivism. Constructivism is a style of learning that involves the learner constructing and adding to their own existing knowledge through interaction with their environment (Piaget, 1973). Constructivist approaches tend to feature collaborative elements that allow the learner to better grasp and assimilate concepts as part of a collective. These educational models, as opposed to the teacher-centred nature of behaviourist models, are generally referred to as “student centred”, which redirects the focus from the teacher to the student (Barraket, 2005).

Constructivism has largely overtaken behaviourism as a practical educational theory (Tinkler, 1996, Thompson, 2000). Behaviourism has remained relevant in several disciplines however, notably computer science (Ben-Ari, 1998). Each approach naturally has perceived advantages and drawbacks; their respective suitability as a theoretical base for teaching game design to tertiary students has not been explored extensively. Themes of behaviourism and constructivism are threaded in immersive learning, with teacher direction apparent, yet within a constructive environment of knowledge. Behaviourism applies initially in the teaching of skills such as programming, where students need repetitions and teacher direction to help them build understanding of the syntax and structures required to effectively program. Constructivism extends this knowledge into the analysis and evaluation cognitive domains, as it allows students to apply the knowledge learnt to new and unique situations, and do so in such a way that involves them engaging with the surrounding environment, rather than through teacher
instruction. Immersive learning builds knowledge based on the structures of behaviourism and constructivism; however a larger component is the community and social attributes.

Learning environments can no longer be considered the sole domain of teacher-dominated “curriculum”, but rather, a broader “learning community” that involves original and innovative representational and communication resources to facilitate learner-directed collaborative learning. Table 2.2 presents the comparison between traditional and community-based learning epistemologies as discussed and confirmed by Harada (2003), Bloom (1956), Oblinger (2006), Blashki et al. (2007), Bruffee (1999), Davis et al. (2006), Jewitt (2005), McLoughlin (1995), Schunk (2005), and Tam (2000).

<table>
<thead>
<tr>
<th>TRADITIONAL</th>
<th>COMMUNITY-BASED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are passive recipients</td>
<td>Students are constructors of knowledge</td>
</tr>
<tr>
<td>Teacher is the master and commander</td>
<td>Teacher is the expert and mentor</td>
</tr>
<tr>
<td>Teaching and learning has fixed roles</td>
<td>Teaching and Learning has mobile roles</td>
</tr>
<tr>
<td>Learning is about memorisation</td>
<td>Learning is about understanding</td>
</tr>
<tr>
<td>Focus is on isolated skills, final products</td>
<td>Focus is on process as well as product</td>
</tr>
<tr>
<td>Knowledge is about recall</td>
<td>Knowledge is about discovery</td>
</tr>
<tr>
<td>Learning is primarily an independent activity</td>
<td>Learning emphasises social engagement</td>
</tr>
<tr>
<td>Emphasis is on acquiring isolated chunks of information</td>
<td>Emphasis is on making connections, fostering inquiry and problem solving</td>
</tr>
<tr>
<td>Disciplines are viewed as discrete entities</td>
<td>Disciplines are viewed as integrated</td>
</tr>
<tr>
<td>Learning is through transmission and repetition</td>
<td>Learning is through transfer of knowledge and construction</td>
</tr>
<tr>
<td>Curriculum is built around textbooks, guides</td>
<td>Curriculum evolves from real-life industry concerns, student questions</td>
</tr>
<tr>
<td>Information is largely restricted to classroom resources</td>
<td>Information access includes global sources of information</td>
</tr>
<tr>
<td>Learning is about acquisition of facts</td>
<td>Learning is about facts within a conceptual framework</td>
</tr>
<tr>
<td>Evaluation is summative and final; it focuses on grades</td>
<td>Evaluation includes formative assessment and focuses on self-improvement</td>
</tr>
<tr>
<td>Learning is undertaken at a fixed, single location</td>
<td>Learning is undertaken in mobile, convertible classrooms that have a plurality of locations and space types</td>
</tr>
<tr>
<td>There is limited, if any, time for reflection</td>
<td>Reflection is integral to the process</td>
</tr>
</tbody>
</table>
As Knight et al. (2006) asserted there is a need for nurturing flexible learning communities, and this requires a change in both the knowledge and behaviour of teachers. Furthermore, as Jewitt (2005) defined, such a learning community requires a substantial transformation of current concepts and contexts of technology, learning and pedagogy, and the ways in which thinking shapes learning environments. It is important to emphasise that an immersive learning environment provides students with a specific framework, both contextual and theoretical, in which to learn, acquire and develop skills (Blashki et al. 2007 pg. 5). It is a learning model whereby students become the architects of their own intellectual structures, acquiring skills of flexibility, reflective abilities and self-management that are necessary in the fluid workplaces of their future (Blashki et al. 2007 pg. 4). The notion of independence and interdependence, as noted by Garrison et al. (2000), is apparent.

2.4.5 Reflective Techniques

Schön’s (1987) technique of reflection in action is central in the pursuit of creativity, and a variable period of time within the context of the problem, during which changes can still effect the situation. Prior to resolution there is a moment where the problem solver will pause and evaluate the situation in the midst of the problem to determine if a better solution is available. The skills of creativity are requisite for students to survive outside the University setting. The technique suggested by Schön (1987 pg. 26) whereby practitioners utilise professional artistry, can be defined as reflection in action, which is an extension of our everyday “knowing in action”. Knowing in action is best described as the spontaneous ability of using our current knowledge to smoothly work through everyday problems. Reflection in action is introduced when a person's “knowing in action” cannot solve the problem to the best of their ability. This method is similar in concept to divergent thinking, while knowing in action could be seen as similar to convergent thinking. The reflection in action technique is in accordance with deBono’s (1992) notion of Provocation (or Po), during which the thinker stops in the midst of the situation and redirects their thinking. Often in Po, extravagant and wild statements are made regarding the alternative solutions. This technique is shown to be effective as the thinker moves from extravagant/nonsensical statements to something that, finally, makes
sense. Furthermore, the playfulness and humour of the Po statements are known for their affective benefits to creative ideas (deBono 1992 pg. 145, Nichol and Blashki 2007).

Reflection in action is a thinking skill used more by individuals than by groups, however, as with creativity, it is a skill that interacts with the wider environment. Additionally, Schön (1987) emphasises the provision of a “reflective practicum” as an environment conducive to reflection. A reflective practicum learning situation assists in facilitating group or collective creativity. Creative individuals are often in collaborative situations when using skills of reflection and action, and as Paulus (1999 pg. 782) suggests, collaboration (or group involvement) is also conducive to a person’s creativity. Schön’s process of reflection in action is similar to Checkland’s (1999) activity models where the participants reflect on the possible solutions without verification of any one factor. Reflection in action is a skill that is to be utilised by all stakeholders in the learning situation: learners and teachers. In the immersive learning environment, technology is also a seminal component in the construction of a supportive environment.

2.4.6 Learner, Teacher and Technology in Immersive Learning Environments.

Kiousis (2002) argued that technology plays an important role in shaping interaction among learners, as it supports structured interaction between a community of learners is fundamental to the shaping of knowledge and achieving collaborative learning. Immersive learning seeks to support a collaborative and co-operative triumvirate of learner, teacher and technology (Nichol and Blashki 2007 pg. 3).

The term “learners”, is used to define multi-dimensional participants involved in a socio-cultural learning process. If they are permitted a certain level of control over content and environment such as selecting semiotic resources, choosing learning strategies, deciding the amount of information to process and the ability to use their preferred learning style, students are inclined to be more highly motivated, thus having an increased potential to achieve more positive learning outcomes, and concomitantly, increasing both self-esteem and trust (Harper 1997 pg. 1, McLoughlin 1995 pg. 3). However, as McLoughlin (1995 pg. 3) pointed out, according the learner absolute freedom and control over their
learning process may not always result in the productivity and success that aligns with the learner’s expectations. Young learners, in particular, may have difficulty in relying on their own experience to manage resources (Harper 1997 pg. 1), thus teachers are still a requisite component within this learning context (Nichol and Blashki 2007 pg. 5). With the teacher as a guide, in combination with the learner’s self-regulated learning process, such an environment increases the potential for successful learning outcomes. The teacher functions as a facilitator, rather than an expert, providing guidance and direction to assist the students’ learning and to share both authority and responsibility for their learning (Tam 2000 pg. 2).

The role of technology is to support the learners’ construction of knowledge, structure their learning processes, and offer tools that stimulate students to make maximum use of their own cognitive potential (Tam 2000 pg. 5). Learning is both a personal and a social activity through which knowledge is gained via the combined effort of learners in dialogue to test, refine and build their understanding in a learning context. Effective learning is most likely to occur when students are provided with access to shared information and knowledge-construction tools to enhance their dialogue and collaboration within a learning community.

To further acknowledge the role of creativity in immersive learning, it was important to define the curriculum and specific learning objectives of the Games Design and Development degree that was at the focus of this study. Definition of the learning objectives and curriculum will aided in defining of where and how creativity was apparent in the games student studies.

2.4.7 Curriculum and Learning Objectives of GDD: Bloom’s Taxonomy

To aid in setting the scene for creativity in the games students at Deakin University it was important to define the curriculum within which it all takes place. The following details the guided “learning objectives” of the Bachelor of Information Technology (Games Design and Development) course that has been on offer to students since 2004.
The Games Design and Development stream within the Bachelor of IT (BIT) degree focused on enhancing students’ hands-on ability to build computer games through the development of an understanding and appreciation of concepts in:

- Software technology relevant to games including graphics engines, input devices, system analysis and design, object oriented programming, game programming, networks and simulation engines.

- Scientific concepts from computer science and related fields including game simulation and modeling, graphics, artificial intelligence, real-time rendering, audio/visual systems, and game theory.

- Art and design principles for games including software engineering, human computer interaction, game production, graphic design, music and sounds effects, and games and society.

The general aims of the Bachelor of Information Technology were:

- To offer a modern and learning-oriented course in IT

- To cultivate the life-long learning culture and skills of students

- To enable graduates to become professionals

Graduates of the BIT course will possess a broad knowledge and understanding of the technological aspects of IT, in particular:

- Strong software development capabilities in generic software, web applications, distributed applications, and applications utilising frontier technologies requiring interfaces with computer networks, servers and other devices

- The technological and management requirements of businesses and organizations, the management of aspects of e-systems and an understanding of security

- Design and analysis of information including modeling technique for databases and analysis of data through techniques such as data mining
• Being able to communicate with clients and translate user requirements into formal specification of system or application

• Being able to write applications in modern programming languages using current development environments and tools

• Being able to effectively and efficiently manage projects

• Being able to work in groups of multi-national membership

The specific units to which the students undertake to achieve these learning objectives:

• Level 1
  
  o SIT101 Fundamentals of Information Technology
  
  o SIT102 Introduction to Programming
  
  o SIT151 Game Fundamentals
  
  o SIT103 Introduction to Database Design
  
  o SIT104 Introduction to Web Development
  
  o SIT131 Object-Oriented Development
  
  o SIT152 Game Design

• Level 2
  
  o MSC228 Information Systems Analysis and Design
  
  o SIT221 Classes, Libraries and Algorithms
  
  o SIT251 Game Architecture and Design
  
  o SIT252 Real-Time Graphics and Rendering
  
  o SIT202 Computer Networks
  
  o SIT253 Audio and Visual Game Elements

• Level 3
  
  o SIT301 IT Practice (ONLINE)
  
  o SIT352 Game Production and Society
Based on the devised curriculum for the game students, Bloom’s taxonomy of educational objectives was applied to draw a comparison of the learning objectives for the Games Design and Development Degree. Bloom, Krathwohl, and Anderson (2001) assert the revised taxonomy of educational objectives that was first devised by Bloom in 1956. Bloom's Taxonomy of Educational Objectives for the Cognitive Domain (Bloom, Engelhart, Furst, Hill and Krathwohl 1956) assesses the level of cognitive processing in student learning based on the following components: knowledge, comprehension, application, analysis, synthesis and evaluation. Bloom’s method encompassed the assessment of learning objectives to determine their effectiveness (Bloom et al. 2001 pg.1), as these ideas pave the way for student interaction and assessment with the learning content. The taxonomy assesses learning objectives along a continuum of how effective they are in satisfying cognitive processes and knowledge (Bloom et al. 2001 pg. 5). Learning objectives are assessed and plotted against the taxonomy, and for the game students this is shown in Table 2.3. Bloom’s, Krathwohl, and Anderson (2001) text aids an educator to assess the verb (cognitive process) and noun (knowledge statement) of each learning objective, in an attempt to promote gaps and difference in the learning approach given by the educator. This process provides a better understanding of what and how the actual learning objectives of an educational program are being applied, and further work on defining the learning objectives can be undertaken until it is deemed more appropriate in terms of assessment, learning and instruction (Bloom et al. 2001 pg. 6). Bloom’s taxonomy can also highlight where aspects of creativity should also come into play, and thus is important as a scaffolding tasks to achieve more creative curriculum (not just a creative environment, which has been the focus on this chapter thus far). Table 2.3 highlights the classification of learning objectives for the Games Design and Development degree on offer at Deakin University, specifically the learning objectives relevant to the X = Games Design and Development major as well as the O = Bachelor of IT degree. These learning objectives have been separated because of the specific nature to which the Games learning objectives are presented, in comparison to that of the more generic IT skills.
Table 2.3 Taxonomy of Learning Objectives of the Bachelor of IT (Games Design and Development)

<table>
<thead>
<tr>
<th>The knowledge dimension</th>
<th>The cognitive process dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Factual Knowledge</td>
<td>X, O</td>
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<tr>
<td>B. Conceptual Knowledge</td>
<td>X</td>
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<tr>
<td>C. Procedural Knowledge</td>
<td>O</td>
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<tr>
<td>D. Meta-cognitive knowledge</td>
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Table 2.3 primarily illustrates that for the Games Design and Development major, knowledge is built within the factual and conceptual aspects and cognitive process remain at a level of remembering and understanding facts. It also shows that for the Bachelor of IT, the learning objects span more dimensions and that a large part of students learning is engaging with procedural and meta-cognitive knowledge to analyse, evaluate and create information. The implications of results from Bloom’s taxonomy as applied to the Games Design and Development degree are discussed further in Chapter 5.

In the development of learning objectives, the games students engaged and contributed to their studies often in very social ways. In this study, the contribution of social factors on students learning is defined as communal creativity.

### 2.5 Communal Creativity

Creativity is often seen as an individual characteristic, however, as argued by Paulus (1999 pg. 782) and Warr and O’Neill (2005 pg. 119), it is essentially a social
phenomenon and almost all creativity involves collaborative and/or group processes. Social, collective or group dynamics of creativity can be referred to as communal creativity, comprises not only individual creative people undertaking group activities but also influences from the surrounding learning environment and community. In addition, the strong emphasis on social collaboration to enhance communal creativity results in more informal development of a person's creative skills. Studies of individual creative people carrying out small-scale tasks can only yield limited information. In addition, acts of individual creativity are often performed with a specific IT tool. For our society to nurture and build a community of creative people, energy needs to be directed to acts of creativity performed in, and around, group situations (Florida 2004 pg. 5). Fischer and Nakakoji also suggest that “creative activity grows out of the relationships between an individual and the world of his or her work, and out of the ties between an individual and other human beings” (Fischer and Nakakoji 1997 pg. 22). The difficulty lies in distinguishing differences between group, collaborative and collective creativity, as well as community creativity. For completeness, we will discuss collaboration and community, but will refer to communal creativity throughout.

2.5.1 Collaboration

Collaboration with others in a creative environment brings together views from different domains and is an ideal catalyst for creativity. Delbridge and Bernard (2003) defined collaboration as: “to work, one with another, cooperate, as in literally work” (Delbridge and Bernard 2003 pg. 182). However, the definition of Hilleges et al. (2007 pg. 137) describes collaboration as knowledge and information needing to be exchanged, different skills having to be coordinated, and information communicated by others needing to be interpreted so that new ideas can be created and new solutions found. As discussed earlier, for the development of novel ideas the creative person needs a certain amount of knowledge, and this may be obtained via collaboration. The collaborative environment either provides direct knowledge or indirect motivation to the creative person (Paulus 1999 pg. 783), while offering individuals a place where they can model the styles of peers, as well as a domain for relevant feedback (Paulus 1999 pg. 783). Contexts, such as a supportive collaborative environment of teachers, mentors and
colleagues, are essential for the knowledge of the creative person. Collaborative creativity is important in academia as well as industry, and is slowly gaining credence as suggested by Eales (2005), Hilliges et al. (2007) and Treffinger (1993).

Paulus (1999 pg. 782) stated that collaboration can bring together people with diverse knowledge and skills and allow them to combine these in unique ways. A collaborative environment can be highly conducive to creativity, specifically when in collaboration with a high level of participation or communication. Other aspects of collaboration that encourage creative activities include an open and frank exchange of ideas or opinions that supports innovation (Paulus 1999 pg. 782). However, the theoretical proposition of collaborative creativity only proffers potential as there a number of pitfalls to collaboration that can result in fewer original and novel ideas. The Internet heralds the potential of distributed collaboration, where individuals may never get the chance to meet a work colleague face to face. Distributed collaboration may occur within online communities and is exemplified in societies where communication is asynchronous and text-based (Weakley and Edmonds 2004 pg. 239). The implications of such practice for creativity are new, however distributed collaboration produces mixed membership within communities that has the potential to be highly conducive to creativity. The Internet begins to blur the definition between collaboration and community, as it allows countless people from diverse backgrounds to come together for various reasons, in this case, learning (Sheard and Carbone 2004 pg. 293). In addition, as Sheard and Carbone stated, “collaboration among a group of people is facilitated and encouraged by the presence of community” (Sheard and Carbone 2004, pg. 293). Do and Gross (2007 pg. 28) asserted that a shared place for work is the basic ingredient for a creative community.

2.5.2 Community

As Foth (2006 pg. 207) argued, the term community is often used as a convenient “container” by researchers and external stakeholders to refer collectively to a more or less well defined group of people. In addition, Garcia, Giuliani and Wiesenfeld (1999
pg. 727) suggest people in a community acknowledge and recognise that they are a member of that community.

From a research perspective a community is pre-existing from the time the researchers enter while Foth (2006 pg. 208) states that communities over computer networks can be categorised as social and informal and often take place within the geographic vicinity of the actors. However, communities are now also made up of members outside the immediate vicinity of the neighbourhood, from a diverse range of communication partners, and may reside beyond physical reach because of the rise of the introduction of communication technology. Garcia et al. (1999 pg. 731) have completed an analysis of the definitions of community that arise in the literature and, from a psychological perspective, defined community as comprising two parts: structural and functional. Structural characteristics are people and the physical environment in which those people live, while functional characteristics are the processes of the existing community and everything that happens as a result of the interaction between the individuals and their environment (Garcia et al. 1999 pg. 729). In communities, people operate via a variety of roles in a diverse number of networks (Foth 2006 pg. 209). As Foth suggests “the roles that people act in and switch between seamlessly can include family roles, job positions, committee and volunteer memberships, and informal roles such as friends, supporters, counsellors and neighbours” (Foth 2006 pg.209). It should be emphasised that roles defined as informal should not be disregarded as irrelevant or unimportant in any community. Informal roles such as friends and supporters may often exert the most influence on community members.

Blumenthal et al. (2003 pg.6) suggests that more successful communities have higher levels and output of creativity, and much of the literature argued for the value of establishing learning communities (Chang Chen, and Li 2006, Fischer and Sugimoto 2006, McDonald 2005, Volpentesta and Frega 2006). The learning community as a new structure which combines learners, educators and business professionals in a contextual, creative space with the goal of developing not only the knowledge and skills of learners but also of creating ideas, synergies and opportunities (McDonald 2005 pg. 109). In
addition, as Dawson *et al.* argue, “a focus on socially constructed networks and interactions is more aligned with current perceptions of effective approaches to learning” (Dawson, Burnett and O'Donohue 2006 pg. 131). As shown in Turvey’s model (Figure 2.3) of the creative process, social and community factors have a large influence on learning and creativity. Fischer and Sugimoto (2006 pg. 31) suggest that much human creativity is social and that learning communities are required to cope with the challenges of ensuring that learning is an integral part of daily life. Importantly, as Rovai (2002a pg. 319) argued, students who feel a strong sense of community from their learning environment are more likely to persist with their studies, than those students who feel alienated and alone.

Rovai (2002b pg. 32) defined a sense of community as: spirit, trust, mutual interdependence among members, interactivity, shared values and beliefs, and common expectations. Dawson *et al.* (2006) define a sense of community as: membership, influence, fulfilment of needs and shared emotional connection. Overall, this sense of community shares elements with CSS’s, such as trust and openness, idea time and idea support, motivation energy and focus, direction and goals, which are important elements in the assessment of community within students (Rovai 2002a, 2002b, Dawson 2006, Chipuer and Pretty 1999, Chavis, Hogge, McMillan and Wandersman 1986). To assess the sense of community a survey can be administered which consists of 10 items relating to feelings of connectedness and 10 items related to feelings regarding the use of interaction with the community, (Rovai 2002a, 2002b, Chipuer and Pretty 1999, Chavis *et al.* 1986). These questions help to construct understanding of the extent to which learning goals are being satisfied (Rovai 2002a, 2002b, Chipuer and Pretty, 1999, Chavis *et al.*, 1986). The questions asked in the sense of community index are rated by participants on the five-point Likert scale of: strongly agree, agree, neutral, disagree and strongly disagree. Furthermore, the questions asked in the sense of community index are not setting-specific, and can be applied to assessment of traditional and virtual learning situations.
In the design of a CSS it is important to determine the support for factors such as communal activities. The cohort to be supported required thorough investigation for a design to be effective, and is discussed in section 2.6.

### 2.6 Design of a Creativity Support System

A specific focus has been drawn towards building a CSS to support communal creativity, where the design components of interaction, social and environments were considered.

#### 2.6.1 Interaction Design

Winogard (1996 pg. ) referred to interaction design as the study of the cognitive world of computer users including the development of approaches and methods for predicting properties of these interactions by users and for supporting the design of interfaces. According to Burleson and Selker (2002 pg. 89), Greene (2002 pg. 103), and Winogard (1996 pg. 46) users should expect the following experience goals from a computer system: satisfaction, enjoyment, fun, entertainment, helpfulness, motivation, aesthetically pleasing, supportive of creativity, rewarding and emotionally fulfilling. Designing a CSS with the interaction needs and human concerns of the user in mind bears close allegiance to Shneiderman's (2002) and Greene's (2002) elements defining a CSS as discussed previously in section 2.4. Their elements refer to specific tools that support creativity and, in this study, these design constraints are in alignment with the CSS factors. The interactions between the user and interface should have a balance of exploration, experimentation, constraint, control and freedom (Burleson and Selker 2002 pg. 89, Greene 2002 pg. 103, Hoorn 2002 pg. 188, Shneiderman 1999 pg. 123). Greene (2002 pg. 103) specified general design constraints as control, flexibility and engaging content. Winogard (1996 pg. 46) defined five specific interaction design steps for the design of computer systems for people:

1. Understanding: finding the underlying problem
2. Abstracting: finding the main elements and the kind of information to be conveyed

3. Structuring: establishing the relationships between the elements

4. Representing: deciding how this structure can be represented in visual and audio form

5. Detailing: defining the exact details of the interactions and tasks

Hilliges et al. (2007 pg. 137), in their study about designing brainstorming technology for collaborative creative problem solving, defined two complementary measures that can help in minimising the cost of interaction and communication. This two stage process includes: blending of the computer into the environment in which the collaborative creative processes take place; then blending the virtual interface into the task so that knowing the craft (or technique) reduces the cost of learning and using the system (Hilliges et al. 2007 pg. 139). In this study the purpose of interaction design is “at the very least...about reducing inhibitors to creativity” (Burleson and Selker 2002 pg. 89). Literature covering the topic of interaction design generally falls within two areas: the overall computer system ontology and interface design. The encompassing ontology in this study was concerned with interaction design, but, more importantly, with the social systems occurring within, and around, the learning environment of the games students. Interaction design in terms of the interface is particularly pertinent, as the interface needs to provide a meaningful connection between the overall system and its users, and functions as the mediator between the technology and the user. This is often represented by a keyboard and pointer, a Graphical User Interface (GUI), sound, dynamical interaction, and more recently, context awareness (Burleson and Selker 2002 pg. 89). The interface is an opportunity for user interaction with task relevant knowledge, skills utilisation, and motivations, which all influence creativity (Burleson and Selker 2002 pg. 89). Various guidelines have been produced (Hartson and Hix 1987, Shneiderman 1999, 2000, Shneiderman and Plaisant 2005, Burleson and Selker 2002) in an attempt to guide interface design of computer systems, however, to produce unique
yet meaningful interfaces, creativity is essential. Creativity, in conjunction with
guidelines and problem solving skills, helps in envisioning the needs of the user for
whom the interface is designed. As this study formulated with Winogard’s (1996 pg.
107) concept of design as a social activity with social consequences, the elements of
social design that assisted in the design of a CSS will be discussed.

2.6.2 Social Design

Social design involves the study of user’s experiences, with a particular focus on the
ways in which the user’s social systems may affect them when interacting with computer
systems. In this study, the social design of computer systems is embedded within a
whole “system” perspective that involves incorporating the influences from internal and
external entities into the design. Donald Norman, in his work at Apple Computers
(Winogard 1996 pg. 233), used the term “user experience” to summarise his work, and
defines user experience as not just concerned with the interface, but rather, everything
related to the user’s experience with the product. Warr and O’Neil (2005 pg. 118) viewed
social design of CSS’s from a situationalist perspective. The situationalist view of
creativity moves away from the individual perspective, where creativity and views
creativity as a social process placing importance on interaction and collaboration with
other individuals and the world around us. According to Warr and O’Neill (2005 pg.
124) to support the situationalist view of creativity the following factors must be
supported:

1. Production blocking: working in collaboration with others can slow
down, and even cease, the production of ideas. The sheer number of
potential ideas flying around at the one time may hamper a really good
idea from receiving attention.

2. Evaluation apprehension: the inability to produce your ideas because of
a fear that the idea will be scrutinised and potentially criticised by
others.
3. Free riding: also known as “social loafing”, is the result of group members becoming lazy and relying on other members. Minimal contribution of ideas is the result.

These factors have resemblance to the CSS factors as discussed in section 2.4. Ideas should attempt to be supported, so as to avoid production blocking and evaluation apperception, and the factors of “idea time” and “idea support”, help to achieve this. As Cropley (1999 pg. 514) stated, an important function is to offer creative individuals a safe space where they can break the rules without sanctions, as well as to offer them a positive perspective on themselves, for instance the view that their ideas are not “crazy”, but rather creative. The social design CSS for the games students are connected largely with the environmental design of the CSS.

2.6.3 Environmental Design

The environmental design of the CSS for the games students is composed of physical elements (computer, facilities) and information resources (access to research facilities and/or teaching staff). As previously mentioned, the environmental design is influenced by the design of the social system that surrounds the environment. Do and Gross (2007) argued for the need to set up environments, so that they “encourage and nurture creative mindsets and approaches” (Do and Gross 2007 pg. 28). The environmental design utilises new “computational” frameworks, where the technology of the computer system is not of primary importance, but rather the focus is on which the technology is used and in what contexts.

Computational frameworks assert the need for computational media and technology to be present in the environment in a structured and purpose built way (Fischer and Nakakoji 1997 pg. 21). Simple inclusion of technology does not necessarily approximate a valid experience for learners of an environment. Fischer and Sugimoto (2006) asserted that computational media and technologies must be designed to enhance each learner's active participation and commitment within their learning experiences. Computational media and technologies allow for learners to engage and express themselves within the learning environment in multi-model forms of interaction (Fischer and Nakakoji 1997
Online technologies such as discussion forums and online communities are varieties of computational media that allow learners to engage and express themselves, while interacting with their learning in a reflective manner (Garrison et al. 2000 pg. 61). Furthermore, online communities are supported by learners currently undertaking University education, predominately comprising of Generation Y students (Oblinger 2006, Guest 2005, Heath 2006, Oblinger and Oblinger 2005a). Volpentesta and Frega (2006 pg. 5) stated that “blended learning communities integrate online learning and face-to-face meetings in order to create richer collaborative learning experiences and to strengthen relationships between learners through structured group interactions that employ technology”. The components that compose a computational framework should include (Fischer and Nakakoji 1997, Fischer and Sugimoto 2006):

1. Access to information and resources for people with different perspectives and from various backgrounds.

2. A shared focus around the topic.

3. Interaction with others through computational artefacts as a shared medium.

4. Provision of an open environment, however one that has boundaries to ensure that the creativity processes have a model from which to be developed and extended.

5. Engagement in meta-design. In meta-design the computational environment should be open, modifiable and extendible, however current computational frameworks tend to be limited and constraining for the user. Currently, the notion of meta-design remains elusive (Fischer and Sugimoto 2006 pg. 41), however people involved at all levels of the learning environment should be able to implement changes (Fischer and Sugimoto 2006).
As literature indicates (Csikszentmihalyi 1996 pg. 128), the environment in which a person is immersed in their creative endeavours strongly influences by the outcome of the creative learning process. By encouraging and supporting reflective activities and behaviours in students, they will be better equipped to thrive and not simply “get through” in the creatively challenging, cross-discipline, study of games design (Blumenthal et al. 2003 pg. 53). As Schön (1987) reminds us, a reflective practicum is a setting designed for the task of learning a practice. A practice comprises a community of reflective practitioners who share conventions of actions such as distinctive media, language and tools (Schön 1987). Knight et al. (2006 pg. 30) asserted that professional education would benefit from a reflexive approach to practice, as reflection stands in the context of change that is brought about by this generations’ interaction with technology.

Other purpose-built reflective environments comparable to the one on offer to the games students have been facilitated in other Victorian Universities with great success. For example, at Monash University, within the Bachelor of Multimedia, a studio type environment was developed that provided students with the practical subjects that establish closer connections/links between experience, knowledge and practice (business principles and processes with business practice) (Blashki 2000). This “immersive learning” approach promoted risk-taking (mistake-making) and collaborative learning. Student centred learning involved student's active participation in their own acquisition of knowledge; a “learning by doing” philosophy (Blashki 2000 pg. 958). In this type of environment students quickly learn the realities of working in a team and can develop communication, negotiation and conflict resolution skills. In addition, a process of peer review is continuous within the environment with varying degrees of acceptance (Blashki 2000 pg. 959). A collaborative partnership between the studio at the University and a multimedia content development company Mondo Studios was established in this situation that allowed the students to use their assessable assignment content for a real world purpose (Blashki 2001).
2.6.4 Other Successful Environments

Exploration of other successful immersive learning environments that exhibited the potential to harness creativity are presented, and three of these environments have been identified at both secondary and tertiary levels of education.

2.6.4.1 The Max

The Max Learning Space is located at Karingal Park Secondary College, Victoria, Australia (KPSC), and was an example of student-centred learning that had the potential to be a fully immersive learning environment (as discussed in section 2.4.3). The Max Learning Space was constructed, both physically and pedagogically, with the concepts of immersive learning to enhance and support the initiation of year 7 students into secondary school learning. The Max was established at KPSC in collaboration with Deakin University to create engaging, immersive and interactive learning experiences for students, assist them in the transition from primary to secondary school, enhance and support the development of a range of skills such as: independent inquiry, higher order thinking and interpersonal reasoning and social interaction. The Max environment is expected to appropriately prepare students for their future tertiary study, social and work experience, and lifelong learning. The Max immersive learning environment was funded by a grant from the State Government and the design was developed by a collaborative team comprising the teaching staff that would use The Max and the research team from Deakin University. Completed in early 2007 for the incoming year 7 students at KPSC, the environment was named “The Max” because of the maximum benefits it was believed it would have for the students. The physical architecture of this space reflects design principles governed by the four immersive learning principles, as discussed in section 2.4.3. The physical room is open and, more importantly, without imposing structures or boundaries as impediments to the free flow of space, an important and active part of the teaching/learning process. It was important that the physical environment support and reflect the values of the research and teaching team; an opportunity for active, interactive and social learning practice.

The arrangement of furniture and other resource materials in the Max was non-linear, often appearing, to more traditionally oriented teachers, as random and chaotic. Students
and staff co-operatively determined the placement of furniture “on the fly” or according to the demands of the current activity. At any one time approximately 100 students were participating in a variety of different subjects: Math, Integrated studies, Science, Literature, and English, with each group comprising of approximately 20 students, dependant on the students’ willingness to participate and staff selection. In the initial session students were introduced to the pedagogic concepts in plain language and were encouraged to take ownership of the learning space. Whilst the space accommodated at least 100 students at any time there were only 25 computers set up in the space. This was to emphasise both practically and visually that the technology was merely a tool, in the same way as books, pencils and paper, and not to be relied upon to do the thinking for them. Each student was allocated a user name and password in order to conduct their own research, or work collaboratively with one or more students to explore a topic. They did not need to sign in to access these computers, and they could use the technology at any school time (including after class) to access these facilitates. All computers were connected to the World Wide Web, thus students had free access to the Internet. In one corner of The Max was a television and VCR set, which served the dual purpose of both a teaching resource and recreational pastime. During work time students needed to request to use it if it was not related to work currently being undertaken. Throughout the space there were many areas students could post their work: notice boards, whiteboards, and walls around the space were available for students to use for display. These displays comprised of pictures, booklets, newspapers, maps, students drawings and charts. Student work was apparent everywhere. Additionally, there were two specific corners that displayed the results of competitions: one based on students’ self-evaluated reading score (a poster indicates the appropriate levels) and one based on a staff record of students who exhibit appropriate behaviours such as providing help to others or by contributing to the community (The “star of the week” and his/her picture will be posted on the wall).

As McLoughlin (2005) suggests, a quick survey of a learning space gives one a good indication of the kind, and quality, of literacy being produced. The setting of The Max ensured that students had easy access to all learning materials and tools, but also encouraged sharing, collaboration and group activities. Moreover, similar to Blashki’s
studio environment, The Max also aimed to bring students into a community and establish stronger connections between experience, knowledge and practice (Blashki 2000).

2.6.4.2 BIM Studio

The Bachelor of Interactive Media (BIM) studio was located within the old “green room” of a performance theatre (basement type facility) at Deakin University Burwood campus. The space was used by the BIM students who spend most of their contact and study time in the space. The BIM studio has a very similar teaching philosophy to that of The Studio at Monash University (Section 2.6.3). Figure 2.5 (a) and (b) illustrates the BIM studio in one of its quieter moments (out of semester).

![Figure 2.5 (a) and 2.5 (b). Photographs of the Bachelor of Interactive Media Studio at Deakin University, Burwood, Australia](image)

The space had a number of computers (both Macintosh and PC), areas for group collaboration, board room meeting style areas, whiteboards and spaces for securing individual items. The students had access to the studio every day of the week and were encouraged to use the studio environment as a second home. Their studies involved working in simulated and real world experiences, often conducting work with outside clients. The BIM degree and studio is relatively new at Deakin University, however since its inception the intake of students into the BIM degree has increased 500% as the quality teaching and learning environment grows stronger and gains in renown.
Currently the BIM studio is still being used as a teaching and learning space, with a focus on providing a space to inception and creation of ideas.

2.6.4.3 Deakin Immersive Learning Environment

The Deakin Immersive Learning Environment initially appears to be a more traditional classroom when compared to the BIM studio or the games lounge, however, it is the way in which the environment was used during class that makes it less like a traditional classroom. Figure 2.6 (a) and (b) illustrates the Deakin Immersive Learning laboratory that is located at the Burwood campus.

![Photographs of the Deakin Immersive Learning Laboratory at Deakin University, Burwood, Australia](image)

Figure 2.6 (a) and 2.6 (b). Photographs of the Deakin Immersive Learning Laboratory at Deakin University, Burwood, Australia

Firstly, the environment was designed to provide a more comfortable working environment for the students who use it. Comfortable couches are placed in front of whiteboard facilities to provide an informal brainstorming area in an attempt to soften the process and function. In addition, only four computers are located in the classroom, again to place the emphasis of the space on human interaction and discussion, rather than about reliance on using computers. Traditional practical classes attended by the games students of Deakin University often resulted in students becoming antisocial, as they habitually use the computer as a distraction from what they perceive to be “boring” lectures and tutorials. The immersive learning laboratory was design in such as way as to
avoid this behaviour, however also encourage students to participate in discussion and activities.

2.7 Conclusion

Chapter 2 presented the disparate areas of research within the literature of creativity and creativity support systems (CSS). Importantly this chapter grappled with the concept of creativity, yet articulated many components that can be influential on creativity, particularly those that build a supportive “creative environment”. Creativity is a combination of factors: person, process, product and environment and that creativity is a trait built within each individual in different ways. Particularly this chapter has made clear that the creative environment or CSS is a relatively unexplored area of research, yet it is of importance in its influence upon creative development. Within a CSS, social or communal factors are of high consideration, particularly for Generation Y Tertiary students. The innovative area of video games design and development was of focus, as without innovative areas such as games development there would be a lack of development of IT to add to the creative economy (Blumenthal et al. 2003 pg. 1, Florida 2004 pg. 5). To assess the creativity needs of the games students the research methodology of action research was chosen in this study as it was deemed epistemologically sounds and participant oriented to aid in addressing issues within a specific domain. Action research is presented in Chapter 3, with application of action research to the context of the games students described in Chapter 4.
3. Research Inquiry

As asserted by Gergen and Gergen (2010), research is constructed in social settings through a process of historically and culturally social processes. The development of knowledge is constructed through a democratic process of interaction, influence and sense making activities. In determining creativity and what aspects are of influence to creative endeavours, this participative process of problem construction was deemed appropriate. Action research provided such a methodological landscape, and was deemed appropriate after an extensive determination of methods of research inquiry appropriate for this study. In this study, action research was utilised with the games students in forming of the aim of this study, which was: To demonstrate if based on the facilitation of certain creativity factors, a technology-enhanced, purpose built learning environment can be conducive to enhancing creative potential. This chapter presents the action research philosophy and methods employed as a part of this study.

3.1 Introduction to Action Research

Action research has been variously described as a democratically-based approach that seeks to explore problems in the form of understanding and changing human behaviour (Pasmore 2006, Reason and Bradbury 2008). Action research is about producing knowledge that is useful to help people in their daily lives and has a wide community purpose, as it can contribute to individuals and a community through building of relationships on economic, political, psychological and spiritual terms (Reason and Bradbury 2008 pg. 2). Creativity is defined as an aspect in everyone that contributes to their everyday life, as well as being something established via social and cultural mechanisms. The purpose of creativity is closely aligned with the purpose of the action research approach; to produce practical and useful knowledge within people and communities as, not only does it support development of creativity, it also supports a community-based approach to knowledge development. Reason and Bradbury argued that a participative and democratic view of knowledge production is a “more adequate and creative paradigm for our times” (Reason and Bradbury 2008 pg. 7).
Avoidance of the title “methodology” for this chapter was an intentional decision. A methodology is an abstract theoretical basis for research inquiry. To emphasise that the research undertaken in this study was both replicable and reliable, this chapter focused on the development of the action research, which has much more practical, realistic and reliable applications than an abstract “methodology”. A methodology, albeit important in the process of research, is presented in this chapter via discussion of the action research which was a solid research process that takes concerted steps to achieving the aims and objectives of this study and produce concrete results (as presented in Chapter 4). Action research is about uncovering and addressing problems within a given situation, with the focus on aiding worthwhile human processes (Reason and Bradbury 2008 pg. 1). It has been argued in the literature (Amabile 1996, Boden 2004, Csikszentmihalyi 1996, Piirto 2004, Ripple 1989) that creativity is a worthwhile human process. Therefore, the action research approach was deemed an appropriate process to invoke to study the creativity of the games students. However, any study involving people is necessarily of an uncertain and indeterminate nature (Foth 2006) as inherently, people introduce many random aspects into the sample. Action research is a flexible procedure of inquiry that can accommodate the random nature of the human inquiry process, yet action research is a systematic process of developing knowing and knowledge (Reason and Bradbury 2008 pg. 1)

The action research perspective used in this study draws data and analysis from the qualitative domain. The approach of gathering qualitative data emerges from the same epistemological origins as action research, which is “research conducted in natural settings such as classrooms, a community or neighbourhood, or a specific culture” (Chi 1997 pg. 279). The idea behind action research is to combine theory of inquiry into practice to achieve solutions to real world problems. As Gustavsen (2006 pg. 18) described, the aim of constructing a theory was to reflect the truth, whereas the aim of developing practice was to achieve success in the real world. However, before we discuss action research further, the other major research epistemology needs to be discussed. Within the worlds of science and the humanities, there exist major differences
between traditional technical rationalism, also known as positivist science, and action research.

3.1.1 Technical Rationalism/Positivist Research

McNiff, Lomax and Whitehead (2003), Levin and Greenwood (2001), and Denzin and Lincoln (2000) all suggested that since the 1940's there has been a considerable shift in knowledge with regard to social and educational research. The strangle-hold of technical rationalism has shifted to approaches of a qualitative, as well as a quantitative nature from behavioural performance to human expertise, as the results of research and its practitioners become less about replicability of research and more about human benefits.

Technical rationalist/positivist research seeks objective truth in undertaking experiments and to seek, predict and control potential outcomes of experiments, in order that they can be replicated for validity (McNiff et al. 2003 pg. 2, Dane 1990 pg. 5, Neuendorf 2002 pg. 1). Theoretical thinking, rather than practical thinking, is the mindset of the traditional researcher (Heron and Reason 2006 pg. 145). Herr and Anderson suggested that, traditional researchers see their impact within positivist research as either positive (using carefully planned and controlled treatments in an experimental design) or as negative (as contaminating or distorting ongoing events in a natural setting) (Herr and Anderson 2005 pg. 29). In addition, they argue that participants within technical rationalism are passive subjects, offering little feedback to the research being undertaken, other than being a vessel for results (Herr and Anderson 2005 pg. 29). In contrast, action research works on the premise that every situation has a problem to be solved and all research participants are active subjects, and contribute neither positive nor negative connotations to the research (Heron and Reason 2006 pg. 145).

While the technical rationalist/positivist research paradigm was not utilised for this study, the positivist processes of rigour, precision and replicability are all integral to the action research process (Strijbos et al. 2006 pg. 30). This study was focussed on communication results through varieties of real pluralistic and democratic social situations (McNiff et al. 2003 pg. 14, Levin and Greenwood 2001 pg. 105, 2008 pg. 211, Pasmoe 2006 pg. 39). Social construction within an action research study is considered
valid research within the scientific community (Gergen and Gergen 2009 pg 462, Herr and Anderson 2005 pg. 10). However, as highlighted by Herr and Anderson (2005):

“It is not surprising from a historical perspective that positivistic, quantitative methods, emerged as dominant in the social sciences in the U.S. during the mid-twentieth century when social engineering was a popular approach to social problem solving” (Herr and Anderson 2005 pg. 10).

This dominance of positivist science is still apparent particularly within Universities, however, the shift to more discursive and narrative forms of data collection and representation is becoming evident in research projects, predominantly in the area of education (Herr and Anderson 2005 pg. 17, Pasmore 2006 pg. 38).

Importantly, it should be noted that the positivist perspective is not without merit and value within this study. As Reason and Bradbury (2008 pg. 2) discussed, framing the action research perspective within a participative perspective requires the ability to draw on appropriate techniques and knowledge of positivist science. Techniques and knowledge from positivist science do not have influence in the theoretical background of the action research approach, but techniques of positivist science such as rigour and reliability of subject matter influence how the data was collected in this study. Procedures such as surveys', tests and interviews were conducted with a degree of scientific rigour and precision. Chapter 4 details the techniques used throughout this study which have influence from positivist science.

3.1.2 Research and University Education

As Reason and Bradbury (2008 pg. 1) discussed, the institutions of science and academia have monopolised on the knowledge-making process, placing a primary value on what is often referred to as “pure” research, and the creation of knowledge unencumbered by practical questions. In addition, as Levin and Greenwood argued:

“Rather than conducting research in the pragmatist mode, University social research proceeds by separating reflection from praxis and by segregating method from application” (Levin and Greenwood 2001 pg. 104).

As Herr and Anderson (2005) similarly argue, traditional research takes a more distanced approach to research settings, with participation of the researcher not central to
the research situation. The action research method used in this study take a pragmatic view of research, in addition to the strong influence of the researcher, and uses these to undertake thorough, grounded, research (Reason and Bradbury 2008 pg. 6, Levin and Greenwood 2001 pg. 105, 2008 pg. 212). University education is undergoing a transformation from more traditional “transmission” forms of research, to those that are more student centred and democratic. Levin and Greenwood (2001 pg. 104) defined this model of education, as the engagement of the student in a critical and reflective learning process that integrates teachers and students in a joint inquiry process, as opposed to a research process where the student learns to imitate the professors’ thoughts.

Furthermore, the notion of reflection within research and University education is as Levin and Greenwood (2001) implied, separated from the application of the research process. Reflection, as discussed in Section 2.4.4 of Chapter 2, is important to bridge the gap between theory and application, and to build “reflective practitioners” (Schön 1987 pg. 19). As discussed in Chapter 2 with reference to Schön's (1987) reflective practicum, Dewey (1938 pg. 8) similarly emphasised the need for students to learn from educators who attempt to teach students to think, rather than merely filling each student with facts. In addition, Dewey urged that education should be a more collaborative process, in which students formulate hypotheses which they can test in practice. Pasmore (2001 pg. 39) agrees, suggesting that in this way, education would better prepare students for life, particularly as it presents many problems for which there are no textbook solutions. Collaboration, testing ideas in practice, and preparing students with life skills in their education, is also referred to as lifelong learning, which is an area of education receiving increasing attention in the literature and discourse of Universities (Blashki 2002, Fischer and Sugimoto 2006, Blumenthal et al. 2003). The approaches of Schön (1987), Dewey (1938), Pasmore (2001) and Blashki (2000, 2001, 2002, 2007) all contributed to the ideas behind the learning of the games students in this study, as indicated within the immersive learning pedagogy presented in Chapter 2 (Blashki 2000, 2001, 2002, 2007, Nichol 2005, 2007, Nichol and Blashki 2005, 2006a, 2006b, 2006c, 2007).

As Levin and Greenwood (2001) argued it is vitally important to reconstruct universities, converting them into engaging social institutions which function as critical and reflective training centres for the next generation of social actors (Levin and
Greenwood 2001 pg. 104, 2008 pg. 212). Interestingly, Do and Gross (2007) argued that universities have begun to realise that traditional methods of education fall short in the changing economic context, and that this realisation in part stems from an interest in creativity. The interplay between methods of University education, creativity and action research are all centred around the notion of practice, and it is hoped that with the increased uptake of action research epistemology, creativity and practice can become more common in Universities. It is however important to position action research within the context of this study, addressing the key factors of the approach which can impact this study.

3.2 The Process of Action Research

Action research is an umbrella term referring to a family of approaches of inquiry that allow a variety of underlying methods to be used under a guiding principle (Foth 2006 pg. 205, Levin and Martin 2007 pg. 219, Herr and Anderson 2005 pg. 2). It has two central goals: to create social development processes aimed at solving pertinent local problems, and contributing to the body of scientific knowledge (Levin and Martin 2007 pg. 213, Levin and Greenwood 2001 pg. 105, 2008 pg. 202). As a research process, action research has the requisite objective to find out something not known before (McNiff et al. 2003). Action research aims to solve urgent problems and improve practice within an organisation or community of members (Reason and Bradbury 2006 pg. 2, Herr and Anderson 2005 pg. 3).

Action research is a process of inquiry that is undertaken for, by, or with, people from an organisation or community, but never “on” them (Herr and Anderson 2005, Levin and Martin 2007, Reason and Bradbury 2006, Heron and Reason 2006, 2008, Gergen and Gergen 2010). Reason and Bradbury (2008 pg. 1) argued that action research “seeks to bring together action and reflection, theory and practice, in participation with others”. Lynch argued for inquiry via social construction in that information and action in a situation are brought into being from culturally and historically situated social processes (Lynch 2009 pg. 462, Gergen and Gergen 2010). Reason and Bradbury (2006 pg. 2) also
conclude that generally action research is focused on the flourishing of individual persons and their communities.

Levin and Martin’s summation of action research was a useful definition and applied specifically to the role undertaken by the research process in this study:

“Action research is a strategic approach to knowledge production, integrating a broad array of methods and methodological approaches in specific ways to create new understanding for participants and researchers through solving practical and pertinent problems and supporting problem owners democratic control over their own situation” (Levin and Martin 2007 pg. 220).

The theoretical position of action research is to identify the reasons for the action, related to the researcher's values, and to gather and interpret data to indicate that the reasons and values were justified and fulfilled (McNiff et al. 2003 pg. 10). Action research is a reflective process, however it is not simply a process of spontaneous, isolated reflection. This reflection is a deliberate and systematic undertaking, and generally requires some form of evidence to be presented to support assertions (Herr and Anderson 2005 pg. 15). In addition, action research is not premised on an objective view of the researcher, as the researcher does not observe within the problem situation, but rather actively participates. The action researcher is immersed in the situation and contributes to the change and exerts influence within the problem situation. As Levin and Martin state, “rather than subjectivity being seen as a negative attribute, qualitative writers recognise that researchers thoughts cannot, and indeed should not, be separated from the research process” (Levin and Martin 2007 pg. 270).

Involvement and influence within the research process is an attribute of qualitative action research. The action researchers have an active position within the action research process as a participant, rather than an observer. The research process can be described as a cyclic process similar to the higher order questioning and change as suggested by McNiff et al. (2003 pg. 11), Heron and Reason (2006 pg. 145) and Foth (2006 pg. 209). As Herr and Anderson (2005) described:
“Action research is oriented to some action or cycle of actions that organisational or community members have taken, are taking or wish to take to address a particular problematic situation” (Herr and Anderson 2005 pg. 4)

These cycles of action research “transcend mere knowledge generation to include personal and professional change and growth and organisational and community empowerment” (Herr and Anderson 2005 pg. 1). Change is an important aspect of focus in the action research process, as it is a facilitator in addressing problems. Change is something that occurs incrementally in an organisation, its environment and in the researchers and participants (Levin and Martin 2007 pg. 215). The process of inquiry in a community, is indicative not only of the symptomatic and apparent issues and problems in the community, but also of the actual causes and underlying circumstances (Foth 2006 pg. 209). As each cycle occurs the action researcher learns more about the circumstance and modifies their influence within the situation to achieve the desired outcome. Through each cycle, the preferred results are re-evaluated to ensure they fit the requirements of the situation. The motivation of the participants within the situation ensures each cycle of the action research process continues.

The core elements of action research, as discussed by Herron and Reason (2006), Levin and Greenwood (2001 pg. 105), Park (2006) and Pasmore (2001 pg. 40), included:

1. Action research does have a strong history in educational applications and is used extensively in educational research (Pasmore 2006 pg. 39). In this case learning refers to the ways in which individuals learn from one another in the action research process. This learning focus also includes the research practitioner, as it helps the practitioner to develop a deeper understanding of their purpose as the researcher “inside” (McNiff et al. 2003 pg. 20).

2. Action research is enquiry, where participants and researchers co-generate knowledge through collaborative communicative processes in which all participants’ contributions is taken seriously. Heron and Reason (2006), described that in action research all active subjects are
fully involved as co-researchers in the research decisions, both content and method, which occur in the form of reflection phases. Park (2006) described action research as being set apart from other forms of research inquiry because “of the central role that non experts play” in the process (Park 2006 pg. 83). It is insider research: the researcher is “inside” the situation and will inevitably influence what is happening in the social situation (Heron and Reason 2006 pg. 36). An action-research practitioner positions themselves within the situation not only to undertake research, but also to demonstrate to the research participants the importance of active participation within a situation (Levin and Martin 2007 pg. 219).

3. Action research considers the diversity of experience and capabilities within the local group as an opportunity for the enrichment of the research/action process. The action researcher in this situation was mindful of the relationships with participants and was sensitive to the research situation. This is unlike a technical, rationalist research approach where the researchers undertaking studies may not necessarily accept responsibility for their own action within the situation (McNiff et al. 2003 pg. 3, Ison 2008 pg. 139, Reason and Bradbury 2008 pg. 2). With the decision-making process the action researchers take responsibility for the outcome and must also acknowledge and accept all influence from participants.

4. The meanings constructed in the enquiry process lead to social action or the reflections on action lead to the construction of new meanings. This alludes to providing a schema of personal and social improvement within the practice of action research and within the fundamentals of human existence. The process of action research can, as Reason and Bradbury argued “help us to reflect on our place within the ecology of the planet and contemplate our spiritual purposes, and can lead us to different ways of being together, as well as providing important
guidance and inspiration for practice” (Reason and Bradbury 2008 pg. 2).

5. The credibility/validity of action-research knowledge is measured according to whether actions that arise from it solve problems (workability) and increase participants’ control over their own situation. An appropriate research process requires every research practitioner to act, reflect on actions, and modify practices in light of what is learned from the research (McNiff et al. 2003 pg. 20; Gustavsen 2006 pg. 21; Park 2006 pg. 84). The very nature of action research ensures these qualities are emphasised. Action research demands the research practitioner engage in good professional practice as the practitioner is required to question the motives of the actions under consideration, unlike other, more positivist, research processes (Park 2006 pg. 84). Democracy is a term that often arises in the definition of action research, and in action research social democracy is considered primary. As substantiated by Lewin (1964 pg. 25), action research is a tool that advances science while dealing with practical social concerns. The purpose is to improve the pressing problems within the social situation and the action researcher is invested with the responsibility in the social situation, however they do not necessarily instigate change within the social situation, but rather, continually evaluate and approximate their functioning with the action research situation.

6. Action research results in higher order questioning. The process of action research may not be definitive problem solving, however a significant aspect involves a degree of problem searching or problem-posing. Problem searching or problem-posing results in a thorough research process as it investigates many avenues before beginning to resolve the problem. Levin and Martin (2007) refered to high order questioning with regard to critical thinking, and state that “critical thinkers inquire into the assumptions in understanding and “givens” in
institutional and structural conditions” (Levin and Martin 2007 pg. 225). To facilitate problem posing, the action research process imposes three levels of questioning. The first level of questioning/learning is to learn about the social situation. Second-order learning requires the action researcher to question what was learned in the first phase. Third-order learning requires the action researcher to ask why the situation is in the state it is, and why one might need to change the way one thinks about it (McNiff et al. 2003 pg. 1). Overall, the concept of high order questioning is enhanced by reflective thinking, as reflective thinking and thus reflective knowledge can, as Park (2006 pg. 84) highlighted, uphold the dignity of human beings as free and autonomous agents who can act effectively and responsibly on their own behalf in the context of interdependent relationships.

7. Action research focuses on change. The people, in this case games students, change situations often simply by the process of being immersed. In addition, as Park stated “the interactions between the knower and the known produce changes in both” (Park 2006 pg.85). Thus, the cooperation between the practitioner and the participants, results in change, simply via the process of gaining and sharing knowledge. As Park (2006 pg. 85) argued, action research brings about change in obvious ways, such as improving the material circumstances of those involved in the problem situation. Social change tends to be implicit and occurs over time. Change is initiated within each individual; however as each person implements those changes they begin to experience a mimetic reflection of that change within the social situation (collectively). This process of change resembles the process of the development of creativity. Slow, elaborate processes, with periods of reflection, that may take years to both enhance and exploit.

The core elements of action research are addressed in this study via action researcher management (covered in section 4.2) and mechanisms of data collection techniques
(covered in section 4.4). The action research approach also had significant cross over with educational philosophies, particularly pragmatic pedagogies. Central threads which both philosophies hold in common include the pragmatic approach to situations and the interaction between participant-student and surrounding social sphere to create knowledge.

### 3.2.1 Grounding in Pragmatic Pedagogic Philosophy

Action research is grounded within a pragmatic pedagogic philosophy. In pragmatism, two central tenets emerge (Levin and Greenwood 2001 pg. 104, Reason and Bradbury 2008 pg. 6):

1. Knowledge generation through action and experimentation
2. An emphasis on a participative democracy

Pragmatism may be defined as the character or conduct which emphasises practical values or attention to facts. In this study of games students, pragmatism refers to an acknowledgement of the games students as contributors to the research process, not merely their role as subjects of research. In addition, it refers to the need to embrace the issues in the situation and consider how they evolved. Levin and Greenwood (2001 pg. 104) referred to pragmatism as uniting theory and praxis in an integrated knowledge construction process. The central meaning of the construction process in pragmatism is “linked directly to cycles of reflection and action that focus on the outcomes of acting on material and social factors in a given context” (Levin and Greenwood 2001 pg.104). When referring to pragmatism as a form of pedagogic philosophy, we embrace elements such as: reflection, practice and influences of social systems and students as social actors in the process of learning. The social actors determine their experiences from a continual interaction between person and the environment. A pragmatic philosophy provides grounding for a different kind of scientific and pedagogical practice (Levin and Greenwood 2001 pg.103, Schön 1987 pg. 2, Gustavsen 2006 pg. 18). Learning is not of specific focus in this study however as described in section 2.4 of Chapter 2, the
immersive learning environment and specific unit objectives do set the scene for the learning situation which the students engage in.

### 3.2.2 Challenges of Action Research

Action research has been discussed as an effective epistemology to assess situations where change is needed and achieved via democratic processes, making it possible to generate new evidence to support claims of new knowledge. However, there is much debate on this issue in the literature (Herr and Anderson 2005 pg. 11). The lack of objectivity in regards to the research situation is often scrutinised and cited as evidence to support the argument that it lacks rigour and reliability (McNiff *et al.* 2003 pg. 2, Levin and Martin 2007 pg. 220). However, there is explicit attention to issues of validity of the inquiry and its findings, because the collaborative findings of the action research and processes are agreed upon between all stakeholders (Heron and Reason 2006, 2008: Reason and Bradbury, 2006, 2008). This was one of the many challenges of action research found in this study. Further challenges included:

- **Documentation of the action research process:** In action research, the process of documentation is often performed after each cycle. Documentation becomes more a reflection on the problem rather than a presentation of facts with generalised outcomes. The reflection takes into account approaches undertaken in the problem situation and presents future alternatives and changes to the problem situation. The problem in action research is that the document is problem specific, often making it hard for the findings of the research to be generalised (Chi 1997 pg. 280). This view is less apparent as more action research projects are being undertaken and more is known about the process.

- **Ceasing the cycles of action research:** As action research is a cyclic mode of inquiry, the difficulty lies in ceasing the cycles, as after each cycle, there are always new problems to be solved within a situation, even if the initial problems have been addressed. It is the action researchers’ responsibility to decide when to stop participating within the cycles of the action research project, and therefore to stop reflecting
and contributing to the problem situation. It is incumbent upon the action researcher to decide when the problem situation has been addressed for the purposes of the study.

- **Bias:** In an action research process, the implication of possible bias is ever present. The researcher participates and displays influence within the problem situation and thus is seen as a potential influence on the results of the study. Bias is alleviated within the problem situation by establishing trust and building relationships of mutual respect between the students and the researchers. Bias is also alleviated within the account given by the researcher in their reflection, as much of the reflection is built around the view of the participants, rather than just an account from the researchers’ perspective.

It is upon the action researcher to be mindful of the challenges of action research process. However, before further documentation of the action research process, the relationship that action research has to soft systems methodology will be discussed.

### 3.2.3 Relationship to Soft Systems Methodology

Action research emerged from the development of Soft Systems Methodology (SSM) (Checkland 1999 pg. 147, Avison and Fitzgerald 2003 pg. 78, 2006 pg. 508, Ison 2008 pg. 139). Soft systems methodology demonstrates a holistic, contextually oriented foundation premised on an acknowledgement of the ways in which human, social, and technical factors will always effect the creation of a system and is fundamental to the adaptivity of such a system (Flood 2006 pg. 211). Soft system thinking emerged from a more holistic systems thinking, that the whole world is systematic, with phenomena to be understood as an emergent property of an interrelated whole (Avison and Fitzgerald 2003 pg. 79, Checkland 1999 pg. 99, Flood 2006 pg. 206). SSM is a means of guiding the exploration of real world situations, which are perceived as problematic for some of the time by at least one member of that situation (Davies and Ledington 1991 pg. 2). Social systems are of significance when referring to soft systems methodology, as SSM perceives social reality as the construction of people’s interpretation of their experiences (Flood 2006 pg. 209). In real world situations, humans attribute meaning to their
experiences with the world, and it is with these experiences that they decide how to act and undertake their role in the situation (Flood 2006 pg. 208). Checkland (1999 pg. 112) referred to this as “purposeful action”, as it is a response to their experiences, even though it is implicit. SSM is about making fundamental assumptions, based on practice, about that which underlies and renders meaningful, within social situations (Flood 2006 pg. 209). It defined that which Checkland (1999 pg. 110) and Flood (2006 pg. 208) referred to as “authentic” ways of understanding people actions. Purposeful action can be defined as: deliberate, decided, willed action, whether by an individual or by a group (Checkland and Scholes 1990 pg. 1, Ison 2008 pg. 139). The definition of the problem in a situation is often framed within SSM and action research in situations where initially there appears to be no clearly defined problem. These methods assist in defining the problem at the onset, and allows for the most appropriate definition of the problem for the situation. Figure 3.1 illustrates the SSM proposed by Davies and Ledington’s (1991) and attempts to draw soft systems methodology into the pedagogic realm. This methodology required an analysis of the real world situation to be conducted before the relevant systems of purposeful activity (often a text book definition of the structure of situations) are determined (Flood 2006 pg. 209, David and Ledington 1991 pg. 30). The relevant systems of purposeful activity allow the researchers to enter the world of systems thinking, and this comparison between the real world, and that of systems thinking, results in comparison models of the perceived “real” situation.
The view of systems thinking as illustrated in Figure 3.1 is very similar to action research. It is in the definition of relevant systems of purposeful activity that soft systems methodology differs from action research. SSM uses formalised, definitions often called root definitions, and techniques such as rich pictures and the CATWOE method, to represent the description of the problem situation in a systems thinking form. It is an established mechanism for assessment of problem situations, particularly in systems methodologies used in IT and Engineering. It is, a methodology applicable, and often cited as beneficial, in the social sciences similar to action research. Action research differs in that the systems-thinking models of a problem situation are not expressed textually, either by the use of pictures or definition. The situations in action research are defined primarily by the social structures that are present within the situation. This comprises one of the challenges of action research, as the systems are perceived by the members of the situation and not objectively documented as formal, replicable models.

The approached used in this study to model the system is detailed in the summary AR process map (Table 4.1). A comparison between action research and SSM reveals a
similar use of the cyclic process. The process in Figure 3.1 is repeated in SSM until the process leads to a situation considered appropriate for the problem defined in the initial stages. The SSM is “just a logical form, but it is often taken as a rational basis for action which will deliver expected results” (David and Ledington 1991 pg.12). Humans are not easily comparable to any model of a system, therefore even a social system methodology is not going to be capable of providing definitive answers. Foth (2006 pg. 206) related the soft systems perspective to action research by describing what he terms “network action research”. Network action research is influenced by networks, both social and technical, particularly due to the update of computer networks in recent years. Network action research influenced this study, and in many ways it could be considered a network action research study. Network action research described systems, in this case communities, as instances of multiple volunteers participating in multiple action research sub-projects that are networked together to form a larger action research project on the meta-level. The specific details of the AR project “communities” of this study are discussed further in section 3.5.2 on participants. The notion of networked action research was termed in this study as communal creativity, because of the focus on social aspects within the action research process and how they build creativity.

3.2.4 Communal Creativity and Action Research

The focus on people in most action research studies often requires debate and definition of the term community (Foth 2006 pg. 207). In Chapter 2 the term “communal creativity” was introduced as a means to describe the collaboration and community undertaken by the games students that served to enhance their creativity, and these elements are defined in this study as;

1. Community: a group of any size, that share locality and common interests through building of relationships

2. Collaboration: working cooperatively with someone to exchange information and build knowledge

3. Creativity: ability to invent, display and produce new thoughts and ideas
Denzin and Ryan (2007 pg. 591) defined that “we come to know, and we come to exist meaningfully, only in community”. It was the interaction as a community and the communications that occurred that bring about change in the situation (Foth 2006, Denzin and Ryan 2007). Influenced by soft systems thinking perspectives, the action research of this study will build models that represent the social structures and communities of the games students in an attempt to use this knowledge to describe the social phenomena. Each community is an action research process in itself, with a problem to be addressed. However, there are strong interdependences between the communities, particularly when it comes to addressing the meta-level issue of creativity. It is from Checkland’s (1999 pg 112) notion of purposeful activity, which the games student’s creativity began to develop. This knowledge of social phenomena is used as a decision making tool to predict events and suggest actions to make improvements within the action research situation in an attempt to enhance creativity (Flood 2006 pg. 211).

The action researcher in this study was also a part of the community of the games students, which must be undertaken in partnership with community members (Root 2007). Control over the research agenda is shared amongst participant and research making the process communal. Influences of communal creativity are seminal, because to fully understand creativity we need to determine all influence. The participants, in their learning and negotiations with the problem situation within this study, will inevitably include the design. In this situation, all participants’ contributions are taken seriously and, subsequently a collaborative, communicative process allowed participants and researchers to co-generate knowledge.

### 3.3 Other Research Methods

In this study, other methodological grounds for the research inquiry were discarded as inappropriate for various reasons. For example, a secure, reassuring and prescriptive “cookbook methodology”, which describes the research process step-by-step, would not be effective because, at best, these methodologies may provide a useful guide for merely novice researcher (Grant 2007 pg. 266). As this study required an investigative approach, it was deemed appropriate to choose a method such as action research, as it
allows problem definition to form a significant portion of the research process. The specific negotiation of the action research approach was chosen in this study to avoid constraining, discouraging or removing the possibility of serendipitous discovery (Grant 2007 pg. 267). While structured approaches may have been adequate to approach this study, they would not have allowed the specific problem (as defined next in section 3.4) to be addressed in a personal and meaningful way, as it is difficult to prescribe “personal” experiences. Other research methods were considered for this study including; case studies, and statistical or quantitative, forms of research inquiry and data collection. However these approaches were not selected because of the need to assess a social situation and implement influence and change within that situation.

3.3.1 Case Study Method

In case study research, the data collected and analysed is of a rich subjective content which may bring to light different variables, phenomena, processes and relationships about a “specific case” that deserve more intensive investigation in the study (Burns 2000 pg. 459). Yin (2003 pg. 4) suggested that a case study approach in research design ensures the research is both operational and explicit. Qualitative case study research also uncovers many facets of future work directions that are specific to a certain group of people. The case study approach was not selected for this study, because the ability to gather in-depth data and build a case about the games students was not a requirement, as the case of the games students already existed (as shown in Chapter 2). Denzin and Ryan (2007) defined that case study methods only offer descriptive materials, rather than interpretive data for a given situation. Furthermore, case study research is about observing variables, phenomena, processes and relationships specific to a case, rather than attempting to answer a pertinent problem within a situation as in action research. The principle difference between case study research and action research is the level of influence of the researcher. In action research, the researcher plays an active role in submersing themselves in the problem situation, and exerting influence within the situation, that affect participants. Conversely, case study research focuses on an objective view of research, maintaining the researcher as an outside observer. The active participation of the researcher in the situation was deemed appropriate in this study, to
gather in-depth data about the personal nature of creativity, as it was deemed that the case study approach would not be able to gather this depth of data on creativity. An additional justification for not undertaking a case study approach was that the inquiry into creativity was not confined solely to the University context, but rather, investigation was undertaken within a whole system context, taking into account factors that would be deemed outside any case study approach, such as wider community influences. Persuasions from the community and industry professionals help to inform the action research process. The need to implement change, as opposed to merely observing the situation, also accounts for the choice of action research over the case study method.

3.3.2 Statistical or Quantitative Data Collection Methods

A purely quantitative study was not considered an effective method for this study because of the need to study behavioural and social phenomena within a problem situation. Traditional scientific rationalism as discussed in section 3.1.1 was formulated around control and assessment with generalised results. Quantitative research is “a systematic approach to the discovery of knowledge based on a set of rules that define what is acceptable knowledge” (Dane 1990 pg. 5). The pure statistical comparisons in the quantitative approach require, as Strijbos et al. state “a hypothesis, derived from theory, formulated in advance (prospective)” (Strijbos et al. 2006 pg. 30). In addition, a quantitative method refers to experimental design that carefully controls and manipulates the variables under study (Chi 1997 pg. 281). As Denzin and Ryan (2007 pg. 582) argued quantitative research excludes stakeholders from dialogue and active participation in the research process. This study, in comparison, aims to understand the creativity phenomenon retrospectively, which requires less explicit prior expectations or even none (in a grounded theory approach) (Strijbos et al. 2006 pg. 40). Quantitative methods have the advantage of objectivity and replicability, however an obvious shortcoming is that one can only make conclusions about the specific hypothesis at hand (Chi 1997 pg. 280) Reliability, in the quantitative approach, is expressed in a numeric value indicating the level of agreement between two independent coders. In comparison, qualitative research approaches reliability and credibility through the use of multiple analysts, comparing two or more interpretive perspectives of independent coders and
triangulating the results with external sources or quantitative data (Strijbos et al. 2006 pg. 39).

This study did not seek to generalise results, rather its purpose was to help the creativity of those within the problem situation (section 4.1). As Reason and Bradbury (2006 pg. 2) highlighted, in action research studies the “process” of inquiry is as important as the specific outcomes. The quantitative method, however, was used in appropriate sections of this study, and therefore some elements have been included, as presented in Chapter 4. The relationship between qualitative and quantitative data in this study was neither considered nor constructed as negative or polar. Chi argued for the importance of both qualitative and quantitative data within a study;

“Although response times and errors can uncover the representation of knowledge, analysing verbal data can provide a much richer, more detailed, and perhaps more accurate representation, so that one can ultimately use such a representation to devise instruction to revise what the student has misconceived or add to a students’ missing knowledge” (Chi 2007 pg. 275).

As Chi (2007pg. 276) expressed, a straightforward way to integrate the two methods of qualitative and quantitative in order to obtain the benefits of both perspectives, is to use a hybrid of both quantitative and qualitative measures. This approach serves as a confirmation of results, with the quantitative results re-enforcing the qualitative analysis, and vice versa (Chi 2007 pg. 274). Naturally, a process of inductive reasoning was used within the conclusions of this study and the process by which the researchers achieved these generalisations was of the most interest. Generalisation in quantitative studies is often assumed, however as Chi (1997) stated “the sterile laboratory environment of experimental studies limits the generalisation of results to the real-world context” (Chi 1997 pg. 276). This was where the choice of a qualitative, action research process of inquiry was applicable, as it allowed the results to be gathered from a real world context, yet with appropriate qualitative and quantitative research techniques.
3.4 Conclusion

Action research is a democratic approach guided by influence from the participants of the research. Given the participant-driven epistemology, action research could be perceived as a potentially chaotic and unreliable research agenda. However, rigour is enforced during the process of action research, and it is via cycles that the outcomes and influence of action research activities become clear and precise. Outcome and influence in action research occur on a “problem situation”. In this study the problem situation was the creativity of the students who studied Games Design and Development. The cyclic process of action research allowed a depth of inquiry into the challenge notion of creativity, and it was via this approach that the problem situation and subsequent aims and research questions of this study were formed. Chapter 4 described in details the specific problem situation, research participations and data collection techniques that were relevant to addressing the need for building creative potential in the Games students.
4. Problem Situation

Action research is about solving pressing problems from within realistic settings (Reason and Bradbury 2008). This process of data inquiry was undertaken by both the researcher and the participants had the goal of helping an issue within a particular situation. It is therefore important to define the problem to be solved, rather than defining an arbitrary hypothesis, which may test something that is not even apparent in the situation.

In this study, the problem domain was focused on the students who studied Games Design and Development at Deakin University. This discipline required creativity (as discussed in Chapter 2), of a transparent nature. Transparent creativity is apparent for the games students as it required creativity to be expressive on a more subliminal level, and not overt like that of the artist. However, the ability of the games students to recognise, and harness, their own latent creativity is not readily apparent (Chapter 5 discusses this further). Additionally, the education situation often failed to harness creativity to the extent required for success in the games industry. Section 2.4.6 on Bloom’s taxonomy presented the learning objectives of the games curriculum and showed gaps. Through the application of an action research methodological approach, the researcher was immersed within the learning situation of the games student to determine the best approach in supporting creativity.

4.1 Action Researcher, Participants and Research Environments

This research focused on the action researcher and games students participating and interacting within their environment. The action researcher, the central motivator for investigation and change in this study, is defined next in section 4.1.1. In addition, the participants (the games students) and the research environment are also described in detail. The combination of all these elements was able to substantiate the research cohort for this study.
4.1.1 Action Researcher

“Action researchers try to reach out and interact with members of a community in order to animate participation and engagement in cycles of critical inquiry, reflection and action” (Foth 2006 pg. 2009).

As discussed in section 3.2 the action research methodological approach allows the action researcher to become a part of the problem situation that is undergoing examination, thus inevitably influencing the problem situation. Levin and Martin (2007 pg. 220) states that the role of an action researcher requires intervention and research skills, theoretical appreciation and capacity for critical reflection, and also, to put up with demands for the capacity to share the knowledge generated in that action engagement. Denzin and Ryan argued “every researcher speaks from within a distinct interpretive community, which configures, in its special way, the multicultural, gendered components of the research act” (Denzin and Ryan 2007 pg. 580). In an action research study the researchers are directly involved in the study with the participants not merely as observers but rather as active participants. Herr and Anderson (2005 pg. 29) described the action researcher as an insider and state that “the researcher and the practitioner may be one and the same” within a study. Lynch (2007 pg. 464) defined the approach as a shift from research conducted by an individual actor to research about coordinated relationships. This form of research results in a shift towards reflection as a significant component of the research process. Reflection is grounded within the surrounding social sphere (Vygotsky 1978), which allows the research to exhibit no strictly independent though processes (Gergen and Gergen 2007, Denzin and Ryan 2007). The action researcher is a part of the community they are researching, and as well as being a member of this society, their task is to monitor the “communicative ecology” and provide additional “meta-networking” communities that act as an interface between different stakeholders to allow the free flow of information and experience exchange (Gilchrist 2004 pg. 72, Denzin and Ryan 2007 pg. 579). This enables the action researcher to attempt to not only answer the problem within the situation, but also to influence the practices of the community. However, as Pasmore (2006 pg. 40) suggested, it is not necessary to change the deep-seated personalities of a community in order to produce new actions, as the potential for a wide range of behaviours, triggered...
by different environmental stimuli, already exists in the individual. Therefore the action researcher in this study was not seen as an authority who dictates the environments in an attempt to build creativity, but rather as a facilitator of the students on their pursuit to creativity.

In this study the action researcher was the PhD student Sophie McKenzie (nee Nichol). Sophie’s involvement in the study was the primary action researcher and tutor of the games students, however not a formal leader of the teaching and learning situation. Thus changes imposed in the learning situation due to the action research study were facilitated in conjunction with the teaching staff and PhD supervisor. Table 4.1 details the action research process in detail and highlights all the stakeholders and types of interaction that occurred between them during the course of the project. In addition, another key player in the action research situation was the PhD supervisor Professor Kathy Blashki. Kathy was the leader of teaching and learning of the games studies and facilitated changes that needed to occur in the learning environment, based on the results of the action research process. Importantly, Kathy was both a friend and foe the students in face to face and online learning environment. Kathy encouraged the community to participate and collaborate in the action research, and was a large negotiator of changes in the community. Students built a significant rapport with Kathy, which fueled their participation and contribution to the study. Sophie and Kathy were both engaged in the environment of the games students, particularly involved in the online community. However, as within any action research study the researchers maintained a professional and democratic view towards their influence and data collection. Many forms of data collection were undertaken in an attempt to canvas multiple views of the situation from all participants, such as interview, surveys and observations. In particular interview with students and dialogue in the online community were two significant forms of communication the students had with the action researcher of this study. Section 4.4 details more on the data collection methods and action research “texts” of this study.

Denzin and Ryan argued that a “researcher is bound within a net of epistemological and ontological premises which, regardless of ultimate truth or falsity, become partially self validating” (Denzin and Ryan 2007 pg. 587). This study employed the relativist ontology (multiple realities), subjective epistemology (researcher and subject create
meaning) and naturalistic methodology (real world). These perspective have been discussed in detailed so far in this chapter, with section 4.4 detailing the data gathering techniques employed to serve the sense making “validating” methodological process of the study. Through the process of action research that involves all stakeholders, action research cycles were formed as shown in Table 4.1. Herr and Anderson (2005 pg. 23) summarised the action researchers’ process of action research, within 4 steps that constitute a continuous spiral of cycles: 1) Develop a plan to action to improve, 2) implement, 3) observe the effects in action, and 4) reflect on the effects through succession of cycles.

The action researcher was often the main observer in the study, in both the data gathering and the analysis, thus “making both the data collection and the analyses vulnerable to subjective interpretation” (Chi 1997 pg. 279). However, as Reason and Bradbury (2006 pg. 5) highlighted, the choices made by the action researcher have implications for both the quality and validity of the research. In addition to the action researcher’s choices, the influence exerted in the environment by the action researcher, in particular the formal data collection methods, is always subject to ethical constraints and review by other stakeholders (as shown in the summary AR process map – Table 4.1). It is vital that an action researcher have ethics and values, so that they responsibly exert their influence in the situation. Section 4.5 discusses the ethics of action research.

4.1.2 Participants

The participants of this study are the students who study a Bachelor of IT, specifically those majoring in Games Design and Development. The students undertook studies at Deakin University during the period of 2006 to 2009. The cohort involved in the action research process were from first year to third year students. The situations that action researcher engaged within are presented next and describe the culture and community of the study participant.

4.1.3 Research Environment: Games Lounge

The games lounge comprised a physical, face-to-face, learning space in which students were encouraged to play co-operatively and participate in collaborative and peer
learning and thus play resulted in physical learning and collaboration among the students. Figure 4.1 shows the games room in use.

![Image](image.png)

**Figure 4.1 “Student at Play”: within the purpose-built Games Lounge at Deakin University**

The games students had access to the room at any time of the day (but dependant on when the building in which it was located was open). Teaching staff rarely visited the games lounge, as the environment is dedicated for student use to explore learning, not as a space to deliver learning. The students felt comfortable to make the space their own because of this fact. In addition to the physical space of the games lounge (Figure 4.1), which was a face-to-face practicum, the students also engaged in online discussions enabled by Deakin University’s online learning facility (Deakin Studies Online).

### 4.1.4 Research Environment: Online Community

The online community of the games students comprise staff and students involved in the Games Design and Development degree at Deakin University. The online community was a tool accessible to students via the Internet. Technologically, the online community was housed within Deakin University's online learning tool Deakin Studies Online (DSO). The tool has four major categories of functionality that aligns with Rovai (2002a pg. 324):

1. Productivity tools: such as a calendar, address books and information services.
2. Communication and collaboration tools: discussion boards, email and group discussion areas.

3. Assessment tools: computer assisted testing, assignment drop box and online grade book.

4. Content management: instructor defined rich multimedia content and hypermedia.

The focus of the online learning facility that included discussion forums (also known as threaded discussions) was course/degree related, however, open discussion of other topics related to games was actively encouraged. The students involved in the online discussions were enrolled in the units of: Games Fundamentals, Audio Visual Elements of Games, Game Architecture and Design, and Games Production and Society. Students gained access to each discussion forum by entering via the home page for each of these units. Each unit's discussion was not integrated with the other units, therefore communities of games students were formed in the online community based on the unit and level of study (first, second or third year). Various opportunities for discussions were offered to students in this online environment such as: general discussion area, favourite game, student talk (first semester), unit information, Leet Speak, and student talk (second semester). In addition to this community established within DSO, the games students created an external discussion forum hosted within the popular free software phpbb. This online community was an accompaniment to DSO with the students acting as facilitators and choosing who they allowed into the community, as opposed to DSO where all students of the unit are automatic members of the community.

The online social environment of the DSO, offered individuals a highly social environment regardless of location. Furthermore, online environments can alleviate social anxiety for individuals (Blashki and Nichol 2005 pg. 249) and therefore offer a social environment for creativity to be expressed.
4.1.5 Research Environment: Traditional Lectures and Tutorials

In addition to the games lounge and the online community, the more traditional learning approaches of lectures and practical classes were included within the education and learning pedagogy for the students. The lectures and practical classes were conducted for each unit within the Games Design and Development stream (refer to Deakin course structure as presented in Chapter 2). The components of lectures and practical classes were the central components to the education of the games students, but were also central to the CSS. However, the games lounge and online community provided an additional component to the games students CSS that allowed immersive learning to take on a different perspective to that shown in the studio models see discussion in Section 2.6.4. The difference between the studio models and the learning environment provided for games students was that student were immersed on a larger scale compared to that of the studio or classroom-centred uses of the learning pedagogy.

With the research environment-situations defined the process of action research came into stronger formation. The following section discusses the cycles of action research that occurred in this study. The three research environment just described incorporated holistically with the action research cycle map. In the map distinction is not clear as to which situation is of focus, however section 4.4 of data gathering inform in greater detail the “sources” used in this study.

4.2 Action Research Cycles

The process map of action research as employed in this study is shown in summary Table 4.1. Appendix E shows the complete list of action research cycles that was employed in this study. The table heading shows the specific stakeholders or “AR Friends” of influence throughout the action research process. These “friends” help to provide grounding, checks and balances, mitigate bias and facilitate influence within the action research process. Often the researcher was the lead “influencer” within the project, however as shown in Table 4.1, much of the research direction was informed via stages of negotiation with all stakeholders. The arrows show directions of negotiation and influence in each component of the action research process. Lastly, the overall
“cycles” of influence within this project are documented via shading each stage. The legend for determining each cycle is as follows.
Table 4.1 Summary Action Research process map (cycles of influence) in this study.

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Researcher</th>
<th>PhD Supervisor/Researcher</th>
<th>Teaching Staff/Researcher</th>
<th>Students</th>
</tr>
</thead>
</table>
| 1     | - Researcher enters into the learning situation of the games students  
    - Investigation of Creativity in students, identification of **16 Factors** from literature  
    - Defined Aims and Objectives of study  
    - Problem Situation Defined  
    - Modification of the CSS | - Within the learning situation, teaching, leading and administering content | - Problem situation reviewed: influence of environment on creativity of focus | - Needs of creativity express focus on relationship between creativity and social. |
| 2     | - Interviews with industry professionals conducted  
    - Problem situation re-defined | - Discussion about creativity skills | - Focus on social “community” factors | - Needs of creativity express more support for engaging environment of social and technical |
| 3     | - Investigation of Creativity in Students, identification of **23 Factors** cycle 1  
    - Re-defined Aims and Objectives of study  
    - Problem situation re-defined  
    - Modification of the CSS | - | | |

1 Action Research Cycle – 2005 to 2007  
Transition Phase – 2006 - 2007  
2 Action Research Cycle – 2007 to 2008
The map is Table 4.1 summarises the process of data capturing and specific stages where the problem situation was addressed. Progressive themes about the action research process and the CSS are evident. It is important in an action research study to show the progressive stage of the social situation, to continually discuss and reflect with all stakeholders what was learned, and to successfully continue iterations of influence and learning within the project. Levin and Martin (2007) emphasis reflection as a key action to undertake within an action research project. Further elaborations on the themes are shown in Chapter 5. Importantly, the cyclic process as shown in Table 4.1 allows the research aim and questions to be formed clearly. As the problem situation of facilitating creative potential became clearer, the following aims and questions were formed as a mechanism to allow the problem to be addressed.

4.3 Research Aim

Based on the problem situation of the games student, the aim of this study was:

To demonstrate if based on the facilitation of certain creativity factors, a technology-enhanced, purpose built learning environment can be conducive to enhancing creative potential.

4.3.1 Research Questions

To address the aim of this study, the following research questions were explored;

1. What is the creative potential within the students who study games?

2. What creative skills are expected of games students by the relevant employing industry?

3. How can the current learning environment for games students at Deakin University be enhanced to facilitate and encourage the creative skills of the games students to increase creative potential?

Via the action research process, these questions will be answered in Chapter 5.
To complement the environments of the game students to enable action research, many techniques were employed by the action researcher to gather data. Some techniques were embedded within the situation, with other techniques imposed by the research after the situation, or moment of action.

4.4 Techniques of Action Research: Data Gathering

Action research involves a holistic approach that gathers data from a whole-system context, rather than focusing on individual components in an attempt to extract data. Mann and Stewart (2000 pg. 3) suggested that action researchers have the ability to pick and choose the tools of their methodological trade. Foth (2006 pg. 209) and Schrire (2005 pg. 51) stated that instead of relying solely on formal structures such as focus groups, steering committees and workshops, an action researcher should use a number of theories and typologies to measure higher-level outcomes within a community. The higher-level outcomes of the action researcher in this study was to map, maintain and harness informal social networks, with an aim to fulfil the role of a community member who not only connects to the society, but also develops sustainable and ongoing learning within this community. In this study, multiple research techniques, theories and typologies were employed to achieve higher order outcomes from the action research process. The multiple techniques used in this study for data collection include: interviews, observation surveys and tests (outlined further in section 3.7.1 to 3.7.3). These various approaches of data collection from the research environment within the community supported the automation of complex constructs on the basis of more than one typology or taxonomy (Schrire 2005 pg. 51). The data was collected from research environment as discussed in 4.2.

4.4.1 Interviews

Interviews were employed extensively within this study as they were a replicable form of gathering data and considered to be a technique of collecting systematic social enquiry, particularly in qualitative form (Denzin and Lincoln 2000 pg. 2). The nature of interviews, allowed the researcher to enquire with participants in a detailed nature, to
discuss the specifics of a topic such as creativity. Interviews also allowed the researchers to note down any implicit body manners of participants, that may be indicative of feelings and emotions associated with an interview’s content.

Interviews can vary on the spectrum from formally structured to almost completely unstructured and from individual to group (Mann and Stewart 2000 pg. 66). In this study, unstructured interviews were considered to be as reliable as structured interviews, with these informal situations producing appropriate results (Gillham 2000 pg. 60, Yin 2003 pg. 9). In this study, interviews were deemed an appropriate form of data collection, as their application traverses many sets of needs of participants and the researcher. For example, an interview can consist of structured questions to an individual or a number of individuals. Alternatively, an interview can be administered in an unstructured way to a quick time frame, to a large group of people. In this study, interviews were both structured and unstructured with participants being industry professionals within the games industry and the games students at Deakin University.

4.4.1.1 Industry Interviews

The industry interviews served to identify the appropriate creative skills that professional game developers possess, that can be taught to Games students. For example, the industry professionals were asked to describe the roles of employees within the games industry, and addressed the issue of how creativity arises in their work. The interviews were conducted in a semi-structured approach, as detailed in Table 4.2

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<th>Date</th>
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<td>Method of analysis</td>
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In addition, Appendix D details example of the Deakin University Human Research Ethics Committee application submitted and approved for the methods of data collection used in the industry interviews. Specifically, the ethics applications outline the ways in which the participants were recruited for the study and the procedures used to ensure
their privacy and confidentiality while participating in the study (Section 4.5 outlines the ethical considerations taken in this study as an action researcher).

4.4.1.2 Interview/ Discussion with Games Students and Games Teaching Staff

Throughout this study, interviews were conducted with the games students and teaching staff on many occasions often in an unstructured format. The interviews took place during lectures and practical classes conducted in games units and, in particular, within the online community. The interviews often consisted of only a few questions over approximately five minutes, which attempted to highlight a specific aspect of the study. The questions asked were often related to a lecture topic or practical subject, thus the unstructured nature of the interviews. Consequently, this type of unstructured interviews may be considered as debate or discussion, where often the interviewer would discuss their views in the context, rather than asking another potentially “loaded” question. Often discussion was conducted via the online community, where students and staff would engage in friendly discussions. Table 4.3 details the interview information.
Table 4.3 Interview schedule

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<td>Interviewee</td>
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<td>Interviewee</td>
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4.4.2 Observations and Reflections

For the action researcher, observational work offered another avenue to understanding the social meanings that are constitutive of, and reflected in, human behaviour (Mann and Stewart 2000 pg. 84). Particularly with regard to the games students, observations provided key information about their creativity, as it was constructed and influenced by social situations. Data for this study often resulted in field notes taken during and after observations to allow reflections. The lectures and practical classes, online community and games lounge were observed and students were interviewed based on their enrolment within these units. Table 4.4 outlines the observation schedule.

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<td>Observed</td>
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<td>Games Students (Practical class and Game Lounge)</td>
<td>Games Students (Practical class and Game Lounge)</td>
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<td>Conducted by</td>
<td>Sophie Nichol</td>
<td>Sophie Nichol</td>
<td>Sophie Nichol</td>
</tr>
<tr>
<td>Events recorded</td>
<td>Practical attendance, group interactions, use of room technology</td>
<td>Practical attendance, group interactions, use of room technology</td>
<td>Practical attendance, group interactions, use of room technology</td>
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The lectures and practical classes were used as research environments as they were the main focus of the games students’ education and thus had a major impact on the
development of their knowledge and creativity. Observations were kept maintained within a research diary by the action researcher Sophie McKenzie (nee Nichol). Checks and balances of this data were discussed with the action research supervisor, Prof. Kathy Blashki, to maintain a period of reflection and change within the CSS. This process of observation and reflection allowed many of the other data collection techniques to be enacted in this study. The notes from the action research diary were not included as a part of this study in explicit form, however are available upon request. The list of observations and reflections is as follows:

1. Observations were taken during practical classes in 2006, 2007, 2008. Observations occurred within the units: Game Fundamentals, Audio and Visual Game Elements. This included observation of students interacting in groups, and observation of students using the online communities. The observations occurred each week during a course teaching about games, thus 2 hours each week for the semester. Within these practical session was when many of the tests and surveys of this study were implemented.

2. Observations were taken during visit to the games room occurred during 2006, 2007 and 2008. Sessions often resulted in relaxed discussions/ interviews with the students about their use and requirements of the game lounge. Other components of the observations noted which groups of students used the lounge, and how the students had self modified the lounge.

3. In addition, the researchers had, on occasion, used the online environments to directly pose questions and discuss topics with students such as research on the use of the gaming language, Leet Speak (Blashki and Nichol 2005). The online environment of the units: Game Fundamentals, Audio and Visual Game Elements, Game Architecture and Design, Games Production and Society, Games Graphics were used as online observation environments.
4.4.3 Online Surveys

As defined by Ekvall (1999 pg. 410), the most common way to ascertain information regarding creative environments is to administer surveys. As Gravatter (2009) stated, it is important to find measurement procedures that can help directly answer the aims and objectives of a study. Although communication amongst Generation Y is continually shifting between online and offline modes and culturally specific languages (such as Leet Speak), have evolved as part of these slippery, social negotiations and hierarchies, the Games students were particularly receptive to online communication as a part of their social negotiations. Therefore, an online survey was chosen as the best method of data collection. Two online surveys were conducted in 2006 and 2007 as part of this study (as shown in the summary AR process map – Table 4.1), which were disseminated via Deakin’s online learning tool DSO within units as part of the Games Design and Development degree. Although minor sampling issues were encountered, these problems were overcome in this study by gathering the year level information of participants.

4.4.3.1 Creative Environment Survey: First Survey Online – 2006

The purpose of the first online survey was to gather data concerned with the creativity factors contributing to the environment of each games student at Deakin University (as outlined in Appendix A). The survey attempted to elicit the type and variety of creative skills of games students, to ensure that the learning environment in which they study was enhanced to support their creative skills. The survey was developed based on work by Ekvall (1999), Garrison et al. (2000), Isaksen et al. (2001), Isaksen and Lauer (2002), Keller-Mathers and Murdock (1999), Mathisen and Einasen (2004), which investigates aspects of the environment which can be conducive to creativity. Ekvall (1999), Isaken et al. (2001), Isaksen and Lauer (2002) defined most specifically in the literature about factors that need to be questioned in situ to determine creativity. However, the survey used in this study was a new construction of question based on the work of Ekvall (1999) and this has not been used in studies before. The survey begins with questions regarding the use of the current environment. The second half of the survey focuses on questions regarding the factors that comprise a CSS, as defined in Chapter 2, to gauge students’ response to each of these factors. Students were asked questions about the
factors that defined 16 creativity factors within the CSS. The 16 factors were delivered to the games students within the form of questions, to which they responded on a 5 point likert scale (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree). A qualitative and quantitative analysis of the results of the survey was undertaken as shown in Chapter 4. In addition the qualitative analysis on the survey aided in informing the researcher about the behaviours, attitudes and feelings of the respondents in relation to their environment, however it was not designed to gather information on study satisfaction and attitudes.

4.4.3.2 Sense of Community Survey: Second Survey Online – 2007

In the second survey conducted with the games students, the sense of community index (Chipuer and Pretty 1999; Chavis et al. 1986, Rovai 2002a) (as shown in Appendix B) was used as a basis for constructing the survey. The need to establish a sense of community within the games students arose from an evaluation of the results of the cycle of the AR process (see map Table 4.1 and Appendix E), which found that students negotiated their creativity often in social ways. The sense of community measure was deemed appropriate for this study based on a review of the creativity literature. Rovai’s work (2002a) on the sense of community had high literature stance, with many studies employing the measure. The validity of the sense of community has been demonstrated via studies such as Chipuer and Pretty (1999) Chavis et al. (1986). The focus in the sense of community on connectedness and learning was also a high consideration for selection of the measure, as this study was concerned with community within a learning situation. The sense of community index relied on students to report, via a survey, the extent to which they absorbed a sense of community from the environment. The surveys asked students to note how they felt with regard to statement such as “I feel connected to others in this course”, “I feel isolated in this course” and “I feel uneasy about exposing gaps in my understanding”. A total of 23 factors were assessed within the form of a question, to which students responded on a 5 point likert scale (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree). A qualitative and quantitative analysis of the results of the survey was then undertaken. In a typical assessment of the sense of community index, the researchers would assign a score (up to
80) for each student’s survey where a higher score indicated a stronger sense of community. The results of the survey, and the assessment of community within the CSS of the game students are presented in Chapter 5.

4.4.4 TCT-DP

The “Test for Creative Thinking – Drawing Production (TCT-DP)” (Urban and Jellen 1996), was employed in this study as a means of performing a psychological assessment of the game students’ creativity. The TCT-DP was developed in 1985 by Hans Jellen and has seen many test being undertaken to establish (Urban and Jellen 1996). The Test for Creative Thinking – Drawing Production (Appendix C) is a screening instrument that allows for a rough, simple and economic assessment of a person’s creative potential. It serves to identify very high creative potential as well as to recognise individuals with underdeveloped creative abilities who are in need of enhancement, challenge and support. The test was used in this study to indicate that games students do have creative potential as proposed in the research questions, as well as to demonstrate that the games student's creative potential has developed further during their studies in Games Design and Development at Deakin University.

TCT-DP was selected as the most appropriate evaluation tool for its applicability to any age range and any level of creativity. The TCT-DP is traversable across many setting for measuring creative potential, as the test has been accepted in many cultures and age settings (Urban and Jellen 1996 pg. 4). The TCT-DP was selected as valid for applicability in this study because of a focus in the test on both quantitative and qualitative traits of creative achievement. Reviewing students approach to the test was an example of the qualitative considerations.

The TCT-DP has been used in many studies, as shown by Urban and Jellen (1996 pg. 57), as an TCT-DP is an instrument that has been validated in many forms. From review of the literature it was not apparent that the TCT-DP had been used in the assessment of IT education, however as Urban and Jellen (1996 pg. 5) argued, the TCT-DP is suitable for studying and examining effect of training and learning as pre- and post-tests. Pears (1993) discussed in their work that teachers were tested, in combination with other
techniques, about their potential to identify creativity in children. Based on evaluations such as this the validation of the TCT-DP was formed.

Gathering data poses many ethical issues, particularly in the collection of data via the online medium. Section 4.5 outlines the ethical considerations undertaken during this project. In addition to the collection of data in the online medium, face-to-face data collection was also conducted for this study.

4.5 Ethical Action Research

The action research in this study was comprised of qualitative research, and as Denzin and Lincoln (2000 pg. 459) argued, qualitative researchers are “guests” in the public domain and strongly argue that the behaviours of qualitative researchers should be “decent” and their code of ethics strict. Denzin and Ryan (2007 pg. 580) contend that the ethics and politics of qualitative research must be considered from the onset as they permeate each phase of the research process. The position of the action researcher within the situation is of importance because the way in which the action researcher positions themselves within the study determines “how one thinks about power relationships, research ethics, and the validity and trustworthiness of the study’s findings” (Herr and Anderson 2005 pg.3). The action researcher influences procedures, data collection and evaluation in their study of the problem situation. In this study, in addition to formal, ethical guidelines provided by the Australian Government (Australian-Government 1999) and administered by the Deakin University Human Research Ethics Committee (DUHREC), the personal values and ethics of the action researcher were considered and negotiated. As McNiff et al. (2003) notes, action research is concerned with the exercise of influence, and it is often assumed that the resulting influence can be negative and/or sinister (McNiff et al. 2003 pg. 47). To mediate and mitigate any negative influence the researchers may have upon the participants, every research project must have a solid ethical foundation, regularly scrutinised by the researcher themselves, and other outside observers. McNiff et al. (2003 pg. 49) defined ethical principles of action research processes in six stages and refer to it as the “Checklist of ethics considerations”.

1. Draw up Documentation
a. Ethics statement (Plain Language Statement at Deakin University)

b. Letters of Permission (Consent form at Deakin University)

2. Negotiate Access

a. With authorities
b. With Participants
c. With parents/guardians/supervisors

3. Promise Confidentiality

a. Confidentiality of information
b. Confidentiality of identity
c. Confidentiality of data

4. Ensure participants’ rights to withdraw from the research

5. Ensure good professional and academic conduct

6. Keep Good faith

The research process for obtaining ethics approval to conduct surveys and collect and evaluate data incorporated contemporary methods of ethically obtaining data in conjunction with the moral and ethical values of the action researcher. Ethically, the issues with collecting data in traditional methodological modes such as privacy, confidentiality, anonymity, and coercion remain similar. However, in this study, there was the additional complexity of conducting a survey online. The six steps of McNiff et al. (2003 pg. 49) referred to above, were adhered to during the application process for ethics clearance to survey the games students, however the distinctive requirements for the successful implementation of the online surveys in particular resulted in the modification and adaptation of the steps to focus on providing a solid ethical framework in an online environment. Based on McNiff et al. (2003 pg. 49), the following was adhered to in the study of the games students:
Negotiated access: Study of the games students within their environment was negotiated with students, teachers and moderators. The teachers were approached about facilitation of a survey within DSO, as well as approached about observing students within the lectures and practical classes. The survey on DSO was voluntary, and this was also expressed clearly in any interviews and observations with the students. This is an indication of good professional and academic conduct.

Promise confidentiality: The surveys, observations and interviews within this study were done with confidentiality for all participants. All personal details were removed from the results data, and original transcripts of data that may have the participants name/details included were stored in a locked filing cabinet at Deakin University. The plain language statement outlines the confidentiality for each form of data collection.

Right to withdraw: The participants knew from the onset their right to withdraw from the study at any time (even in the midst) and have their information and data removed from the results. As with confidentiality, the plain language statement that is presented to each participant before they become involved in the study, outlines their rights to withdraw. In addition, the researcher made this verbally clear upon acquiring participants.

Good will: The offering of results upon their analysis is a form of good will expressed to participants. In addition, the researcher can offer good will in the form of verbally expressing the importance of confidentiality and participant’s rights to withdraw.

Appendix D contains the acceptance letters for ethics applications approval for this study. Overall, as Foth (2006 pg. 221) stated, the attributes that comprise the communication strategies of action research assist in maintaining a credible level of
accountability and rigour by ensuring that the research process, observations and interpretations are made public, and subject to challenge by community participants.

4.6 Analysis Techniques

Denzin and Ryan (2007 pg. 587) argued that in qualitative studies, particularly studies with the focus on engagement with the research community, a number of interpretive analysis strategies can be used. Chi (1997 pg. 280) summarised the action research method as consisting of comparison of internal measure within the data analysis, compared to more scientific studies where comparison with external factors is considered of high importance. Root (2007 pg. 566) argued the appropriate analysis techniques are employed based on the nature of the problem situation. Via processes of immersion within the problem situation (as shown in AR Map in Table 4.1) the following technique were “chosen” as formal procedures for gathering data in this study: Interview Transcription, Content Meaning Analysis, Observation Reflections, Discourse Analysis and Quantitative analysis. The results of these techniques are presented.

4.6.1 Interview Transcription

Interview transcription is a lengthy process and should be carried out as soon as possible following the interview to ensure memory assists in the transcription (Gillham 2000 pg. 60). It should also be undertaken with mechanisms in place to ensure each transcript is similar and easy to analyse. In this study the tool Express Scribe (http://www.nch.com.au/scribe/), was used to assist in the analysis of interviews, as its ability to stop and start interview playback through the keyboard, processed the verbal content to the written word much faster. In addition, the annotation in the program allowed for line numbering as well as notes for observations that the researcher may have made while undertaking the interview. These observational notes within an interview are also important as they indicate ambience, feelings and emotions from the interviewee. Interviews are techniques for data collection of verbal communication and verbal utterances (Chi 1997 pg. 273). It is up to the researcher, in employing a content analysis technique, to determine the knowledge implicit in the verbal and non verbal,
“to do so in a way that is not subjective: therefore, it needs to be quantifiable in some way” (Chi 1997 pg. 275). The approach used to make interview data quantifiable was via content meaning analysis.

4.6.2 Content Meaning Analysis

Content analysis consists of identifying substantive statements from within verbal instances (Gillham 2000 pg. 60, Neuendorf 2002 pg. 1, Dane 1990 pg. 57). More formally, “content analysis is a research method used to make objective and systematic inferences about theoretically relevant messages” (Dane 1990 pg. 58). Chi (1997) defined content analysis as a form of verbal analysis, and argued that “in verbal analysis, one tabulates, counts, and draws relations between the occurrences of different kinds of utterances to reduce the subjectiveness of qualitative coding” (Chi 2007 pg. 273). In this study, the face-to-face interviews of the games students and industry experts could be considered the unit of data collection, whereby the analysis focused on creativity and skills required to facilitate and enhance creativity. Strijbos et al. (2006 pg. 31) referred to a unit of measurement in discussing ways in which to draw data in order to analyse content during analysis. More simply, they define data drawn from the content analysis method within three categories:

1. Message (e-mail or forum contribution)
2. Paragraph (section), unit of meaning (or themantic unit)
3. Sentence (syntactical unit), or illocution

In addition, Chi (1997pg. 274) defined the unit of measurement as a “cut” of the data, and this can occur in the following ways: proposition, sentence, idea, reasoning chain, paragraph interchange such as conversational dialogue or an episode (such as event of specific activity). As Chi (1997 pg. 274) noted, one needs to worry about whether the chosen “cut” is appropriate for the question asked in order to interpret the results meaningfully. In this study, the “cut” was determined through initial review of interview transcriptions and finding the best possible fit for ways in which to draw data from the interviews. In addition, this review also assisted in determining an initial set of codes for which the interview transcriptions were coded. As Chi stated “codes must be developed
to correspond to a formalism which will be used to represent the knowledge” in each interview (Chi 1997 pg. 289).

These units of measurement were drawn from interview transcriptions within this study. After transcription, the process of content analysis was undertaken by going through each transcription and highlighting the substantive “units”, ignoring “repetitions, digressions and other clearly irrelevant material” (Gillham 2000 pg. 71). In addition, it was important to repeat this process with each interview a number of days apart in order to pick up any missed statements. Once all substantive statements were highlighted, the next step was to go through all transcriptions again to derive a set of categories for the responses to each question. To implement the coding, “one the needs to decide what utterances in the protocols constitute evidence for a specific code” (Chi 1997 pg. 282). Simple headings were used to categorise the responses. After an initial set of categories were defined, it was necessary to go over and combine potentially similar categories within the list, as a way of removing redundant categories (Gillham 2000 pg. 61). Additionally some categories needed to be split to stop one category from classifying too much. Once categories had been defined, the highlighted transcripts were reviewed to create a count of the number of times a category appeared in the interview and this count was marked within an analysis grid (Gillham 2000 pg. 61). Chi (1997 pg. 274) argued that content analysis was an important method for analysis of verbal communications, as it enabled quantification of qualitative coding (Chi 1997 pg. 274). In contrast to direct counting methods, whereby a researcher picks out aspects of the qualitative data that can be directly quantified, such as counting the occurrences of a given word in a newspaper article (Chi 1997 pg. 275), content meaning analysis looks at whole phrases of data, and codes based on the meaning of the phrase.

4.6.3 Observation Reflections

Observation offers the opportunity to directly examine the research phenomena “in action” within the problem situation (Yin 2003 pg. 55). Behaviours of participants and environmental conditions are integral to both the structure and function of the methodological premise used in this study, and thus observation was necessary.
Observation evidence was useful in providing additional information about the situation being studied (Yin 2003 pg. 55). However, as Denzin and Ryan (2007 pg. 587) argued observations cannot be objective, and must be situated within the social setting of the observer and the observed. In this study, annotations were made within the CSS (as described in section 4.2) and notes produced, explaining the situation at the time to the best of the researcher’s ability. These observations aided the action research process to implement and justify change while also allowing themes within the action research process to occur. In addition, this examination enabled the researcher to be the connection between the field of the research text and the community under observation, and allowed every voice in the community to be heard (Denzin and Ryan 2007 pg. 590). Observation was important to conduct as it allowed a heightened look into the inner workings of the CSS, which permitted the more subjective verbal and written expressions to have meaning and presence within the research process.

4.6.4 Discourse Analysis

An important component to compliment the analysis of data collected in this study was that of discourse analysis, which holds epistemological values to that of action research in that the view of knowledge is held communal with the community that is under review (Gergen and Gergen 2010). The field of discourse analysis stems from the area of semiotics and social linguistics. While semiotics looks at language as being created from signs “performed” in a specific context, discourse analysis examines the meaning of that language as an integral part of the sense making process. Bloor and Bloor (2007) stated that “language is a controlling force in society and deeper understanding is needed of the way language is used to persuade and manipulate individuals and social groups” (Bloor and Bloor pg. 1). Language is referred to in discourse analysis as an “utterance”, which has reference to the who, what and why components of the specific language used (Lynch 2007). The premise of discourse analysis substantiates that meaning is derived not just from the analysis of language, but from the symbolic human interaction within texts, or as Bloor and Bloor defined “the whole act of communication” (Bloor and Bloor 2007 pg. 6). Gee (2005) referred to this as “situated meaning”. Lynch (2007) refers to discourse analysis as; text which is spoken or written, of a large organisation unit such
as a narrative, story or conversation and, language occurring in natural settings which
are “in action”. Such texts can include: spoken or written language, gestures, diagrams,
films of music. In this study, the researcher draws results from a multimodal approach of
contextually defined homogenous texts. The texts included were: survey data,
curriculum design, online discussions, test for creative thinking – drawing production,
interviews, and reflections from the action researcher. This multi-modal approach of
discourse and survey data are as Gee (2005) stated, tools used alongside other tools, to
design or build things. Denzin and Ryan (2007) argued that many voices are needed
before a deep understanding of social phenomena can be achieved. The multi-modal
combinations of data collection methods were all used within the situation of the Games
students (as discussed in section 4.4). The situation of the Game students is important to
define because language closely reflects its discourse situation (Bloor and Bloor 2007 pg
29, Lynch 2007 pg. 500). As Gergen and Gergen argued “the language conventions for
communicating about human motivation are linked to certain activities, objects and
settings” (Gergen and Gergen 2009 pg. 463). In the context of discourse analysis, all
data collection has significance in the larger discourse picture, or what Gee (2005) called
“big D”, however the data collection analysed more closely under the discourse banner,
or “little D” (Gee 2005) include the online discussions, interviews and action research
reflections that were conducted as a part of this study. Bloor and Bloor (2007) argued
that any researcher undertaking discourse analysis needs to be critical of their position
within the analysis, and this is particularly apparent within this action research study
where the primary researches have direct involvement with the research situation.
Gergen and Gergen (2009) discussed that the action research should conform to the rules
of the community situation as to enable maintenance of relationships, because without
these relationships and convention for construction, action of the researcher in the
situation loses value. Discourse analysis looks at the social actors and their collective
practice as a significant component of the sense making process, thus the researcher
must look critically at their own influences as well as the utterances of other participants
sums up discourse analysis as an approach to structure action, within a framework of
interaction (utterances, language and signs).
When reviewing discourse analysis we can look at text within seven standards of textuality: cohesion, coherence, acceptability, intentionality, informatively, situationality, and intertextuality (Bloor and Bloor 2007 pg 7). Gee (2005) provided a more applicable framework for which we can transfer standards via presentation of the seven building tasks of discourse analysis: significance, activities, identities, relationships, politics, connections, signs and systems of knowledge. These tasks help the discourse analysis to break down the components and attempt to provide not only insight into specific discourse, but also to provide a system of analysis for larger cultural meanings of the discourse. Lynch referred to processes in discourse analysis as “extending all the way down to the minor, seemingly trivial, utterances and gestures, and places them on a different organisational base: a shifting base of situated communicative actions rather than a stable base of rules and meaning stored in the head of a speaker” (Lynch 2007 pg 503). The text drawn from the discourse analysis situation is also grounded within an “event” framework which the analyst records at the time, then later uses to analyse results. According to Bloor and Bloor (2007) and Gee (2005) the components within the event recording included:

- The setting
- Time or times and aspect of the event
- Mode and medium of the event
- Participant and their roles (identities and relationships)
- Topic, theme of the event (significance of the event)
- Purpose of discourse and purpose of participants (activities of the event)
- Attitudes of the participants (politics or social goods)
- Dynamics of the participants (connections between language and theme)
- Genre (if applicable)
- Sign System and knowledge (if applicable)

Within this study, the analysis of language within situation was recorded on many occasions and over a significant period of time (3 years). Discourse analysis was
rigorous in approach, with recording and inscriptions articulated and clear so as to appeal to the realist notions of the objectivity of the referent. This study incorporated such recoding mechanism, as shown in the table of interviews observation (Table 3.2 and 4.4 respectively). The notations captured were analysed using the 7 building tasks of discourse as indicated by Gee (2005). The overall approach of discourse analysis in this study resulted in a thematic analysis.

4.6.5 Quantitative Analysis

Quantitative analysis was also undertaken in this study. Two online surveys of creativity occurred (as discussed in section 4.4) resulting in measurable, empirical, quantifiable responses. In addition, the creative environment survey and the sense of community survey produced quantitative descriptive, statistical results. The percentage of students who responded in particular ways and the descriptive statistics are presented throughout the results in Chapter 5. This method was selected for use within this action research study, as it allowed a greater number of questions to be presented in the results, illustrating a greater scope and application of creativity within the problem situation.

4.7 Conclusion

Action research is a philosophy that can enhance human activity and thus aid human conditions such as creativity. Levin and Greenwood argued that “to be fully human is to enquire pragmatically, and social conditions that enhance this activity also enhance the human condition” (Levin and Greenwood 2001 pg. 43). This chapter argued for the importance of action research to investigate creativity within games students of Deakin University, Australia. Action research was chosen in this study because of the difficult to define nature of creativity, and thus a single outsider’s perspective on the matter would not suffice. A cyclic process of action and influence from the researcher and participations was the endeavour chosen as appropriate as it allowed the precise nature of creativity to be discovered by a cyclic process of investigation and action. Only via this process can the participant’s creative needs be understood.
Chapter 5 details the results and discussion uncovered during the course of this action study. To address creativity, a collection of quantitative and qualitative data sought via a variety of methods was undertaken. In addition, discourse analysis was used extensively in discussion, to build examples of stakeholder participation in this study.
5. Results and Discussion

For decades, researchers have been trying to pinpoint what builds creativity within people, in the hope of finding the definitive answer to aid humanity. However, the nature of creativity makes it so inherently complex within each individual that we cannot, at this time, safely assert “what is creativity”? We can however focus on factors that influence creativity and it is in this study that we focus on environmental factors and “the world around us” as a source of inspiration and influence on our creative potential.

In this chapter, the CSS of the games students will be discussed, with a focus on the results of creativity factors that were deemed seminal. The results of this study that were gathered from survey, interview and test data as described in the problem situation (Chapter 4) will be presented. Students, staff and industry experts were the providers of the result data in this study, which were produced through guided action research (as shown in section 4.2 of Chapter 4). Many avenues of data were gathered in an attempt to answer the aim and research questions of this study. And this focus on multiple providers of data helped the research process to deal with bias. Although it was difficult to accurately and definitively refute, it was hoped that through a concerted approach via multiple texts, that avenues for increasing creativity could be provided. Additionally, the application of an action research methodological approach, the researcher was immersed within the learning situation of the games student to determine the best approach in supporting creativity. Through this immersion of researcher in the problem situation, the following research aim and objectives have been addressed in this study.

The aim of this study was:

To demonstrate if based on the facilitation of certain creativity factors, a technology-enhanced, purpose built learning environment can be conducive to enhancing creative potential.

To address the aim of this study, the following research questions were explored;

1. What is the creative potential within the students who study games?
2. What creative skills are expected of games students by the relevant employing industry?

3. How can the current learning environment for games students at Deakin University be enhanced to facilitate and encourage the creative skills of the games students to increase creative potential?

This chapter brings together themes, literature and results into a discussion that answers the research questions. The chapter is structured firstly with a discussion on the learning environment and curricula, which the students engaged in at Deakin University, after which the creativity that is specific to the cohort of the games student will be addressed. Presentation of factors which were specific to the support of creativity of the games students will also be presented, with a focus on the “purposeful activity” of these factors.

5.1 Creative Curricula? Learning Situation of the Games Students

The social situation in this study was defined within the boundaries of a learning situation, specifically the teaching and learning surrounding the students who study games design and development at Deakin University. The school situation initially defined common relationships such as student and teacher, thus it had relationships that are built around “place”. Social discourse was important and encouraged in the social situation of the games students, and was used as a vehicle for individual learning. The collaboration of students and staff was achieved through the running of games units at the Burwood, Geelong and Off Campus of Deakin University, thus location-based communities were formed. These social networks within the local community were inherent, however as to be discussed further in this study, needed to be supported for creative success.

The learning pedagogy of immersive learning (Blashki et al 2007 pg. 3) was employed in this study, which focused on facilitating: immersion, engagement, agency and risk/creativity in the context of a learning environment with facilitating agents of students, teachers, community, resources and technology. Section 2.4.3 discussed the
immersive learning pedagogy in detail, which highlighted the importance of building an environment for learning to occur. In this study this was important because as determined through the process of action research, a “purpose built” environment was required to support and facilitate creativity. The corollary between learning, creativity and environment is seminal to highlight, therefore a focus on the learning environment and curricula of the games student is presented. The curriculum is presented within the foundation of Bloom’s taxonomy (section 2.4.6)

The learning situation and CSS in this study were composed of the same situations: traditional face-to-face teaching and learning, games lounge and the online community. Teaching in games was conducted based on students entering and engaging in these situations. Section 2.4.6 highlighted the specific curriculum in which the game students engaged, showing that the games students were immersed in a curriculum where they learnt foundational IT skills as well as specific games design and development skills. Generic skills of communication, management and organisation were facilitated, with application of specific skills (such as the focus on game design and development) was also apparent. In their learning of games, the students were immersed in many technical development classes, that allowed them to learn a foundational skill such as programming in C++. In their first year of studies the games students were formally and purposefully educated on the process of creativity, and that they would need to develop creativity to make successful games. Creativity education involved the presentation of information on what is creativity, and how to build a creative process, as well as via activities in practical sessions in which the nature of creativity was discussed. From the beginning of the games students’ tertiary education they are shown that creativity is accepted and anyone apparently “breaking the rules” of the environment and expressing views in a social or colloquial way will not necessarily be considered antisocial, but may instead be seen as attempting to creatively work through a problem or situation. In their final year of study students were engaged in a final project which was oriented towards the production of a game. Much of these components of study incorporated group work and the need to work collaboratively to undertake a project. Students engaged in the curriculum and learning environment dealt with learning objectives that required them to engage with knowledge, cognitive process, comprehension, application, analysis,
synthesis, and evaluation, as shown in Table 2.3 (page 67). Largely, and somewhat unrepresented in the taxonomy in Table 2.3, the learning objectives with which the games students engaged in from their learning environment were social learning theories (the heart of immersive learning). Aspects of collaboration and peer based involvement in assessment tasks, was seminal towards meeting the learning objectives as detailed in Table 2.3. For example, a collaborative peer based assessment task was used extensively in SIT152 Games Design. Students were required to form groups (of at least 3) to conduct two game design assignments, where they were required to negotiate their own groups and inform the teaching staff. During the process of conducting the assignments, students were asked to keep a reflective journal (hosted online and viewable only to group members and teaching staff). The journal asked for students to record efforts, as well as reflection upon progress and assignment results upon completion. Some students used the journals extensively to discuss with their groups, project-manage and provide feedback upon progress. Often students would inform each other of issues and areas where students could do better. So in addition to working face to face to produce a game design, the students also used the online forum as a way to collect and reflect upon information. Students commented on their use of the online journal mechanism as a part of the unit. While some thrived and enjoyed the opportunity, others used the mechanism in a “just in time” way, so as to achieve the marking criteria for the assignment. The results from this learning experiment were based on discussions of student perceptions, and not based on validated survey data. The mechanism to use reflection and discourse, as described in the SIT152 Games Design situation, as a part of the learning objective to create a game design, was a component of the teaching and learning in games that was specifically designed to support social learning theories (and as a subsequent way to support communal creativity). Example such as this served to highlight how the learning situation involved a combination of communication mechanisms for students to engage in. Technology in this case was provided to service learning needs, however also allowed an option in the delivery of teaching and learning. Technology was also required by creativity, however often in a more transparent manner. Students regularly connected with technology to facilitate their learning and creativity in the study of games, however the process was not overt, but more so simply an extension of activity
into the digital domain. The technological components that were a part of this study are discussed further in section 5.2.

The taxonomy of learning objectives as shown in Table 2.3 outlines the curriculum as undertaken by the games students in 2005. The current taxonomy shows a failing in the games design and development units to harness creativity to the extent required for success in their chosen profession in the games industry. The gaps in the learning objectives showed that primarily information knowledge is built only from factual consumption on a conceptual level, with remembering and understanding facts the forms of assessment. Rather than being extended down into more procedural knowledge, the learning objects did not show that students needed to be able to adapt their skills to create games of different genres. This discrepancy was somewhat made up for in the presentation of learning objectives which were at the core of the IT course, with learning objectives spanning into procedural and meta-cognitive areas, where students were expected to evaluate and create work, as opposed to just remembering facts. In addition, the implementation of a wider creativity support system in which the learning environment sits also helped to bridge the gap in learning objectives, and what was required of students by employing industry. It is important to note that while the learning objectives represent the state of the Bachelor of IT (Games Design and Development) in 2005, it is not reflective of the state of the course today, as changes due to this study have been made to the curricula (as discussed at the end of this chapter).

5.2 Games Students Creativity

Creativity has been studied and tested within the specific situation of the games students at Deakin University. The games students’ creativity is specific to the cohort, based on certain traits and ways in which their creativity was manifested. This section will define the creativity of the games students, and attempt to demonstrate how creativity was tested and facilitated via action research and the games students’ immersion within a CSS. This section will draw data from: TCT-DP, attendance data, online community data, survey data, interview and observational data.
5.2.1 What is the Creativity of the Game Students?

As discussed in section 5.1, in their first year of studies the games students were formally educated on the process of creativity, and were informed that they would need to develop it to make successful games. This happened consecutively for each group of first years. During 2005 the initial stages of action research captured data from the first year students with regards to their thoughts on creativity. During interviews with the games students in the first action cycle (via questions in practical class) many students commented that they were: “Not creative”. Comments such as “I cannot draw” or “I cannot come up with ideas” were common amongst discussion with the students. Also in the first action cycle a student responded in the online community when asked if family and friends because of their interest in computers and games considered them a “wiz kid”:

“I doubt it and nor should they, everyone is a “wiz” at something, I just happen to be good with computers”

It was comments such as these that solidified the difficulty in educating about creativity, particularly creativity that was not required to be of the overt nature. During phases of action research, students were continually interviewed about creativity with the researcher inquiring with them with regards to the nature of creativity. Similar sentiments occurred: “I don’t need to be that creative”, “Creativity is only need to come up with a game idea”, “I never really think of myself as being a creative”. During 2007 and 2008, interviews with students focused more on social aspects in the support of creativity. Questions such as “why do you refer to the online community to help you with your games designs?” were asked to the students to help give a more focused answer with regards to the nature of creativity. In addition to interviews and discussions with students to assess creativity, the Test for Creative Thinking – Drawing Production was also conducted to assess the potential for creative endeavours.

5.2.1.1 Results of the Test for Creative Thinking – Drawing Production

The “Test for Creative Thinking – Drawing Production (TCT-DP)” (Urban and Jellen 1996), was employed in this study as a means of performing a psychological assessment
of the game students’ creative potential. The TCT-DP is a test that indicates creative potential, and is directly aligned with the research question focusing on the creative potential of the games students. The TCT-DP used in this study did not solely assess creative potential within the game students, yet was used as a device in combination with further discussions on creativity. The action research process started with an extensive process of determining the type of creativity we could expect from the games students with which the TCT-DP was a part. The outcomes of this study did not necessarily assert that creativity was improved, though it was hoped that from the immersive approach used within the learning environment as well as facilitation of certain creativity factors, it can be asserted that avenues for creativity have been supported. TCT-DP was selected as the most appropriate evaluation tool for its applicability to any age range and any level of creativity. The test rates creativity according to the following grading system:

- A = far below average
- B = below average
- C = average
- D = above average
- E = far above average
- F = extremely high above average
- G = phenomenal

Table 5.1 describes the administration of the TCT-DP in this study.

<table>
<thead>
<tr>
<th></th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Test</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Random selection of 17 first years and 13 third years.</td>
<td>Random selection of first years. 10 identical third year participants at in first test (were first year in 1&lt;sup&gt;st&lt;/sup&gt; Test)</td>
</tr>
<tr>
<td>When</td>
<td>March: 2006</td>
<td>April: 2008</td>
</tr>
<tr>
<td>Percentage of cohort:</td>
<td>30%  (120 students enrolled)</td>
<td>33.3%  (90 students enrolled)</td>
</tr>
</tbody>
</table>
Figure 5.1 (a) and (b) compare the creativity potential test scores between the first and third year games students.

![TCT-DP results first year students (a) and third year students (b)](image)

Figure 5.1 (a) and (b). TCT-DP results first year students (a) and third year students (b)

Figure 5.1 (a) illustrates the creativity potential test scores for first year students, which highlights 18% of students are below average, 58% average, and 24% above average. In
a comparative analysis with the results from the third year students (Figure 5.1 (b) it is clear that there are no below average students, 69% rate as average, and 31% above average. Figure 5.2 summaries all the results for the 2 tests undertaken in the TCT-DP.

Figure 5.2 Test for Creative Thinking-Drawing Production Result for all Games Students

Figure 5.2 identifies that the games students’ predominately had average creative potential which is in the middle 50% percentage of the ranking of the studied population, as described by Urban and Jellen (1996 pg. 39). The results also show that overall 63% of the students had creativity score averages and that 27% of students had above average potential. The results in Figures 5.1(a) and 5.1(b) could indicate that the creative potential of the games students had increased in the transition from first year to third year, with an increase in above average creative potential by 8%. In addition, no students were deemed “below” average creative potential by the time they entered third year. However, due to the nature of this study in exploration via action research of the games students CSS, it was not deemed that a further analysis of these findings would uncover any results of significance for the games students. Thus no further analyses of the test scores were conducted. Additionally thoughts on the creativity of the games students were confirmed during the industry interview conducted during 2006.
5.2.1.2 Results of the Industry Interviews

As discussed in Chapter 4, two independent interviews were conducted with relevant industry professionals during the first cycle of the action research process in order to ascertain the perceived skill requirements for graduates entering the games field from an industry perspective. The questions posed to the industry professionals specifically focused on the skill requirements of the games students in relation to the development of creativity (details of these interviews can be supplied upon request). As mentioned, two interviews were conducted with prominent game development companies located within Melbourne. For confidentiality, and as requested by the interviewees, all results presented maintain the privacy of each individual thus names have been changed. In Chapter 3, the techniques used for data analysis were introduced; content meaning analysis, which was used to deconstruct the interviews given by the two industry professionals, to include only the relevant content information. This is common practice in the use of the technique as the majority of interview content comprises “filler” conversation that, while appropriate in face-to-face communication, is less useful in a written account (Gillham 2000, Neuendorf 2002, Dane 1990). The content analysis technique was applied to the interviews, and the results from these analyses are presented in Table 5.2. In content analysis, the unit of measurement or degree of granularity of the analysis conducted indicates the level and desired meaning to be achieved. The level of content analysis can be specific, for example one word, or can be implicit in dialogue, which can include acknowledgement of a theme reoccurring throughout an interview. In this study, due to the qualitative nature and the desire to illustrate “how” and “why” certain skills are required by the games students, the unit of measurement chosen was an “episode”. An episode refers to a specific activity presented during the interview, and content analysis utilises the interview as dialogue from which to draw results (Gillham 2000, Neuendorf 2002, Dane 1990).

Table 5.2 indicates the taxonomy used for the content analysis, based on categories, which have been displayed in a simple table presenting the means for each of these categories (Chi 1997 pg. 297). The results are presented as a relevant word or phrase that occurred during the interview and a count is provided for each word or phrase as it arises during each interview, presented as a tick in Table 5.2. Table 5.2 indicates the content
analysis of the skills required for employment in the games industry based on the opinions of two industry “experts”. These experts are the CEO and chief programmer from two Melbourne video games companies; Tantalus and Torus Games, respectively. The phrases listed in Table 5.2 are derived directly from their interviews, rather than their applicability in facilitating creativity. During interviews, the industry experts spoke of each of these elements in a variety of ways, as indicated by the count, and it should be noted that the questions were semi-structured and offered to the interviewee in a manner that sought not to lead answers. As the interviews were semi-structured, the questions varied for each participant.

Table 5.2 Content Meaning Analysis: Content Count Interviews: Games Industry Professionals

<table>
<thead>
<tr>
<th>Content Analysis</th>
<th>Interview 1</th>
<th>Interview 2</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial pressures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant change and evolution of the scope of the project and the technology</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td>Lack of contribution in individual roles in regards to contribution to the game on the whole</td>
<td></td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td>Fun</td>
<td>✓</td>
<td>✓</td>
<td>2</td>
</tr>
<tr>
<td>Appreciation of the games development life cycle</td>
<td>✓</td>
<td>✓</td>
<td>2</td>
</tr>
<tr>
<td>Lack of formal game development life cycle</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓</td>
<td>12</td>
</tr>
<tr>
<td>Self project management (Quality)</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Team dynamic (many roles)</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓</td>
<td>5</td>
</tr>
<tr>
<td>Self teaching and research</td>
<td></td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>3</td>
</tr>
<tr>
<td>Creative Industry</td>
<td>✓</td>
<td>✓</td>
<td>2</td>
</tr>
<tr>
<td>Brainstorming</td>
<td></td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>2</td>
</tr>
<tr>
<td>Creative freedom</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Understanding of target audience</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Idea time and support</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Conflict</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
From the results in Table 5.2 it is clear that the dominant topic of the interviews was “lack of a formal game development life cycle”, “idea time and support”, and “passion for hard work” and thus these areas would appear to be of significance for any student who is seeking to enter the games design and development area. For example, interviewees noted that in games design the lack of a formal game development life cycle seriously impeded the success of the industry. In most project work, a development life cycle generally guides the project and reduces “scope creep”. However, the industry experts noted that within the unique medium of games design, there is a little in the way of a formal methodology of development. This ad-hoc method used by games companies results in either time or scope blow-out, or both. Whilst the newness of the area of games design may be the primary reason for this, there is an additional complication, fast pace development of the technologies used to develop games. Games technology changes rapidly, sometimes on a six month to one year cycle, making it very difficult for small to medium sized game developers to formalise methods for developing such technologies. Recently, the AGILE software development method has increasingly emerged as a way of managing games projects with constantly changing requirements and the need for fast development (Martin 2003, Boehm and Turner 2003). The establishment of the method and the testing in practice of AGILE development is still continuing.

In Table 5.2 other highly noted skills were “idea time and support” and “passion for hard work”. To compliment these required skills of industry upon its graduate, students that are enrolled in games design and development programs need to be flexible in their study so they have time to delve into ideas, and are capable of exercising self-management so they can be hard working and produce top quality work.. The industry experts were very keen for each employee to have time to create and build on ideas. In
addition, both experts agreed on the importance of support for ideas, and this was indicated in work practices within their companies where formal avenues for proposing games ideas to the company for development were available. Passion for hard work in the games industry is a pre-requisite, as the salary for working in games is significantly less than that for someone working in a software engineering development role. The games industry however is much more demanding in terms of creativity and that is why passion, in addition to good ideas, was considered very important.

The industry interview looked at a number of skills that student should posses to be better equipped to enter the games industry. While the results do not assert explicitly the needs for creativity, there is clear support by the industry professional for the support of skills that can help overall creativity. The industry experts alluded that creativity contains a certain flexibility, and ability to navigate fluctuating situations on a day-to-day basis. One of the industry experts noted in their interview the difficult aspects of the games industry:

“Our industry is different and special because the software is creative, there are all these variables, scope changes and technology is always changing, which is another interesting thing”.

The comments indicate the challenges of the industry, and the skill of adaptability comes through as required. Further ascertain of the requirement to be adaptable and flexible in the games industry is asserted in the industry experts comments that:

“There are multiple ways to make a game”.

The process of making a game requires many technical and organisational skills that a games student needs to harness to effectively enter the industry, and it requires their creativity to determine the best approach towards creating a game. Changes in technology negatively affects the games students’ creative process due to the constant need to update knowledge and skills into a new technological domain, preventing students from delving into a particular game medium for any prolonged length of study time. In addition, because the students need to be learning about their domain, rather than simply mastering it, the length of time it takes to learn about technology is longer. A coupling difficulty is that technology change is so rapid that it is therefore even more
difficult to master the domain of knowledge, which is when creativity is most often exhibited.

To create a successful environment for creativity to be possible, it was necessary for discussions and debate to be centred on creative skills. It was therefore important for the research to establish a dialogue with the games students in which to discuss creativity.

### 5.2.1.3 Developing a Dialogue of Creativity

During these initial stages of the first action cycle the action researcher and teaching staff were still in a stage of building relationships, trust and connection with the students, and not yet particularly influential on the games students (see section 5.4.3). It was noted that it was often difficult to discuss in person with the games students about their nature of creativity, as many were shy or inarticulate in the online medium. Additionally, the desire to speak up amongst peers about the topic of creativity was also a problem. The following typifies a characteristic discussion about the nature of creativity that was had with games students during their practical sessions:

**Researcher:** What do you think about creativity and the design and development of video games?

**Student:** I think there is creativity in making games, but the designer and artist have to do a lot of that.

**Researcher:** Why do you think only these two roles need to be creative?

**Student:** Because they have to create the visual of the game, and make it look good for the player.

**Researcher:** Do you think you are creative?

**Student:** No not really, I come up with ideas for games and like to play different games to see the different styles, but would not say I am creative.

Discussions such as these showed the nature of the games student to be unsure about creativity and how it is involved in the development of games. Specifically this student was reluctant to acknowledge the need for creativity in all aspects of games development. The student admitted to coming up with games design ideas and of playing different gaming genres almost as a process of research, however did not consider these exploratory activities, which can help build creativity. A discourse
analysis of the online community for the first year unit “SIT151: Game Fundamentals” showed a particular focus on the discussion of highlighting what each students “favourite game” was. Students initiated this discussion activity under their own premise and were not encouraged by the teaching staff. Titles headed “what's your favourite game and why” appeared in the online community, with strong and passionate answers appearing. What ensued was often a common thread and passionate discussion on their favorite game with a declaration of game play experience (and reasons for playing certain games) provided. The inclusions of discussions such as “favorite game” helped to establish a congenial attitude in the online community as it allowed students to come together on a topic in which objection to assertion of a favourite game was not a common practice. Particularly evident was that students justified their choice. Examples of this from the online community include: this game “still lives up to its legacy”, “the physics of game play is really incredible”, “it's not action packed or spectacular....but the whole storyline and specifically the humour is what makes it my favorite”. The suggestion of favourite game often led other students on a process of inquiry to seek out and play that game, often reminiscing about their experiences. On the contrary, students often debated and agreed in the online community when discussing about the passionate topic of best game ever. Students would retort often with a statement such as “read the whole post” in response to a student’s disagreement. These discrepancies, while not supported in the online community, were not moderated or ceased by the teaching staff of researchers involved. This was because it was up to the students to moderate and negotiate their own community and exploit (however they choose) in order to support their creativity and learning. It was observed that often disagreements would simply end, with another topic of conversation brought up where discussion, debate and support would continue. Whilst these observations do not necessarily support creativity, they do support students in exploring and engaging on a topic which is relevant to their studies. These interesting elements of purposeful activity enacted by the games students occurred during the first action cycle of this study, with influence from these interactions supporting the proposition that games students’ creativity is supported in social ways. Engagement in topics via the online community became seminal in units such as SIT352 Game Production and Society (third action cycle) where students connected strongly
over the issue of video game censorship. A discourse analysis of a thread within the online community for SIT352 showed how displeased students were with laws in Australia regarding censorship “I am extremely displeased at the unfair treatment of video games, why no R18+ rating”, and “Australia really needs an R18+ rating”. Debate runs rife on the topic with students researching interviews, reviewing website and providing list of information on the topic to encourage discussion. During the course of the debate, students asserted their opinion by stated “In my opinion” or “That’s my opinion” On occasion students were enraged with the Australian censorship on games, and band together to create a petition on the issue of getting an R18+ rating system. The issue of censorship focused solely on the issue of violence in video games, and the media attention towards violence in video games as being a contributor towards people acting dysfunctional in society. One student commented, “The media tends to blow a lot of things out of proportion I guess”. Students made it clear that they felt games were not to blame for problems in society: “if a video game tips someone over the edge, they were teetering on that edge long before they ever played any video game”. Students continued to debate with one student instigating “I do agree in that they (the media) never seem to show, about the benefits of games and how it encourages creativity and yes, INCREASES KNOWLEDGE”. This student comment acknowledged their opinion on the importance of playing of games and that it can be a creative act.

This initial highlight of discussion and observation of students transformed into a much more integrated discourse model, which included many modes of communication. This is discussed further in section 5.4 where the focus is on the social structure of the games students’ environment, which serves to highlight the complex and detailed web of interaction the games students engage in during their studies. However, an important component to describing the nature of interaction and creativity of the games students is via an analysis and evaluation of the language used within online discussions (Blashki and Nichol 2005).

5.2.1.4 Online Discourse Model of the Games Students

It became apparent in the first cycle (during interviews with students) that an influences from the environment, communication and collaboration were apparent. This was
required because of the seminal change and forthcoming nature of the games students via the online community (in contrast to face to face situations). This form of communication (enacted by the students) served to highlight aspects of the discourse model of the games students. Over time during the process of action research the discourse model was built and came to be shared amongst the group. Symmetry with traits describing generation Y (section 2.4.2) also became apparent, including the affinity for people from generation Y to be connected to each other all the time via various forms of communication mediums. The multimodal nature of the games students was shown through their approach to learning and creativity, in that they required many lines of communication, and different presentations of data. The aspects of the CSS studied this behavioural concept and attempted to improve it in order to increase creativity (see section 5.4.1).

The discourse model encompassed the use of Elite Speak language (known as “Leet Speak”) with which the students used regularly while conversing online. The nature of the interaction via Leet speak was important to acknowledge as it helped in the forming of relationships, connection, identity and attitudes of the game students in their interactions within the CSS. It was noticed by the researcher and teaching staff, that students were conversing in the online community in the form of Leet Speak, therefore an online discussion thread was started to canvass opinion about this form of communication from the user themselves; the games students. This discussion topic began in the first action cycle of this study, and was helpful for the researchers to understand and learn how to engage within the community more effectively.

*One student defined it in the online community:* “Elite: the upper class, selected as the best, of superior intellectual, social or economic status, basically “better than you”. *Another student offered comments and definitions* in the online community, stating that a “Noob or Newb is gamer speak for someone who is new to something and is being picked on by 1337 (leet) players that think they are good to explain the working of the game to them.”

A physical example of Leet Speak from the online community is shown below:

*Student:* “1337 h4x0rz pwn j00!”
This combination of letters directly translates into “leet hackers own you”, which basically means “ha, caught you out/gotcha/I win”. Often students would just use small aspects of Leet to cover up what they deemed sensitive information in their posts. Using small words used as “pwned” rather than “owned” (to represent when they are going well at a video game), is one example.

Often students used Leet as a puzzle to other students:

*Student:* “1|-=|| 0u |{/4N r34} t|-|l5t|-|3N|| 0u i5 t3|-| |337”

This directly translates as: “If you read this then you is the leet!!”. These communicative interactions of students were detected during observation of the online community, and allowed students to express their identity and knowledge. The use of Leet Speak allowed playful collaboration amongst the students and determined aspects of political relationships within the community, particularly relationships amongst teaching staff, researchers and students. A discourse analysis of the discussion thread of Leet Speak highlighted a notable division in the games students’ uptake of use of the language, with many students referring to Leet Speak as just “slang” a “mockery” and “just slang”. However, the prevalence of Leet Speak in the wider community was made clear, with many students contributing to the discussion by sourcing links to slang dictionaries, slang translators, and other cultural references such as the use of Leet Speak in Star Wars. It was noted in the discussion (as much as students did not want to openly admit to), that, despite their use of Leet Speak, they still corrected each other on the pronunciations and appropriate style to engage in.. The intended purpose of Leet speak is about “substitution” and “speed” by which you converse online. A large majority of students noted that their use of Leet Speak was mild and abbreviation based. Use of terms such as “lol” (laughing out loud) “rofl” (rolling on the floor laughing) and “IMO” (in my opinion), are just a sample of the number of abbreviation used in online discussions.

In the online community of the games students, Leet Speek was used, however often in mocking or playful terms. The desire to hide the context of conversation from others was not paramount, but rather Leet Speak was employed mainly to engage in playful
conversation. In addition to defining terms such as this, students offered their opinions about the origins of Leet Speek. One student noted:

“Each generation adds their own “slang” to the language and by the next generation that slang is now a real part of the language”.

While online discussions have introduced a new form of communication, as shown in the evolution of online languages such as Leet Speak (Blashki and Nichol 2005), such modes of communication have also significantly changed social interactions and human relationships (Foth 2006, Dawson et al. 2005, Martins 2006, Fischer 2005). Languages such as Leet speak, helped to set the scene for the discourse model that emerged during the course of this study.

Table 5.2 highlighted important skills, however skills of high importance were not the only focus. All skills in Table 5.2 were considered important for games students to possess; otherwise the industry experts would not have mentioned them. Section 5.1 discussed the learning situation and curricula of the games students and how it attempted to build creativity. Students learnt technical, organisational and communication skills while undertaking their degree, and it was through this process that the notion of “everyday” creativity was supported. From the action research process students were found to need creativity to deal with the assessment and the requirements to design and build games, without constant and direct influence and direction from the teaching staff. Creativity, but its definition, required the aspect of novelty to be acknowledged when formalisation a discussion into its nature. However, the game students’ novelty becomes difficult to assert in regards to creativity because of the “everyday” nature of its existence. In addition, because the study of games and IT in general is a fast and vastly changing area, it is difficult to assign novelty to an outcome from this domain, as it may only be applicable to an idea or product for a matter of months. However, in asserting that creativity does occur in the study of games, we can apply the definition of usefulness to our project, to assert creativity in assessment. Students learned the craft of designing and developing video games during their degree, and via assessment tasks, the researchers and teaching staff became consumers of the creative product and assessors into the “usefulness” of the students’ creative act. This was particularly paramount in the final year of studies, where students conducted a complex final year project, whereby
they had to present a complete game. Assessment looked at aspects of novelty and usefulness, with the majority of games designs being assessed as useful (ie that a game player could pick up and play their game without issue). Creating a novel game was not something that many students flourished in, with efforts being more focused towards functionality and user satisfaction. Nonetheless, aspects of novelty and usefulness in terms of creativity were considerations for the games students, which they became aware of over time in their studies because of formal teaching practices, assessments and immersion within the CSS.

5.2.2 Formalised Definition of Game Student Creativity

In an effort to differentiate the creativity of the games students from other forms of creativity that can occur, a formalised definition has been provided. The discipline of Games Design and Development requires creativity (as discussed in section 2.2.2 of Chapter 2) of an everyday/ transparent nature, which is required for the development of video games in this industry. Transparent creativity was apparent for the games students as it required creativity to be expressive on a more subliminal level, and not overt like that of the artist. As Table 2.1 illustrates, creativity has been variously defined as comprising two forms: historical and psychological (or everyday creativity). Everyday creativity is more personal and occurs on a smaller scale than historical creativity and is not specific to a domain of enquiry such as art or science. As Boden suggested, everyday creativity is “grounded in everyday abilities such as conceptual thinking, perception, memory, and reflective self criticism” (Boden 2004 pg.1).

The games students have an immature relationship with creativity, and therefore their creative processes may be considered undeveloped, many of their ideas manifest as novel products. The games students experienced the creative processes via established, “purpose built” environments designed to encourage social interaction. Creativity is a result of the specific design and management of a creativity support system, which provides the appropriate “setting” for the games students to enjoy creativity and be nurtured by peers and mentors.
5.3 The Games Students Creative Environment

During this study, two surveys were conducted in an effort to assess the creative environment factors. These surveys were performed primarily online and were done so to compliment the action research process investigating the CSS. Table 5.3 details the administration of these two surveys.

Table 5.3 Administration of the Online Surveys

<table>
<thead>
<tr>
<th></th>
<th>1st Survey</th>
<th>2nd Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population:</td>
<td>Games Design and Development students at Deakin University. All year levels of undergraduate.</td>
<td>Games Design and Development students at Deakin University. All year levels of undergraduate.</td>
</tr>
<tr>
<td>Sample:</td>
<td>Random selection of 36 students from the Games Design and Development Degree.</td>
<td>Random selection of 25 students from the Games Design and Development Degree</td>
</tr>
<tr>
<td>Assignment:</td>
<td>Assignment to survey based on enrolment in Games Design and Development Degree.</td>
<td>Assignment to survey based on enrolment in Games Design and Development Degree</td>
</tr>
<tr>
<td>When:</td>
<td>March: 2006</td>
<td>April: 2007</td>
</tr>
<tr>
<td>Percentage of cohort:</td>
<td>43% (120 students enrolled)</td>
<td>22.5% (90 students enrolled)</td>
</tr>
<tr>
<td>Demographical Information:</td>
<td>% of contribution.</td>
<td></td>
</tr>
</tbody>
</table>

Appendix A and B describe the surveys in detail that were used in this study.

5.3.1 Surveys: Use of the Games students’ CSS

In both surveys conducted, the initial section of the survey asked students questions about their use of components of the CSS. Questions were posed in both surveys as a comparison of student opinions. The results found that in the first survey 36% of student responses stated that they used the online community, with 64% saying they did not. Conversely, the second survey yielded a result that 72% of students stated that they used the online community, while 28% stating they did not. This shows an increase of 36% in the professed use of the online community. These results do not indicate the actual level
of use of the online community, however they do show the professed usage of this service by students. This result is not highly useful in its sole context, however it does indicate use of the online community was occurring.

Students were asked about their use of the games room as a part of the CSS. In the first survey, 59% of students responded that they used the games room, with 41% saying they did not. A marginal rise of 9% was observed between the first and second survey, with 68% of students saying that they used the games room and only 32% saying they did not. Although the rise of 9% is not statistically significant, it does show a consistent use of the environment device of the games room.

The question of more “global” collaboration amongst the games students was also posed in the surveys. Students were asked to respond as to whether they would like a global online community created where all games students in every year level could contribute. The survey responses were that 69% of students responded positively to the notion with a slight rise in favour in the second survey. During the survey students were also asked to provide their opinion with regards to the social and educational benefits of the game room for students. Figure 5.3 highlights the various response rates provided by the student.

Figure 5.3 Creative Environment Survey: “Social and educational benefits of the games room”
Figure 5.3 suggests that the students used the games room as a means to pass the time at University, while playing games and having fun. The use of the games room as an area for relaxation and social inclusion is apparent from the results. Yet this result can have an impact on on facilitating creativity, because of the welcoming and conducive environment.

In addition to “use” data being captured in the surveys, data on the creativity factors were also captured. The results from the creative environment survey and the sense of community survey are presented next. However it should be noted that given the small frequency of results presented in the creative environment survey and the sense of community survey, the result analysis was conducted as shown in this thesis, and to no further extent. In addition to “use” data being captured in the surveys, data on the creativity factors were also assessed.

### 4.3.2 Creative Environment Survey

The elements that made up the games students’ creative environment were many and varied. Initially in the study 16 factors were identified from the literature, while a further 7 factors were recognised from further work into the creative environment following the initial survey. These factors included; energy, focus direction and goals, diversity, experience and skills, team work (collaboration), and community. These elements were based on further review of literature, which highlighted factors as well as from the researcher’s immersion in the learning environment. Chapter 2, section 2.3 details all of the creativity factors under investigation in this study. Extra constituents were included in the second phase of the action research cycle (detailed in Table 4.1), and in particular aspects of team work, work group supports, playfulness and humour and community became strong influences in the support and engagement of creativity in the games students. It should be noted that the factors that support the creative environment were interdependent from each other, as it was via this interdependent nature that creative factors were developed build to create a CSS. Naturally some factors were more prominent and important than other, in particularly the CSS’s. However in any test of a CSS, the 23 factors should be considered and tested “in-situ” to determine the best approach for supporting creativity. The 23 factors include:
1. Resources: idea time, idea support, challenge and involvement, sufficient resources including: materials and facilities, people and information

2. Personal Motivation: trust and openness, tolerance for uncertainty and ambiguity, playfulness and humour, leadership (includes status quo and political issues), energy, absence of interpersonal conflicts, focus, direction and goals


4. Social: supervisory arrangements, diversity, experience and skills, work group supports, team work (collaboration), community

Previously the factors that facilitated a creativity environment were presented as a list, however in an effort to make the factors easier to understand, they were grouped under relevant headings of influence. Students assessed the factors on a 5 point likert scale (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree) as shown in Figures 5.4 (a) through (e). The results show the overall percentage response rate for that factor based on agreement with the likert scale factor. Issues of validity are present when discussing the results of the creative environment survey, as the development of the creative environment survey was undertaken specifically for this study, hence there was no previous survey in the literature, which looked at the assessment of the 16 creativity factors. Problems of legitimacy can occur due to extraneous variables which may be present when undertaking the survey, and which the survey does not capture. Additionally, the internal consistency of the survey may have confounding variables, due to the survey not having been tested in studies before. However, in this study the assessment of the creativity factors undertaken was appropriate for this case, as the results were merely one component of the total results gathered to investigate creativity. Therefore, it was not the intention of this study to thoroughly test the validity and completeness of the creative environment survey.
Figure 5.4 (a) Percentage of strongly agreed surveyed creativity factors

Figure 5.4 (b). Percentage of agreed surveyed creativity factors
Figure 5.4 (c). Percentage of neutral creativity factors

Figure 5.4 (d). Percentage of disagreed surveyed creativity factors
For each question in the survey, there were varying responses along the *likert* scale. Interestingly, there was a significant amount of “neutral” answers provided by games students in the survey (as shown Figure 5.4 (c)). This may have been a result of misunderstanding of the survey question, or the games students may have had “no opinion” when it came to questions about a creativity factor. However, consideration of the neutral response was taken into consideration. For instance, the result for “idea time”, “tolerance” and “risk taking” had high responses from students with regards to feeling neutral on the matter. From each graph however, it was easy to determine a sense of which factors were agreed with, and those disagreed with. For example, it was apparent that the games students supported the notion of “idea” as a requirement of their CSS, with 41.7% and 38.9% students strongly agreeing and agreeing, respectively. In addition to these results, a quantitative analysis was undertaken on the results obtained from the creative environment survey (Table 5.4 (a) through (c)). The results indicate the descriptive statistics for the factors that define creativity, as determined by with the games students.
Table 5.4 Descriptive statistics for the “Creative Environment Survey” factors

(a)

<table>
<thead>
<tr>
<th></th>
<th>Work group supports</th>
<th>Sufficient resources (facilities)</th>
<th>Freedom</th>
<th>Supervisor</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>N of Cases</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Median</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Arithmetic Mean</td>
<td>1.83</td>
<td>1.58</td>
<td>1.64</td>
<td>2.44</td>
<td>2.19</td>
</tr>
<tr>
<td>Standard Error of Arithmetic Mean</td>
<td>0.14</td>
<td>0.17</td>
<td>0.14</td>
<td>0.18</td>
<td>0.16</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.88</td>
<td>1.02</td>
<td>0.87</td>
<td>1.08</td>
<td>0.98</td>
</tr>
</tbody>
</table>

(b)

<table>
<thead>
<tr>
<th></th>
<th>Status quo</th>
<th>Political Risk taking</th>
<th>Conflict</th>
<th>Debate</th>
<th>Idea support</th>
</tr>
</thead>
<tbody>
<tr>
<td>N of Cases</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Median</td>
<td>3</td>
<td>3</td>
<td>2.5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Arithmetic Mean</td>
<td>2.66</td>
<td>3.25</td>
<td>2.47</td>
<td>2.31</td>
<td>2.08</td>
</tr>
<tr>
<td>Standard Error of Arithmetic Mean</td>
<td>0.16</td>
<td>0.20</td>
<td>0.16</td>
<td>0.24</td>
<td>0.13</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.98</td>
<td>1.20</td>
<td>1.00</td>
<td>1.43</td>
<td>0.77</td>
</tr>
</tbody>
</table>

(c)

<table>
<thead>
<tr>
<th></th>
<th>Idea time</th>
<th>Trust</th>
<th>Sufficient resources (Info)</th>
<th>Playfulness and humour</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>N of Cases</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Median</td>
<td>2.5</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Arithmetic Mean</td>
<td>2.41</td>
<td>2.14</td>
<td>1.6</td>
<td>1.55</td>
<td>2.25</td>
</tr>
<tr>
<td>Standard Error of Arithmetic Mean</td>
<td>0.12</td>
<td>0.17</td>
<td>0.12</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.73</td>
<td>1.04</td>
<td>0.72</td>
<td>0.73</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Descriptive statistics were formulated and presented for the 16 creativity factors as asked to the game students, because of a need to further describe the data. In addition, the results in Figure 5.4 (a) through (e) showed an increase in score of various factors.
over others in the survey. However this does not accurately substantiate the reflection of results in this study. Descriptive statistics helped to identify which of the central tendencies of the data indicate aspects of statistical significance, which is important when considering the validity of the questions on the survey. Mean and standard deviation helped to measure the variability of results in the creative environment survey, thus those scores with a larger standard deviation were not considered statistically significant (Gravatter 2009). Descriptive statistics was the only statistical data provided for the survey, and no further technical forms of analysis were required for this study. The numbers in the descriptive statistics relate to the following values: 1 is strongly agree, 2 is somewhat agree, 3 is neutral, 4 is somewhat disagree, 5 is strongly disagree. The descriptive statistics showed that factors of “political issues” and “conflict”, had the most variability in the results, and thus were considered statistically insignificant. However, factors such as “sufficient resources” (material, facilities, people and information), “playfulness and humour” had more conclusive results in that the games students “strongly agreed” for the need for these factors in their CSS.

The results highlight that in the creative environment survey, material and facilities were statistically significant, highlighting less variability in responses from students. Materials and facilities can be defined as stationary, technology, equipment and space. In the learning situation, the student’s access to tools and technology was a significant part of creating an environment for creativity. Urban and Jellen (1996 pg. 5) highlight in their components model of creativity (Figure 2.2 of Chapter 2), technology is an integral constituent in the environment to enhance the ability of students, to access a general knowledge base, as well as to give them access to specific knowledge and skills. As Edmonds and Turner (2003 pg. 45) emphasise, technology both creates and controls the creative energy within the environment and needs to be supported. As Oblinger and Oblinger (2005a pg. 2) argue, it is not the technology that is of prime importance, but rather the activity that the technology enables. Technology was not completely disregarded as merely functional (Padula and Reggiori 1999, Foth 2006, Hilleges 2007, Blashki et al. 2007) within this study, as it was seen to enable a range of emotional processes, including supporting, encouraging and motivating students to achieve. Thus, technology needed to support the students both physically as well as socially. Table 5.1
illustrates a survey of the technology design and uses the ways in which they changed during the course of this study. It elaborates on the technology used in this study and indicates the purpose-built technological designs, which were based on the action researcher’s observations and immersion in the learning environment. Based on discussions with staff in action cycles 1 and 3, the influence of technology was found to be that of a function and facilitator role. The continued version of the problem situation (as confirmed in Section 4.1) was undertaken in collaboration with all stakeholders, particularly the teaching staff.

Table 5.5 Technology uses within the Creativity Support System of the Games Students

<table>
<thead>
<tr>
<th>Technology</th>
<th>Designed Functionality</th>
<th>Purpose Built Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet</td>
<td>Immediate access to a wider network of content and information from both informal providers and formal institutions.</td>
<td>Access to a wider network of content and information, with association and preference placed upon certain content. Internet is used for its immediacy of information, and relied upon every day as a refined source.</td>
</tr>
<tr>
<td>University Personal Computer</td>
<td>Assistance in undertaking learning at University, specifically assignments and University practicals.</td>
<td>Used as a mechanism to aid in learning at University, however a primary focus is on use of the University personal computers to access the Internet and social collaborations, often with their peers.</td>
</tr>
<tr>
<td>Gaming Consoles (and Games)</td>
<td>To entertain and engage people in game play and story.</td>
<td>To entertain, engage and teach students about game play, story and construction of games. Game consoles and games also used as a reason to meet with friends, to engage in collaborative play.</td>
</tr>
<tr>
<td>Deakin Studies Online (DSO)</td>
<td>To provide an additional “online” learning space for students enrolled at Deakin University. The tools were designed as a document repository, assignment submission tool and grade book with some elements for social interaction such as discussions. Student who were enrolled within</td>
<td>Used as an additional learning space in conjunction with face-to-face learning. Students access the document repository for each class, as well as assignments and grades. However, the social interactions and discussions are a significant component to the tool. They not only help</td>
</tr>
</tbody>
</table>
units at Deakin University, were automatically enrolled in their unit on DSO each semester. students, but also inform decisions regarding the ways in which DSO should be managed and the content provided.

| DSO Discussion Forums | Provide an element of threaded discussion, within each unit, hosted on DSO. Each unit at Deakin University that uses DSO requires a discussion area called “student talk” to be available. | The provided discussion area of “student talk” is deemed to discussion specific to the unit of study, however other discussions are established to allow more informal and free forms of social interaction |
| Online Communities outside DSO | For collaboration and communication on a variety of topics, often administered by individuals or small groups, rather than institutions like Deakin University with DSO. | Online communities similar in some functionality (such as discussion board structure) were developed by games students, while undertaking game studies at Deakin University. The online community mimicked the style of DSO, however allowed students to control their domain, as they could accept or reject members at will. |
| Practical Room Facilities (digital projection, headphones, microphones) | To watch and listen to educational content and presentations while in class. | Practical rooms were used by the games students to establish server-based sessions of video games. The projector displayed the scores, with each student being a participant on their own computer. |

Table 5.5 deals with technology use on many levels, from physical hardware and facilities to software and the Internet. The online community, Deakin Studies Online (DSO) is specifically built for learning, however was adapted for use in this study to incorporate a more community-focused orientation. As Foth (2006) argued, “the process of critical inquiry and reflection on an individual level is supported through online journals, discussions or blogs to write up” (Foth 2006 p.218).

While the constant change of technology facilitates creativity in the students as they are compelled to constantly research and update their skills to fit in with that of the industry, the University infrastructure is not set up to deal with regular change. In the creative environment survey and the sense of community survey, students commented on
improvements to the CSS, regarding the need for more “comfortable seating”, “whiteboards to discuss projects or assignments”, “computers that were more conducive to high-graphics games”, “more up to date games”, “larger range of games”, “all next generation consoles”, “table-top RPG’s and arcade machines” and “games of different genres”. These suggestions were deemed important by the researchers and teaching staff, and every effort was made to essentially “update” the technology, game library and facilities for the games students. In addition to suggestions about furniture, other comments made by students in both surveys included the need for increased numbers of games to keep their knowledge and skills up to date. One student commented in the creative environment survey “perhaps if the budget was right we could compile a list and as a group vote for the most wanted console games”. All suggestions regarding how to improve the games lounge were considered by the researchers and in particular the teaching staff of the games units. Unfortunately, the change of technology was not always a priority for those who made the decision, as equipment can become quickly outdated (Yee et al. 2007, Lemmon et al. 2007). However, if computers did not support high graphic games, they were not discarded, but rather used for playing older games or as a machine for benchmarking games created by the students. As the interviews with local industry highlighted, access to knowledge such as this was integral to the students’ professional development (Tantalas 2006, Torus 2006, Insight-Economics 2006, Blumenthal et al. 2003). Financially, students are in a precarious position to maintain an “edge” in terms of knowledge of games within the industry. As Urban and Jellen (1996 pg. 4) illustrate in their components model of creativity, access to knowledge is integral, particularly specific knowledge, which will lead to specific skill development.

Interestingly, students noted other aspects aside from technological constraints when it came to building a learning space. One student commented on the creative environment survey: “The games room doesn’t have a very relaxing vibe, I think you’d get more people in there if it looked a lot nicer”. Another student commented in the survey: “A good environment to settle down and relax for a little bit is all that is required”, highlighting less requirements for them to feel comfortable in the games rooms. The
ability to relax and enjoy the environment in addition, to the “relaxing vibe”, was conducive to “play”, which was a integral aspect in the study of games as it allowed a safe place for self expression (Lemmon et al. 2007 pg. 44). In addition, Blashki (2007) Lemmon et al. (2007), Kennewell and Morgan (2006) and Urban and Jellen (1996) all acknowledge the concept of “play” to be an important characteristic of human behaviour that, given the right stimulation, could nourish and encourage engaged learning and creativity. Playing video games was a source of exploration for the games students, particularly as, during their studies, they were trained to analyse games for the gameplay and technological innovations.

In the first survey (creative environment), we found that many on-campus students did not know where the games room was, with one comment in the survey stating, “I actually don’t even know what the official games room is”. Comments such as this resulted in a wider dissemination and use of the games lounge as a teaching space, as opposed to just a “play” space. Initially the space was intended for “play”, however students commented in the creative environment survey that there was a “need to establish rules” and “inform security so they don’t kick us out”, thus highlighting the need for a more structured approach to the use of the games room, which was modified to meet the students’ needs.

In Figure 5.4 (a) pg. 143, 69% of the students strongly agreed that sufficient resources of people and information were required. Social factor became apparent via observation of the environment by the researchers. Coenen (2005 pg. 256) suggested that to expand knowledge and creativity required an expansion of the social network. Furthermore, Paulus (1999 pg. 780) affirmed that social groups tended to be more productive in the generation of ideas. For example, students attended practical classes very consistently during their study of games. The online community discussions about games and relevant assessment were extensive, with a notable contribution in the online community by many students. In the course of 1 semester, students posted in excess of 1,500 discussions in the online community. In a unit with similar student population and demographic, often only 500 discussions were posted at most. In 2005, students and staff commented in discussions and interviews with teaching staff and other students, that aspect such as collaboration and group work were important to the development of
creativity. Teaching staff commented in interview that they felt like a complimentary factor to the CSS (Section 5.4):

“The games students participate well in class and online. I have been encouraging discussion and collaboration by myself contributing to the community, it is fun”.

It was important for the teaching staff and researcher to participate in the CSS, not only to gather data on the situation, but also to inform the CSS of any changes apparent that could facilitate creativity. The researcher easily gained access to communication structures and the way the society worked and evolved, via communication and collaboration with the games students, and it was using this approach that social elements became the biggest contributor towards their creativity. The discourse model of the games student was uncovered during the initial stages of the action research process, with elements such as “Leet Speak” uncovered as a constituent of the online community. The discourse model informed social interactions and resulted in a situational network of change within the CSS. Figures 5.5 shows the social structures, which in turn helped to uncover the discourse model. Further details of this model are discussed throughout this chapter, and specifically, section 5.4 details social aspects between students, researcher and teaching staff which helped to inform the discourse model.

5.4 Communal Approach to the Support of Creativity

Throughout the study of creativity in the Games Students, it became apparent from the action research process that social factors, including collaboration, community, supervisor arrangements, resources (such as people and information), and work group supports were a focal point in the support of creativity. The process of analysing and testing the creativity factors in-situ, resulted in “root definitions” of the CSS appearing, similar to the definition of systems in SSM. Root definitions were formed based on prior research, education about the current system, and an activism of the inquirer to find out about the situation. The researcher looked into the “purposeful activity” presented in the CSS, and grounded system of purposeful activity in literature from the IT domain (as shown in Chapter 2). To achieve a thorough investigation into the CSS, the researcher
was an active participant. Where information was gathered from participants to produce a valid action research study, trust was formed between the researcher and participants from close human proximity. In this study through the process of action research via 3 cycles, human relationships were forged, and creativity was investigated through human interaction, collaboration and influence. The following section details factors of the CSS specific to: social, community, playfulness and humour, and supervisory relationships all with a framework of dialogue and purposeful activity, as these factors were the most applicable to the creativity of the games students.

5.4.1 Social Creativity

In the first action cycle the results showed that 69% of students strongly agreed to access to people and information in their CSS. Coupled with the need for work group supports (strongly agreed by 44% of students) and playfulness and humour (58% of students strongly agreed), students highlighted their need for access to peers within a conducive and fun environment. These statistics were noted in the creative environment survey, which modified and influenced the problem situation of the CSS. The following section details further aspects which support the need for social interactions by the students, as was observed and recorded through the action research process. Specifically, how community was shown to be seminal to the game students will be discussed.

The social system of the games students is depicted within the rich pictures of Figure 5.5. In a rich picture, each role a person plays within the community exists as a node that is linked to a wider social network, which indicates how members may also fulfil a bridging function between networks (Foth, 2006 pg. 208). The description of the social system as presented in Figure 5.5 is the suggested “overt” model, and does not indicate all the implicit intertwined components of relationships. The model serves to show the communication structures avenue of influence that can be perpetuated in the games students CSS. The model was created in the second action cycle in an attempt to demonstrate the interrelated nature of communication and influence in the CSS. Providing avenue for contribution of these roles in the CSS was attempted many times during the action research process, and also because of student’s immersion within associated curricula.
The games students were at the centre of the social structure, while other members within the community included: family, friends, teachers, industry representatives and the Deakin University academic community. All of these members interacted continuously within the community, as well as interacting with the greater community that surrounded the games student. To acquire the knowledge required to build creativity, students needed to learn from “greater” knowledge in domains such as, factual knowledge presented by the teaching staff, from reading, and from task specific knowledge that occurred through participation within class. The relationships in Figure 5.5 were developed through observations of the action researcher, and through direct activities in the curricula. An example of the communication and influence from the social structures was demonstrated when students engaged with industry representatives. In SIT352 Games Production and Society a guest speaker was organised to come and speak in class about Game Design and Development. Additionally, during their final
year of studies, students would interact with industry in efforts to seek out potential employment. Through the action research process the interaction of students with members of the community, including teaching staff, friends, the Deakin community and family, became apparent. During discussions in the first action cycle, students were asked about their creative influences, with many answering “other games” and “good game developers” as their influences. In action cycle one, students did not acknowledge that their friends, family and teachers influenced their creativity, and this was particularly apparent during the beginning of the action research process in 2005 when students had only begun their degree. The trend continued through to 2008 with students only marginally expressing reliance on peers, friends and teachers. However, the idea that the “world surrounding” can be of influence to the self admitted “uncreative” game students did become a more common thread, with students admitting in discussion that: “I bounce my ideas off others, often talk to those not directly in the field, such as my family”, “I share my game design ideas with team mates to see what they think”. Games students had difficulty in discussing their creative abilities, and were much more adept at discussion in technical language dealing with bytes and bits. Blumenthal et al. (2003 pg. 17) discussed the difficulty in asserting creativity within the technically oriented domain of games design and development. Often discussions with students occurred in practical class time, or in the games lounge, and thus the somewhat public nature of the discussion may have resulted in a reluctance to discuss the topic.

The development of original ideas was the first point of creativity, and in the games students CSS this was strengthened by support for ideas from the surrounding social sphere. The notion of idea support was reinforced in the creative environment survey with this factor having a high level of strong agreement amongst students, as well as being statistically significant (as shown in Table 5.4). In the online community for the unit SIT151 Game Fundamentals (which occurred in the first action cycle) students initiated a discussion entitled “what games do you believe have unique and/ or underrated gameplay”? Students provided links and screen shots to games which they felt showed examples of gameplay, and students used their expert experience “I think”
and “In my opinion” as game players to help express details. A student comment in the forum included:

“Lets perhaps do some critical thinking of the games we play at the moment, for example for me I reckon the professional system in WoW should be more variable in the way you can play the game...”

The discussion on the topic resulted in much critique and reflection of games by each student. Pursuing discussion where the students were asked to critical think was poignant to note in discussion, as it resulted in focused and purposeful responses from students, as opposed to “banter” that did occur in online discussions. Students progressed their discussions to focus on certain genres of gaming and how those styles of gameplay were unique and different. The difficulty with creating exclusive content in video games was also addressed by a student in the comment: “it’s hard for developers to come up with original content any more though, as everything has been done already”. However, this did not stall the discussion on unique gameplay. The researchers and teaching staff captured this reflection and a point was made to always actively encourage creativity and formulation of unique ideas. Assessment during the games course often involved brainstorming of games design in groups, and then following through of these ideas into game development.

Further expression of idea support were shown in the online community often in the form of debate. An example from a SIT151 discussion illustrated a student-initiated active debate regarding the gaming console Xbox 360. As the debate moved through varied and often heated viewpoints, the students clearly acknowledged each other as valid contributors:

Student 1: “Well put John, my only problem is.....”

Student 2: “Yeah you’re right Brendan. All the hardware companies...

The students in their debate showed respect and acknowledgement of each comment, which led to students feeling that there was time to discuss their ideas, and that they would be supported. The teaching staff, often via interaction in the online community, actively encouraged a continual support for ideas. This notion was also encouraged by reflections from the industry experts from Tantalus and Torus Games in Australia. An example from an industry expert from Tantalus wrote:
“We encourage everyone to contribute, ideas in relation to every aspect that we do. We have a formal process for bringing original game ideas”.

In the industry sense, ideas were encouraged and purposeful effort was made to actively support ideas, which occurred in either formal ways (as described in the industry case), or more informal as desired by the students in their above discussion in the online community. In addition, many stakeholders had an influence on idea support. In the CSS, it was apparent that the games students required more influence from the industry practitioners. In both the surveys students made comments such as:

“I would love to hear more from people in the gaming industry. Find out things like how they got there [sic] start, what’s the most enjoyable part of their job, what do they recommend students work on to increase their chances of employment”.

This comment was re-iterated by more students:

“I would like to see more industry based information to which can be tested on [sic], I found it too basic and obvious maybe a little more industry based would be more useful.”

“I would like to know more information regarding jobs in the IT(games area) as well as other key industry concepts”

These feedbacks and reflections from students show as much as their was some support an overall lack of influence from these avenues was apparent. In addition, the comments helped to support the needs for external influences into the social structure of the CSS. The development of the rich picture in Figure 5.5, helped to show how members of the community acted as nodes in the thick fabric of social network that was a part of the games students CSS. An important consideration of this is how relationships were formed to build the social structure.

5.4.2 Relationships within the CSS

Technology, such as the online community can be used as a vehicle in building relationships, particularly with co-located students. As Weakley and Edmonds (Weakley and Edmonds 2004 pg. 241) describe, the Internet has resulted in a mindset of space and place within this generation of learners were, “space is the opportunity and place is the
understood reality” (Weakley and Edmonds 2004 pg. 241). In this study, the development of relationships was no longer reliant on location, as location was now online, and these relationships developed and deepened during the three years of study. In this study, the games students showed that in the creative environment survey results 44% of students strongly agreed to work group supports, with another 30% moderately agreeing and minimal disagreement to work group supports in the CSS.

The establishment of relationships in this study was achieved via a multimodal collaborative approach through articulated interaction via action cycles by the teaching staff and researcher within the student cohort. Relationships were formed via face-to-face practical’s and lectures, and within the online community. The online community resulted in students connecting over a large geographical area, with practical’s allowing more local community to form. Students commented in the sense of community survey the reason why they used the online community:

“The fact that there are others like me out there. My tutes were full of stupid buggers who for the presentations would do EA games and need for speed when researching a company/game that pushed the envelope. These students where [sic] the reason I never went to tutes and the reason I only used discussions”.
“Nothing better than discussing games with fellow gamers (people get passionate about their favourite games/genres)”
“Being able to share opinions with other students, especially students at other campuses”
“Just sharing opinions with others”
“I believe communicating with students is a very important aspects of studying, the forum is awesome”
“Students with interest similar to me”

A discourse analysis of the online posting and also discussions from practical classes (during the first action cycle) recorded by the researcher with students showed that students referred to “fellow” gamers as the ones they get along better with. Strong meaning was placed on having a common ground amongst students to form relationships. A student commented in the online community for SIT151 Game Fundamentals: “I obviously get along better with people I have more in common”.
Examples from the online community illustrate this interaction and reliance upon their peers:

“Anyone heard of guild wars? Its an MMORPG. that is soon to be released that is similar to WoW”...(Another student continues the discussion) “Can you post the link here? I would like to see it. Sounds interesting”.

“Anyone heard of Grim Fandango (spell check). I heard it’s a pretty good game, weird but a good addition to an adventure games fans collection”.

Student discussions such as these not only extend to their knowledge, but also assisted to build relationships within the community. The forming of relationships for the games students began in their first year of studies, and was supported by mediums such as the online community. “Relationships“ that were formed between teachers, researchers and student were deemed “supervisory relationships”.

One of the important initial relationships to conciliate in the CSS was that of supervisory arrangements. In the creative environment survey, 19% of students strongly agreed, 33% of students agreed with 30% responding neutral on supervisory arrangements. This result indicated that some students did not have a strong opinion on whether supervisors were important component of a CSS, or they did not understand the survey question. However, the descriptive statistics also highlight that the results were statically significant, thus indicating a need for “negotiated” supervisory arrangements in a CSS. Supervisory arrangements were found to be rather a “supervisory presence” in the CSS rather than functioning as a facilitator who directed every move of the students within the environment. A way of describing the presence of the teaching staff within the games students’ environment is that of a mentor or a mediator (Blashki 2002 pg. 37). Perceptions of power can be at risk of being accepted uncritically within a community where students and staff collaborate, as it can be assumed by students that the “teacher” is the authority. Therefore it was imperative for the teaching staff to regulate their interactions to become members, rather than leaders, within the community. Within the online community, teaching staff and researchers had to negotiate and demonstrate their approach and feelings towards communication and collaboration. The teaching presence had the explicit purpose to facilitate the learning experience through elements of interactive structured discussion (Volpentesta and Frega 2006 pg. 4).
Whilst the games students had previous experience with the online discussion forums because of enrolment in other subjects, such interactions were invariably facilitated by staff, and for the express purpose of discussions about unit related content only. Thus, each student enrolled in the games unit automatically became a member of the community. A potential problem with automatic participation is that the students may assume that they are required to participate in the community as a compulsory part of their studies. However the teaching staff clearly indicated the intentions of the online discussions early on, with the students very quickly catching onto the premise of the discussions. For example:

> “Feel free to use this area to your advantage to discuss various games, present your views on the construction and quality and how they might be improved. We will not be moderating the discussions, but hopefully contributing, if you all let us!”

This example of teacher-motivated freedom and agency sets the scene for the discussions within the online community. Relationships were formed due to the welcoming natures of the online community for casual discussion.

In the initial stages of the action research process, and particularly when dealing with first year students, it was observed that a role-play most simply identified as factions of “us” and “them” was occurring. Often the games students assumed the role of an all-knowing “us”, with others having not yet proved themselves within the community being seen as “them”. More often than not, the researchers were seen as “them”. This indicates that a games students’ bond with their fellow students was strong, while staff playing the supervisory role within the community, often received comments to exclude them from the game students’ community. For example, this student was responding to the researcher’s attempt at making a joke:

> “Holy crap I worry about your level of maturity”.

The student did not comment on jokes made by the other students. This excerpt implicitly defines the boundaries between the games students as the “real” community members with the “newb” researcher not yet accepted as a “geek” within the community. Essentially, and initially, the researcher occupied marginal status in the social structure of the online community. This type of incident demonstrated that with
Generation Y games students, irrespective of the “outside” authority a member of the community may possess, were still required to establish themselves as a worthwhile contributing member of the community. The technology of an online discussion board allowed each member of the community to clearly view the contributions of others. Levels of authority were not indicated in the online discussions, therefore removing (to an extent) the notion of an authority, however teachers and researchers needed to earn the right to engage in the online community in anything other than a teaching role. The dichotomy of “us” and “them” were not just present between students and staff, but also between students themselves. As alluded to previously, the passion that students had for video games was often very strong, and with this passion, segregation in the community could occur. In the online forum for SIT151 Game Fundamentals in particular, students exhibited a split in the community in that they either played or loved the video game “World of Warcraft” (WoW) or they did not. WoW is a perpetual online RPG game, in which people enact tasks and objectives often in a group (clan fashion). The game has many “addictive” labels attached to it, and is often referred to in the online community as “World of Warcrack”. In the online discussion, students constantly referred to WoW as “the best game ever”, “WoW rockz”, “playing WoW should constitute as study” with the argument from other students that WoW is “just too addictive”. The discussion forum resulted in a significance contribution from WoW players as to which character and server they play as, and how to enhance the gameplay experience. If students did not play WoW they essentially could not comment in this thread without retribution from the WoW players: “you need to get in there and experience before you can actually comment”. The factions in the community were not detrimental to the community makeup, however, as the general consensus were always brought back together over other topics such as video game censorship or technologies for the development of games. Discussion such as this showed the thriving interactions in the online community.

5.4.3 Community

In this study, the term community referred directly to the learning community of the games students as well as the greater community that surrounded each creative person.
as shown in Figure 5.4). Foth (2006 pg. 207) argued, the term community is often used as a convenient “container” by researchers and external stakeholders to refer collectively to a more or less well defined group of people.

After reviewing the results of the creative environment survey, it was apparent that social needs were important to the games students. In an effort to affirm the support of this factor in the CSS, the sense of community survey was undertaken for 25 of the Games students (as discussed in section 4.4). A sense of community index (Chavis et al. 1986) was employed to undertake assessment and evaluation. The sense of community index is a psychological assessment that breaks community down into two dimensions of learning and connectedness, which is composed of: membership, trust, mutual interdependence among members, interactivity, influence, fulfillment of needs and shared emotional connection (Rovai 2002a, 2002b, Dawson et al. 2006, Chipuer and Pretty, 1999, Chavis et al., 1986). In the sense of community index used in this study, 20 questions were posed and student responded on a 5 point likert scale (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree) (statements outlined in Appendix B).

The results in Table 5.6 indicate the individual and total scores for the sense of community index undertaken with the games students. Subsequently, the results from the sense of community survey were analysed quantitatively to produce descriptive statistics, where each survey response in the sense of community index was recorded in a 5 point likert scale, thus the descriptive statistics could be produced.

<table>
<thead>
<tr>
<th></th>
<th>Total: Community</th>
<th>Connectedness</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>N of Cases</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Minimum</td>
<td>48</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Maximum</td>
<td>82</td>
<td>45</td>
<td>39</td>
</tr>
<tr>
<td>Median</td>
<td>68</td>
<td>35</td>
<td>32</td>
</tr>
<tr>
<td>Arithmetic Mean</td>
<td>66.56</td>
<td>33.87</td>
<td>32.69</td>
</tr>
<tr>
<td>Standard Error of Arithmetic Mean</td>
<td>1.92</td>
<td>1.37</td>
<td>0.84</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>9.19</td>
<td>6.59</td>
<td>4.04</td>
</tr>
</tbody>
</table>
Initially, it was noted that the median response for connectedness (35) was comparable to that of learning (32) thus suggesting that equal elements of learning and connectedness were provided. Following the procedures and scoring system outlined in Rovai (2002b) the total score for community can be 82. Table 5.6 highlights that the sense of community index for the games students yielded a community score of 68, which suggested according to Rovai (2002b), that a sense of community was moderately supported within the situation. Further analysis of the results of the sense of community was not undertaken at this time as confirmation that community was facilitated within the games students’ CSS.

Connection to a learning community can emerge through participation. The desire for connection to the learning community by the games students was indicated in the games students’ use of, and commitment to, the environment, specifically the games lounge and online community (Nichol and Blashki 2005, 2006a, 2006b, Nichol 2005, 2007). As discussed in section 5.4.1 the professed use of the online community by the game students rose from 36% in 2005 to 72% in 2008, indicating that more students were aware and participating within the online community. This measure, however only indicates an awareness of the community, comments and collaboration by students were of higher importance. In the creative environment survey, students commented on their use of the online community:

“I regularly check the online community for info and discussion of games. In other units, I normally go there just to get important information regarding assignments, practicals and other work not documented elsewhere.”

“I use the online community as it is an interesting community of gamers from Deakin.”

“I can make friends with other students and share experience with friends”

A community is often defined and formed based on the common purpose to which the participants come together. The comments given by students shown above indicated this. In the CSS of the games students the common purpose, or community bond, was based strongly around video games. The establishment of a “common interest” is regarded highly in the literature as integral to community (Dawson et al. 2006 pg. 130, Rovai 2002a pg. 322, 2002b pg. 200, Martins 2006 pg. 284). The topic of video games was a
naturally interesting, motivation and challenging topic of study for games students’. The teaching staff of the game degree exploited the student’s natural recreational affinity within games, to engage them in learning and provide them with a challenging and stimulating work environment. Section 5.4.2 details how relationships were formed over this common purpose, with many students commenting on how they enjoyed engaging with those who have the same passion about games. Further comments expressed in the creative environment survey show a similar commonality:

“I like the overall approach of each student’s involvement. For years I thought that computing was so separate from gaming, but after the introduction of the gaming units I found my interest and also realised that I was not alone”.
“People with similar interests”
“Just sharing opinion with other people”
“Interested in what other Deakin gamers talked about in there”

Sharing of knowledge and information amongst peers in a community was very valuable for the games students. For example, one student noted in the online discussion:

“It’s good to see that I’m not the only one who loves games. There’s a lot of good web links and insights that fellow gamers can give”.

Students in the creative environment survey commented on the facilitation of the online community:

“I regularly check DSO for info and discussion of games. As for other units, I normally go there just to get important information regarding assignments, practical’s and other work not documented elsewhere.”
“The discussion forum is a place to chat about topics that I’m interested in, I wouldn’t normally just chat in other units”.

In addition to comments such as these, a discourse analysis of the online discussions from SIT151 Game Fundamentals indicated that students enjoyed discussing relevant gaming hardware and software with their peers. Students engaged in a comparison of gaming hardware with posts including: “what gaming systems do you own, and which is your favourite”, to which a good natured debate continued about whether playing games on a console or a PC was more favourable. It was noted in the discussion that listing the systems that you own was somewhat of a status symbol of “gaming experience”.

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Students recommended to other students that they “have to buy all of them (consoles). Each system will have its great games”, and that “I reckon you can’t ever have enough”. Students debated over the pro and cons of related gaming technology, and engaged with each other in a detailed manner, while they justified and corrected the information in posts with a collegial approach. It was also interesting that in a discussion about gaming hardware, the students moved chronologically through discussion of technology, starting with “older” technology moving towards current day. If a student interjected with a comment about new technology when the debate remained about old technology, that student would be reprimanded: “this discussion inst about what next generation consoles will suck, but about what we like about current technology”.

Significant meaning was placed behind discussions on topics about gaming hardware, and experience of these technologies came from self initiation, before being supported by links and other research on the matter. The discussions, while not specifically related to assessment, enabled dialogue that aided in building community for the games students. Dialogues in the online community continued towards assessment–related topics, with students starting a thread in the online community of SIT151 entitled “Choice of game for assignment 1”. Students requested of each other, information on what games they were going to review for assignment 1, with students starting the thread with “I’m just curious”, and “Is it alright to study”. Students became “authorities” of the choice of game, with students essentially asking for approval of choice from their peers. Students responded with “It’s good to pick something different than the norm” for the assignment and “nothing can beat a classic” as another example of student dialogue. The discussion showed a process by which students determined their choice for assignment 1 via collaboration and support with their peers. It was also interesting to note that students formed groups in the discussion either towards choice of analysis of the popular game World of Warcraft (WoW) or choice of one less fashionable, where they debated about the reasons for and against the analysis of this game. The discussion in itself resulted in critique of how to analyse of game, which was a useful endeavor for the students in their learning (in addition to actually completing the assignment task).
Leveraging off the common purpose developed within the community, students where asked what other type of discussion/area they would like to have available in the online community, one student commented:

“I’m into quite abstract, unique games, so obviously that is the type of thing I want to talk and learn about”.

“All discussions in student talk are about ‘pop’ games, I can’t learn much about them as they are talked about everywhere and are all basically the same. Plus my interests lie in abstract, unique games that few people have heard of”.

“A section specific to games development would be nice e.g. resources to go to, people could share their own games, talk about various engines etc”.

“One that goes in-depth about the new games in dev. Discussing the hardware and software they are being designed for/with, etc.”

“Console specific discussion”

“Research websites”

“Online messaging with the lecturers for help”

“Gaming Industry”

“Kinds of Jobs “

“Sharing of own games, talk about various engines”

These suggestions were important to engage within the pursuit of building creativity and learning specifically for the games students. Suggestions such as these were used to modify the content of the online community, such as the teaching staff enacting an area for specific discussion about “unique games”. However, some changes that had been suggested by students were more difficult to enact. For example, a student commented in the sense of community survey quite strongly to the importance of diversity in assisting creativity:

“It would be really good if we had a more diversified lot of students to study with. Pick people with CREATIVITY because that is what seems to be lacking in the industry the most these days and these students demonstrate their lack of creativity and that bored me and the other 3 people in the tute who put the extra effort in”.
This feedback via the survey showed the student dissatisfied with their peers and the feedback they obtained from interaction in the practical class. It was important that the online community provided a more diverse subject group of discussion to allow all students to potentially engage. It was particularly encouraging to note a student refer to the notion of creativity, as games students often avoided the concept creativity, as it was perceived as more abstract and not applicable to the area of games design and development.

Community was not present only in the online form. In class, students engaged daily with regards to games, and enjoyed sessions of gameplay together in the games lounge. Students commented in the creative environment survey with regards to their use of the online community:

“There’s never been an occasion where I’ve needed to ask a question over the forum. Sometimes it’s convenient, but I feel that most of the time it’s an annoyance, having to wait for a reply. I prefer to ask questions in person”.

“I see no point, I don’t have any troubles or queries”

Face-to-face interactions remained important to the learning of the games students, as shown in this feedback. Additionally, students noted the importance of these face-to-face communications, particularly when working on something of importance such as an assessment. Students commented that “I prefer face to face communication when given the opportunity”, “Speaking just much more efficient”. Communication via face-to-face means was provided and encouraged wherever possible. The inclusion of the online community did not cease face-to-face consultation time in lectures and practicals for students and staff.

The factors that build creativity in an environment were highly interdependent, and their inclusion were required for mutual support of other factors. Community indicates the negotiation of access and building of trust in order to encourage participation, such as community and trust. In the creative environment survey, students moderately agreed (30%) that trust was important to facilitate creativity, however from further investigation it was seen that trust was integral to facilitate other factors of the creative environment, particularly social factors, and was also found to be statistically significant. Mathisen and
Einasen (2004) argue that when an environment makes the creative person feel safe the creative ideas are more eagerly expressed, as ideas that are ridiculed are seen as an indication of failure. Rovai (2002a) further emphasised, with safety and trust comes the willingness of community members to speak openly. These notions of safety and trust within an environment, particularly one that exhibits community aspects such as in this study, are not easy to implement. However, it was interesting to note one student’s comment in the creative environment survey, regarding “The environment surrounding you when you are doing University work should provide a showing of trust and the ability to be open” was “pretty obvious” and that “not many people would disagree with that”. Members need to be made a part of the community for them to feel safety and have trust, and for members to be creative and show risk, they must establish this trust. The community of the students who study games, was established via a learning environment, thus a similar purpose and direction, which was to be a part of a learning community about games. This similar purpose is a contributor towards building trust and community.

The difficulty of providing a community that caters to all its members is not easily resolved as it is the very differences in opinion and values that ensures a community remains interesting. The use of technologies such as an online community allowed these differences to be explored and explained. The online community of the games students exhibits attributes that are both unique and successful; such as increased participation in comparison to other units, high post levels, and a myriad of discussion topics which all contribute to its success. Community was supported and sustained via students, supervisors, peers and technology. A final creativity factor which helped to support relationships and community was that of playfulness and humour.

5.4.4 Playfulness and Humour

In the community of the games students, one factor that stood out largely from observation and discourse analysis was that of playfulness and humour. Urban and Jellen (1996) defined in their components model of creativity that an environment of playfulness and humour helps to facilitate motivation, trust and tolerance. Ekvall stated “a free relaxed exchange of ideas and an atmosphere where humour is common is a
characteristic of innovation within an organisation” (Ekvall 1999 pg. 406). Students strongly agreed (58%) or agreed (27%) that playfulness and humour was required to be a part of a CSS of the games students. In addition, the descriptive statistic for playfulness and humour was statistically significant.

On many occasions the researchers, staff and students of the games units used humour and playful behaviours in the online discussions. Initially, students engaged particularly within the online discussions in much more formal fashion. However, based on the interactions and influence of the teaching staff and researchers, the nature of the environment became much more relaxed (as discussed in section 5.4.2). The playful behaviour also stemmed from initial interaction with the teaching staff, who offered a warm and welcoming introduction to units. This essential “confirmation” of playful behaviour was thus facilitated strongly by students.

An example of playfulness and humour was shown within the focus of a game called Myst. The teaching staff focused on the game of Myst extensively during the teaching of first year units. Myst is an adventure based game, which is not a popular genre of gaming amongst the majority of students. One student inserted a thread on the online community entitled “Myst IV” with a picture from the comic “penny arcade”, a witty comic/ commentary of video games and technology. A student replied to this post “That’s totally awesome, This should tick Kathy [teaching staff] off”. Students often initiated jokes in the online community, making a parody of the fact that academic staff are titled “doctor”. The joke received a reply from the Professor (about whom the joke was parodying) relating a humorous story designed to entertain the thread participants even further. One student revelled in the relaxed and fun contributions made by their professor: “LOL – that made my day. Doctowned!!”

The term “doctowned” can be translated to Doct-owned meaning the Professor (Dr) provided a good joke and essentially won this round in providing a better joke than anyone else. In other instances, after staff had been assimilated into the online community, they were vigorously defended by the students for their actions. For example, in one discussion a student initiated a thread pointing out the spelling mistakes
made by a staff member in a number of lecture presentations. Another student stepped in before the staff member could retort, saying:

**Student:** “I’veae him anole his a gemar!”

(Translation: Leave him alone he is a gamer!)

In maintaining a sense of community and interdependence that supports the CSS, humour and playful behaviour was used extensively by the games students, where both students and staff interject with humour and playful behaviour on many occasions within the CSS. Interestingly, humour relies on timing for its delivery, yet in an online medium where communication is asynchronous, the effects of humour were not lost. On many occasions in the online discussions, playful behaviour was used as a means of introducing oneself to the community:

**Student:** “I missed my first lecture and people are talking about WoW...like wow... I don’t have the game but it sounds really good...well I’m just playing solitaire but I think it’s the most exciting game...*jokes*”

This is another example of the support that the environment provided the games students with, not only to have fun and build relationships with their fellow peers, but also to permit them to contribute in a safe comfortable environment. The relationship between staff and students, on all other occasions where humour was not involved, was treated with respect. The games students thrived on the enthusiasm and commitment demonstrated by the staff within the community, once they were past the “newb” status, and thus engaged more deeply with the learning content. This energy and motivation within the games students was a factor that contributed to harnessing creativity within each student.

The students thoroughly enjoyed this playful discussion with the lecturer, and it was supportive casual discourse such as this, which provided students with the confidence to approach other topics of study with their peers and teachers in the virtual community. In addition, stronger social structures were formed within the community of the games students (as shown in the social diagram of 5.5). Playfulness and humour were established within a process of dialogue. The specific dialogue as presented in this section was important to highlight as it detailed the interactions and constructions of relationships and community in this study. Dialogue helps to establish social within the
CSS. The breakdown of influences as shown in this chapter is concluded by a reflection of the changes made in the CSS based on the process of AR. Without the focus on dialogue, the process of change in the CSS would not have been explicit, or democratic within the games students.

5.5 Changes to the CSS

For any action research process to be considered successful, positive change had to be noted, and this process of change needed to be conducted in a democratic and thorough way. This chapter has discussed the democratic processes enacted within the CSS and has highlighted areas in which changes were perpetuated. In summary, the changes have been listed below:

1. In the learning and CSS for the games students, more input from external sources such as industry experts and personal from other skill areas (such as arts) were included over the course of this study. A continual process of including industry contacts and links to other disciplines to keep information up to date in a rapidly changing discipline was a consideration.

2. Technology requests by students were a part of a continual process of change. An imperative was placed on the constant update of technology based on the feedback from students. It should be noted however that a deficiency of expertise in video game technology at universities reflects the situation of the game developers in industry, who are required to mitigate the constant dilemma of technology changes (Lemmon et al. 2007 pg. 45, Parberry et al. 2006 pg. 511, Shaffer 2005 pg.105, Tantalas 2006, Torus 2006, Yee et al. 2007 pg.28). Technology that students required largely included computers and games toolkits (such as the Unity Engine and Cry Engine 3).
3. The various environments incorporated into the CSS (i.e. games lounge and online community) required aspects of “rules” to be placed so as to maintain aspects of structure towards a formal learning situation. Particularly environment such as the game lounge required rules and supervision (in the form of teacher and student) to allow the environment to be used for work, and not just play. An articulated approach to use of the environments was required.

4. To allow for avenues of creativity, a change to the forms of assessment for students was required. More flexible forms of assessment in the study of games allows for students with varying forms of creative processes to be supported. The varying forms of assessment were shown via students feedback with regards their learning community. Having more diversified projects, and scope for creation of games from the students game design perspective were required. Continually modification of assessment will ensure.

5. The online community required contribution and updates by the teaching staff. Based on reflections by students, the online community required specific discussion areas such as “unique games” to allow all different types of students to be supported in their discussions. Students were typically accustomed to only one discussion area, entitled student talk, in other disciplined areas they studied. However, the available discussions were extended and the conventional student talk discussion forum was used to promote the changes. In designing these additional discussion topics, the researcher also enforced some rules of discussion that each student read upon entering the discussion. The researcher also contributed to these discussions and played an active role as a tutor and peer. The lecturing staff of the games units also undertook this contribution ensuring teaching staff for the game units were included in the discussions. A continually change and update of discussion topics makes the online community thrive, rather than becoming stale.
The final section in this chapter presents a prototype model of the CSS of the games students. The model attempts to explain the creative influences from the surrounding environment of the games students, and is only in prototype stages of development.

5.6 A Creativity Support System Model for supporting Social Creativity

In the presentation of the games students creativity it was apparent that certain aspects were prominent in their influence. In the game students situation it was observed that in regards to sufficient resources each students utilized material and facilities or people and information on a continuum. In addition, students also moved from independent to interdependent support of their creativity from the CSS, as they grew, managed and negotiated their learning process. As students negotiated the CSS they nurtured their creative energy in a myriad of ways such as via: personal motivation, social, exploration of individual. The resulting outcome of this reflection produced the model as shown in Figure 5.6. This model is based specifically within the games students’ situation, however may resonate in other learning situation or organisations where large groups have to come together to form communities and collaborate towards a common goal.

From the literature, results of Chapter 4, based on observation, discussions and interviews with students, the four quadrants emerged: personal motivation, social, exploration and individual. The quadrants are within two axes; on the vertical axis the factor of independent and interdependent is plotted. Some students thrived on constant collaboration and building of ideas, with others contributing less and taking what they needed out of the CSS to build their creativity more individually. On the horizontal axis, the factor of sufficient resources: materials and facilities and people and information are plotted. The second level of creativity that occurred within the games students CSS was on the level of sufficient resources. Defined on the horizontal axis, students made use of technology, for example PC’s and software, and/or made use of people and information. These factors are plotted on the model in a way that best allows the varying degrees of creativity exhibited by students to be displayed.
This shows that the level of creativity that occurred with each games student of the CSS was either on an independent (individual) or interdependent (social, with others) basis.

![Figure 5.6 Model of the CSS](image)

When thinking about how each student fits into this creativity model of Figure 4.6, the intention was not to define the cohort of games students as points along either the horizontal or vertical axis, rather it was to show the varying degrees that creativity can occur individually in each games student. Students will be a combination of many of the factors in the model, however in some way each will always skew towards one factor. Therefore, for completeness of the model, it can be assumed that students can be “plotted” on the diagram along either axis or within a quadrant. The varying degree to which the students use that factor for creativity can be explored. However, to better understand the model, some examples of students and how they fit into the model will be presented:

- Example 1: Games student A uses the CSS to gather information and knowledge on the topic area of video games. When using the CSS the games student uses the technology and information available to them to explore. They are self-driven and do not rely on others to facilitate their
interactions and creativity in the CSS. These types of students map into the lower left hand quadrant, and are independent yet explorative students who use materials and facilities of the CSS to broaden their creativity.

- Example 2: Games student B uses the CSS to gather information and knowledge on the topic area of video games. When using the CSS the games student uses technology, materials and facilities to build their creativity. Personal motivation is gained from use of the CSS, and collaboration with peers via the CSS suggests an interdependent relationship between the student and the CSS. The student needs the CSS not only to give them knowledge, but also to support their efforts and motivation. These types of students map to the top left hand quadrant, and are interdependent on the CSS to provide them with motivation to seek information and use the materials and facilities of the CSS.

- Example 3: Games student C uses the CSS to socialise and discuss information and knowledge on the topic of video games. When engaging within the CSS the games student interact with people and information within a social context to build their creativity. Elements of community are important for socially oriented students, and therefore an interdependent relationship between the students and the CSS is apparent. These types of students map to the top right hand quadrant, and be socially dependant on the CSS to provide them with people and community as a source to gather information.

- Example 4: Games student D uses the CSS in an individual manner, to gather information and knowledge on the topic of video games. The student does not need to engage socially to gather knowledge, and uses the information available in the CSS to build their creativity. These types of students would map to the bottom right hand quadrant, and be individual and independent within the CSS.
It cannot be asserted what is the correct “level” of creativity that needs to occur within each student. Moreover, this model serves to show that creativity can occur in many varied forms, and all these forms can be supported by a CSS that is designed, managed and facilitated for its users. The correlation and combination of how the creativity factors interact within another CSS will inevitably be different, and require time to substantiate what creativity factors are appropriate.

5.7 Conclusion

This chapter has presented results and discussion that look into the creativity of the games students. The creativity presented in this study was occurring within a learning environment, thus this chapter discussed the combination of creativity and learning via “purposeful” activities. The setting in which creativity occurs was influential for continuous support of creative endeavours, with the results for creativity grounded within an influence from industry, teacher and student interviews. Further support of creative abilities within the games students was determined via the facilitation of social factors within the environment. A discussion on the importance of supportive relationships and community was given, which helped in forming the “Model of a CSS” as shown in Figure 5.6. The results and discussion in this chapter show that a successful combination of person, place and process can build “everyday” creative skills, such as those required by the industry experts. Research questions focused on the person (research question 1), the process (research question 2), and the environment (research question 3) all working in combination to provide an experience. Chapter 6 concludes this study and highlight in further detail how the research questions were addressed to build creative potential for the games students.
6. Conclusion

This study utilized an action research approach to investigate the problem of building creative potential for the game student. This study identified the learning environment of undergraduate Information Technology (IT) students who study Game Design and Development. Games students were selected based on their requisite need to build creative skills.

Within the action research approach the aim indicated the problem situation of the game students which was: to build an environment (a CSS), which had the potential to increase their creative potential. Research question 1 specifically asked: *What is the creative potential within the students who study games?* The CSS for the games students was a purpose built installation that combined factors of learning, creativity and environment to provide an influential experience on creative potential for students. Through a combination of learning with peers, interaction with staff and the addition of the student’s experiential learning that they bring with them, that which Schöno refers to as “background learning”, the students learned to negotiate their way through the creative world of learning, which allowed them to face the world at the end of their games degree. The world at the end of their games degree is an environment of both dynamic technical and creative skills. This study helped to address the required industry skills of games students by addressing research question 2: *What creative skills are expected of games students by the relevant employing industry?* Results indicated that a flexibility and adaptability to change and rapid technological advances were creative skills for games students to possess, as well as the ability to build ideas and also work in teams. The industry experts solidified the expectations of graduates and highlighted gaps such as a need for collaboration and team work, aspects in which University education in games needed to address.

A significant component of this study was the testing of 23 factors of creativity. These included:
1. Resources: idea time, idea support, challenge and involvement, sufficient resources including: materials and facilities, people and information

2. Personal Motivation: trust and openness, tolerance for uncertainty and ambiguity, playfulness and humour, leadership (includes status quo and political issues), energy, absence of interpersonal conflicts, focus, direction and goals


4. Social: supervisory arrangements, diversity, experience and skills, work group supports, team work (collaboration), community

These factors were assessed and tested in-situ with games students in an attempt to answer research question 3 of this study which was: How can the current learning environment for games students at Deakin University be enhanced to facilitate and encourage the creative skills of the games students to increase creative potential? The results and discussion as presented in chapter 5 indicate that creativity was affected largely by social factors.

So, what is creativity? Creativity is the successful combination of the factors: person, process, and product within a meaningful environment. Creativity is difficult to learn, (Blumenthal et al. 2003 pg. 17) and in particular, proved difficult for the games students of this study who were more comfortable dealing with numerical bits and bytes. The ability of the games students to recognise and harness their own latent creativity was not readily apparent, particularly initially during their degree. The creative process of the games students could be considered as immature and innate, as the students who were the focus on this study were still developing their knowledge and creative skills via tertiary education, and had not had time to practice their creative endeavours on a wide audience. This study has shown that the embodiment of certain creativity factors (resources, personal motivation, exploration and social) can have an impact on the
facilitation of creative skills within students. The specific nature of creativity remains a concept difficult to define, but this study has contributed to the body of knowledge on creativity by detailing an exploration of specific creative acts (as addressed via answering research question 1), and how the social and educational situation supported endeavours.

In the study of creativity in the games students was the need for communication, language and setting to support their activities. Initially in the action research process, 16 factors, which could influence environmental creativity, were tested. However, there was a lack of questioning regarding social factors such as community and relationships. From the first action cycle it became apparent that creativity was not just individual, but also collective for many students. Attributes to describe generation Y, as well as influence from the literature, further asserted the requirement for social factors to be assessed. However, in defining the games students’ creativity, models such as Urban and Jellen’s (1996 pg. 4) componential model of creativity (Figure 2.2) were important as they illustrated considerations when trying to educate and facilitate creativity. This model was assessed initially (as well as other models as shown in Chapter 2) to understand the process of creativity, and the focus was on building creativity within the individual, yet processes from local and wider communities influenced the model. As the researcher became more involved in the action research situation, it became apparent that the model influenced the type of games students’ created. From immersion in the action research situation, the researcher observed that students (in their creative pursuits) were not functioning in the pursuit of building their own individual creative skills, but were strongly influenced by their peers, teachers and colleagues in the creation of games. The researcher observed continued participation in classes by game students, drawn by the fact that they could attend class with supportive and engaging peers. Aspects of assessment such as formal presentation of games ideas also helped in fuelling the desire for attendance and discussion on games. The natural ability of video games to provide a common ground for learning, creativity and community was paramount in this study.

The discussion in Chapter 5 showed that collaborative and “democratic” approach in determination of the research agenda, allowed for a meaningful investigation into
addressing the problem of the situation of creativity for the games students. Without a
democratic approach to knowledge acquisition and CSS design the action research
process as employed in this study would not have processed through cycles of activity to
effectively address the issue of creativity. As shown in Chapter 4, students became
social actors within their learning environment contributing daily to its formation and
maintenance. The building of community was based on the forming of relationships
specifically trust between the students and researcher/ teaching staff. Chapter 4 provided
examples of how trust was integral in the building of relationships, and with trust
student’s felt that they could express their creativity through, debate, reflection, idea
time, idea support, engagement, energy, focus, direction and goals, and playfulness and
humour. In addition, trust assists each student to reflect upon their individual abilities,
ideas and interactions within the CSS. Trust in peers and the teaching staff ensured that
the games students’ community was a supportive and nurturing environment for each
student to harness their creativity and build knowledge. For example students engaged
within the community quite actively in many discussion topics. This active discussion
also resulted in students instigating feedback about their studies:

“Kudos[sic] to Deakin for actually creating a course/unit that stimulates the
ture desires of its computing students. I always envisioned software
development would have game programming. I was glad to experience”

This comment appeared in the online community during a discussion between students
about what they were studying at Deakin. The discussion was without any influence
from the teaching staff or researchers, thus the desire to highlight the comment given by
the student as it encompasses the passion that many students had for studying the topic
of video games as a part of IT.

Levin and Martin (2007) argued that “a central duality in action research is a pair of
goals, one to create social developmental processes aiming to solve pertinent local
problems and the other to, at the same time, contribute to the body of scientific
knowledge” (Levin and Martin 2007, pg. 221). In this study the local pertinent problem
of games students creativity was of focus, however creativity was tested within the body
of knowledge about CSS. Thus, generalisations about the construction of future CSS (in
various contexts) can benefit from the discussion on implementation of the CSS for games students. An integral conclusion of the action research process for the games students was the presentation of change as well as future plans for the teaching of games at Deakin University. Section 5.6 summarised aspects of change that occurred in the learning environment and CSS of the games students based on influence from action research. However, this report is not a final account of the total changes made in the CSS, but merely a snapshot of changes that were implemented at the point at which this thesis was written. Change is a constant process, and based on the work conducted in this study, will continue to be an active and ongoing process in the CSS. The teaching and learning in Games Design and Development at Deakin University will continue, thus the need to continue support of the CSS. In addition, future research into the CSS is an imperative in order to continue exploration into the support creativity.

### 6.1 Future Work

The knowledge domain on CSS is relatively new and thus there is still much to learn. Many areas of future work have been identified based on the results and discussion in this study, which include:

1. A sample of the 23 factors within other environments, such as corporate and private organisations, primary and secondary schools, and modern working environments. These studies will further ground the finding presented in this thesis about creativity, environment and CSS.

2. Further assessment of creative people (i.e. individuals in practice) needs to be conducted. Some research such as the COSTART project, conducted at Creativity and Cognition Studios (Candy et al. 2004), shows examples of individuals using technology as a method of creating art assets. Further research would help develop our understanding of the influence of technology upon the person, process, product and environment.
3. More research into the assessment of valuable creative “products” needs to be undertaken. There is minimal literature on a video game being a “creative product”, and this knowledge would contribute to the debate on creativity in that a framework for the assessment could be established and testing in unison with factors of person, process and environment.

4. Development in regards to CSS and learning is needed to compare traditional teaching styles (as discussed in Chapter 2) with that of more modern teaching styles such as the immersive learning pedagogy and constructivist theories. How the level of creativity may differ when comparing different learning pedagogies is as yet unexplored, as not only does it apply to university education, but also primary and secondary institutions.

5. Further to the assessment of creative people, more research needs to be undertaken in situations of collaborative creativity. Candy et al. (2002 pg. 97) argued that by understanding the factors that influence collaborative creativity we may devise ways to promote and enhance creativity and build a foundation for the development of computer based tools and systems that augment the creative process. Collaborative creativity in situations with small teams, as well as larger communities of people needs to be undertaken to allow more thorough testing of the creativity factors.

6. Further research needs to be undertaken in the development of artificial intelligence/ forms of artificial creativity. By the investigation and application of artificial forms of creativity, we can continue to articulate what its means to develop the creative process by the support of technology. Only through a thorough understanding of creativity, will aspects of artificial intelligence even be considered to produce any semblance of a creative product.
References


Checkland, P 1999, Systems Thinking, Systems Practice: Includes a 30 year restrospective, John Wiley and Sons, Chincester.


Dewey, J 1938, *Experience and Education*, Kappa Delta Pub, USA.


European Commission 2002, User-Friendly Information Society, Scenarios for Ambient Intelligence.IN ISTAG (Ed.).


Friedman, V 2001, “Action Science: Creating Communities of Inquiry in Communities of Practice”, in P Reason and H Bradbury (Eds), Handbook of Action Research, SAGE Publications, London, pg. 131-143


Gillham, B 2000, Case Study Research Methods, Continuum, London


Heath, R 2006, Please just F* off it's our turn now, Pluto Press, North Melbourne.


Pears, G 1993, “Teachers of gifted and talented: Are they competent?”, Paper presented at the 10th World Conference on Gifted and Talented Children, Aug 8-12, Toronto, Canada


Piaget, J 1973, To Understand is to Invent, Grossman, New York


Rovai, A 2002b, Development of an Instrument to Measure Classroom Community. *Internet and Higher Education*, vol.5, pg.197-211.


Appendices

Appendix A – Creative Environment Survey Questions

Each question within the Creative Environment Survey was answered on a 5 point likert scale, like shown above.

The environment surrounding you when you are doing work should provide a degree of freedom, so to develop new ideas.

The environment surrounding you when you are doing work should provide a sense of challenge (a sense of having to work hard on challenging tasks and important projects).

The environment surrounding you when you are doing work should provide an aspect of conflict (personal or emotional tensions).

The environment surrounding you when you are doing work should provide areas for debate (occurrences of encounters and disagreements between viewpoints).

The environment surrounding you when you are doing work should provide mechanisms of idea support (support and recognition for your ideas by mentors, teachers and peers).

The environment surrounding you when you are doing work should provide the notion of idea time (amount of time people can use for elaborating ideas).

The environment surrounding you when you are doing work should provide a degree of unity and cooperation (a cooperative, collaborative atmosphere in which there is a lively flow of ideas around a shared vision).
The environment surrounding you when you are doing work should provide a showing of *trust* and the ability to be *open* (which shows emotional safety in relationships).

The environment surrounding you when you are doing work should provide the ability for *playfulness* and *humour* (fun which is spontaneously exhibited).

The environment surrounding you when you are doing work should provide *sufficient resources* such as materials and facilities (i.e. computers, peripherals and the Internet).

The environment surrounding you when you are doing work should provide *sufficient resources* of people and information (i.e. links to people in other areas, links to industry, links to information).

The environment surrounding you when you are doing work should provide an aspect of *supervisory arrangement* (a leader or manager who sets up appropriate goals, values individual contributions, and serves as an intelligent, enthusiastic role model).

The environment surrounding you when you are doing work should provide an element of *work group support* (communication with peers who are open, trusting and constructive).

The environment surrounding you when you are doing work should provide an element of supported *risk-taking* (tolerance for uncertainly and ambiguity).

On what level do you agree/ disagree that *time pressure* should be present in an environment?

On what level do you agree/ disagree that *evaluation* should be present in the environment?

On what level do you agree/ disagree that *status quo* (an emphasis on following stated rules and/ or avoiding risks) should be present in the environment?
On what level do you agree/ disagree that political problems (excessive destructive competition, territoriality) should be present in the environment?

Do you use the discussions in DSO for any of your games units?

For what unit(s) do you use the discussions? Check all that apply.

Why don't you use the discussions on DSO for any of your Games Units?

What discussions have you contributed to (be that currently or in the past)? Tick all that apply.

Can you tell me what drew you into use the discussions on DSO?

Is there any other discussion that you would like available to you through DSO, for either social discussion about games or to help you in your studies of games?

Do you think a general games design and development discussion area should be established (that is all games units listed in question 6 have access to the 1 discussion area)?

Do you use the Games room?

Can you tell me what draws you into use the games room? Tick all that apply.

What other services could the games room offer? This can include equipment, games, notice boards or physical room features (i.e. heaters)

What of these facilities/services, that you as a games student would like available to you for advancement in your studies? Tick all that apply.
Any other comments you would like to make in regards to the Game environments on offer or this questionnaire please put here.
Appendix B – Sense of Community Survey Questions

1. I feel that students in this course care about each other
2. I feel that I am encouraged to ask questions
3. I feel connected to others in this course
4. I feel that it is hard to get help when I have a question
5. I do not feel the spirit of community
6. I feel that I receive timely feedback
7. I feel that this course is like a family
8. I feel uneasy exposing gaps in my understanding
9. I feel isolated in this course
10. I feel reluctant to speak openly
11. I trust others in this course
12. I feel that this course results in only minimal learning
13. I feel that I can rely on others in this course
14. I feel that other students do not help me learn
15. I feel that members of this course rely on me
16. I feel that I am given ample opportunities to learn
17. I feel uncertain about others in this course
18. I feel that my educational needs are not being met
19. I feel confident that others will support me
20. I feel that this course does not promote a desire to learn
21. How many of the following tools do you use on a weekly basis (check all the apply)?
22. Have you used any of the following tools (check all the apply)?
23. How many hours per week do you spend playing games?
24. How many hours per week do you spend watching television (including watching DVD/Video but not including play of games)?
25. Do you use the discussions in DSO for any of your games units?
26. Which unit(s) are you currently studying?
27. What discussions have you contributed to (be that currently or in the past)? Tick all that apply.
28. Do you think a general games design and development discussion area should be established (that is all games units listed in question 6 have access to the discussion area)?
29. Do you want the Games Room to be maintained at the Geelong Campus? or Do you want a formal Games Room established for the Burwood Campus?
Figure A1. Test for Creative Thinking – Drawing Production Part A
Appendix D - Acceptance Letters for Ethics Applications

Figure A2. Test for Creative Thinking – Drawing Production Part B
MEMORANDUM

TO: Ms Sophie Nichol
Information Technology
Geelong

FROM: Secretary, Deakin University Human Research Ethics Committee (DU-HREC)

DATE: 21 November 2005

SUBJECT: PROJECT: EC 269-2005 (Please quote this project number in future communication)
CREATIVE GEEKS: FACILITATING THE CREATIVE GROWTH OF COMPUTER SCIENCE STUDENTS USING ENGAGING ENVIRONMENTS

This project was considered at the DU-HREC meeting held on 2 November 2005.

APPROVAL HAS BEEN GIVEN FOR SOPHIE NICHOL, UNDER THE SUPERVISION OF PROF KATHERINE BLASHKI, SCHOOL OF INFORMATION TECHNOLOGY, TO UNDERTAKE THIS PROJECT FROM 21 NOVEMBER 2005 TO 31 DECEMBER 2006.

Approval for the questionnaire phase of the study is subject to submission of the final questionnaire.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the application and approval. It is your responsibility to contact the Secretary immediately should any of the following occur:
- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

Victoria Emery
Secretary, DU-HREC
(03) 9251 7123

Figure A3. Ethics Approval 1
Research Services
Office of the Deputy Vice-Chancellor (Research) (Melbourne Campus)

MEMORANDUM

TO: Ms Sophie Nichol
   Information Technology

FROM: Secretary, Deakin University Human Research Ethics Committee (DU-HREC)

DATE: 14 June 2006

SUBJECT: PROJECT: EC 47-2006
          (Please quote this project number in future communication)
          CREATIVE GEEKS? FACILITATING THE CREATIVE GROWTH OF COMPUTER
          SCIENCE STUDENTS USING ENGAGING ENVIRONMENTS - PHASE 2

This application was considered by the Deakin University HREC on 3 April 2006.

APPROVAL HAS BEEN GIVEN FOR SOPHIE NICHOL, UNDER THE SUPERVISION OF
PROF KATHERINE BLASHKI, SCHOOL OF ENGINEERING AND INFORMATION
TECHNOLOGY, TO UNDERTAKE THIS PROJECT FOR A THREE YEAR PERIOD FROM 20
MAY 2006.

The approval given by the Deakin University Human Research Ethics Committee is given
only for the project and for the period as stated in the approval. It is your
responsibility to contact the Secretary immediately should any of the following occur:
• Serious or unexpected adverse effects on the participants
• Any proposed changes in the protocol, including extensions of time.
• Any events which might affect the continuing ethical acceptability of the project.
• The project is discontinued before the expected date of completion.
In addition you will be required to report on the progress of your project at least once every
year and at the conclusion of the project. Failure to report as required will result in suspension
of your approval to proceed with the project.

Vicki Xafis
Secretary, DU-HREC
(03) 9251 7123

Signature Redacted by Library

Figure A4. Ethics Approval 2
MEMORANDUM

TO: Ms Sophie Nichol
Engineering and Information Technology
Geelong

FROM: Executive Officer, Deakin University Human Research Ethics Committee (DU-HREC)

DATE: 2 May 2007

SUBJECT: PROJECT: EC 54-2007

(\textit{Please quote this project number in future communication.})

THE 'SENSE OF COMMUNITY' WITHIN A LEARNING COMMUNITY OF CREATIVE GEEKS

This application was considered by DU-HREC on 2 April 2007.

\textbf{APPROVAL HAS BEEN GIVEN FOR SOPHIE NICHOL, UNDER THE SUPERVISION OF PROF KATHERINE BLASHKI, SCHOOL OF ENGINEERING AND INFORMATION TECHNOLOGY, TO UNDERTAKE THIS PROJECT FOR A PERIOD OF THREE YEARS FROM 2 MAY 2007.}

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Secretary immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HREC's.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

\textcolor{red}{Signature Redacted by Library}

Silvia Rametta
On behalf of DU-HREC
(03) 9251 7123

Figure A5. Ethics Approval 3
### Appendix E – Action Research Cycles

<table>
<thead>
<tr>
<th>Researcher</th>
<th>PhD Supervisor/Researcher</th>
<th>Teaching Staff/Researcher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Interested in creativity</td>
<td>- Within the learning situation, teaching, leading and administering content</td>
<td>- Discussion and interactions within the learning environment with researcher and students</td>
<td>- Discussions with teaching staff whom have entered their learning environment</td>
</tr>
<tr>
<td>- <strong>Researcher enters into</strong> the learning situation of the games students</td>
<td>Discussion about creativity and the learning environment with teaching staff and students</td>
<td>- Setup of online and face to face teaching and learning</td>
<td>- Discussions with research staff whom have entered their learning environment</td>
</tr>
<tr>
<td>- <strong>Observations, Discussion and Interaction</strong>: students in class and online</td>
<td>- <strong>Acknowledgement of Creativity in Games via Literature and Industry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Discussion and interaction</strong> with staff</td>
<td>- <strong>Investigation of Creativity in students, identification of 16 Factors</strong> from literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Defined Aims and Objectives</strong> of study</td>
<td>- <strong>Problem Situation Defined</strong></td>
<td>- <strong>Problem situation reviewed: influence of environment on</strong></td>
<td>- <strong>Interview</strong> students about Creativity: what</td>
</tr>
</tbody>
</table>

- Discussion and interaction with staff
- Setup of online and face to face teaching and learning
- Discussions with teaching staff whom have entered their learning environment
- Discussions with research staff whom have entered their learning environment
| **Discussion of initial techniques. Testing within the Learning Situation** |
| | **Documentation of Games Student Environments** |
| | **Observations, Interviews and Discussion continued** |
| | **Problem Situation Re-Defined** |
| | **Documentation of Games Student Environments** |
| | **Modification of the CSS** |
| | **Investigation into the skills needed of students by industry, interviews** |
| | **Needs of creativity express focus on relationship between creativity and social.** |

- **Discussion about creativity skills**
- **Focus on teamwork, sharing ideas and collaboration**
- **Problem situation re-defined**
- **Observation environment survey**
- **Interviews with students about their learning environment and creativity**
- **Reflections on what is lacking**
- **Discourse Analysis**
- **Administer tests of TCT-DP**
- **Administer creative environment survey**

is it? How does environment influence
<table>
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<tr>
<th>Activity</th>
<th>Action</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Researcher assesses results from previous cycle</td>
<td>Focus on social ‘community’ factors of creativity within the environment</td>
<td>- Interview student about their social ‘community’ and creativity</td>
</tr>
<tr>
<td>Investigation of Creativity in Students, identification of 23 Factors from Literature and Action Research cycle 1</td>
<td>Problem situation reviewed: influence of social and environment on creativity of focus</td>
<td>- Administer sense of community survey</td>
</tr>
<tr>
<td>Defined Aims and Objectives of study</td>
<td>Problem situation re-defined</td>
<td>- Observations with students about their social ‘community’ and creativity</td>
</tr>
<tr>
<td>- Problem situation re-defined</td>
<td>Testing within the Learning Situation</td>
<td>- What are the social structures to support?</td>
</tr>
<tr>
<td>Documentation of Games Students Environments</td>
<td>Discussion of problem situation</td>
<td>- Discourse Analysis</td>
</tr>
<tr>
<td>- Documentation of Games Students Environments</td>
<td></td>
<td>- Administer tests of</td>
</tr>
<tr>
<td>Observations, Interviews and Discussion continued</td>
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<tr>
<td>Modification of the CSS</td>
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<td>TCT-DP</td>
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<tr>
<td></td>
<td>Needs of creativity express more support for engaging environment of social and technical</td>
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