Through the LCD Glass: Investigating the Experiences of Gifted Students in a One-to-One Laptop Classroom

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Submitted in fulfilment of the requirements for the degree of

Master of Education (Research)

Faculty of Education

Queensland University of Technology

2017

Keywords

One-to-one, curriculum, differentiation, gifted, learning, activity theory, case study

Abstract

Over recent years we have seen a dramatic infusion of technology into schools and educational settings and as such, technological advances especially those involving mobile computing devices are now an integral aspect of modern education. Technology may also provide a tool for differentiating learning experiences especially for those students likely to be pioneers in the knowledge economy, namely the gifted.

Support for the identification and education of the gifted is not a new concept. Its origins run long and deep in many countries and can be traced across and influenced by historical periods such as the Cold War and the Space Race. Despite the long history of gifted education programs there are still many unanswered questions about the impact these programs have and how best to optimise outcomes for the students involved.

Currently there is real push and focus in education circles in Australia that focus on the needs of the individual and the use of differentiation across a whole class to support improved student outcomes. Education Queensland depicts this as the school improvement hierarchy where ultimately when all programs in an education setting align this will enable or trigger the opportunity for differentiated teaching and learning. Furthermore, under the Framework for Gifted Education, all state schools in Queensland are required to meet the learning needs of students who are gifted. The problem becomes apparent at this point of what opportunities can we provide for a gifted learner?

This case study focused on the experiences of gifted students involved in ubiquitous one-to-one laptop classroom where each student has his/her own laptop.

Using activity theory as a conceptual framework, the question explored the extent to which a one-to-one laptop environment interaction with a learning tool be it teacher, computer or peer, build the confidence, autonomy and set in place effective relationships that position the student to achieve enhanced outcomes for gifted students.

> "It is really not about the laptops. It's about what the one-to-one laptops enable in terms of new ways of teaching and learning" (Dunleavy, Dextert, & Heinecket, 2007, p. 5)

Qualitative data were captured from multiple sources to construct validity. The data for this case study were obtained through interviews, surveys, questionnaires, classroom observations, documents and video recordings. The data was analysed through inductive analytical processes including open coding, creating categories and abstraction.

From the study four broad findings were evident:

1. The needs of gifted students can be supported through a one-to-one laptop program;
2. That the authentic teaching environment is still paramount to the outcomes of teaching and learning;
3. That laptops provide an opportunity for gifted students to customise learning and increase engagement through self-efficacy and management;
4. That laptops are a tool that provide gifted students with the means for greater self-regulation.

The results of this research indicate that participation in a one-to-one laptop classroom can be beneficial to a student's achievement and create rich and positive experiences. However, it is dependent on how the program is structured by the teacher.

This study has added to the sum knowledge about gifted programs involving ICTs and gifted students. Further research is needed into other avenues of teaching that, when combined, provide the very best for gifted students, explicitly the distance travelled by gifted students in the later years of high school education and the impact that laptop and one-to-one learning opportunities and engagement at a primary level had on long terms outcomes.

Dedication

To my father who did not live to see this finished but always supported me.

To my wife, Annette, and to my family who have always encouraged me to go further.

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Definition of Terms

The following terms are used operationally in this study:

Ability - Grouping: Grouping students according to scores on standardized tests of aptitude, intelligence, or ability (Heacox, 2002).

ABTutor - PC remote access software that has been designed to control a number of student workstations in a computer training room - or remote location - from one central workstation. It contains a range of functionality including classroom management, broadcast and share, computer monitoring, violation notification, PC remote control, application control, question polling, file management and distribution, and security.

Acceleration - An intervention based on progress through an educational program at rates faster or at ages younger than typical (Colangelo, Assouline, & Gross, 2004).

ACMA - Australian Communications and Media Authority Commonwealth regulatory authority responsible for broadcasting, radio communications, telecommunications and online content, formed on 1 July 2005 from a merger of the ABA and the ACA.

Activity Theory- Activity Theory is a psychological meta-theory, paradigm, or theoretical framework, with its roots in Lev Semyonovich Vygotsky's cultural-historical psychology. Its founders were Alexei N. Leont'ev (1903-1979), and Sergei Rubinshtein (1889–1960), who sought to understand human activities as complex, socially situated phenomena and go beyond paradigms of cognition, psychoanalysis and behaviourism.

Bloom's Cognitive Taxonomy Model - The classification of the goals of education regarding the development of intelligence within three categories or domains: the cognitive domain (emphasizing mental processes), the affective domain (emphasizing feeling and emotion), and the psychomotor domain (emphasizing motor skills; Leonard, 2002, p. 216).

Byte Table – A circular student table with a crescent shape byte removed from one side that allows for adaptable group settings and collaborative learning.

Constructivist – Constructivist is the social construction of knowledge is one that is sometimes diametrically opposed to notions of didactic teacher-led or transmission models of learning.

Case Study - is an intensive analysis of an individual unit (e.g., a person, group, or event) stressing developmental factors in relation to context.

Curriculum Compacting- Condensing a semester or years' worth of learning into a shorter time period by providing students with opportunities to participate in enrichment, extension activities, or accelerated study (Winebrenner, 2001).

Differentiation - Curricula that differs in terms of "depth, complexity, challenge, creativity, abstractness" and acceleration (VanTassel-Baska & Stambaugh, 2006, p. 85).

Differentiated Curriculum - Courses of study in which the content, teaching strategies, and expectations of student mastery have been adjusted to be appropriate for gifted students (GaDOE, 2004).

Distributed Cognition - is a hybrid approach to studying all aspects of cognition, from a cognitive, social and organisational perspective. The most well-known level of

analysis is to account for complex socially distributed cognitive activities, of which a diversity of technological artefacts and other tools and representations are an indispensable part.

ENIAC - was an early electro-mechanical computer.

Enrichment - Curricula that expose students to ideas, interests, and activities not usually provided, along with the associated skills and opportunities to pursue them further (Davis & Rimm, 1998).

Experience – experience includes the dynamics of interaction within classrooms with peers and teachers, the way technology was used and how students approached learning activities. “Thus, it means you have gained knowledge or insight about something through that experience or event.” (Allodi, 2002).

Gifted Education - refers to systematic and intentional efforts to provide appropriate programs and services to promote the cognitive, social, and affective needs of gifted students (Purcell & Eckert, 2006).

Gifted Student – “Children and youth who give evidence of high performance capability in areas such as intellectual, creative, artistic, or leadership capacity, in specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities” (Allen, 2005, p. 3).

ICT – Information Communication Technologies

Individualisation - Differentiating the curriculum for individual students to “take into account their individual learning styles and preferences, as well as the level of achievable challenge that they need in order to stay motivated and stimulated” (Willis, 2009, p.156).

Individualised Education Program (IEP) - A written document that addresses a student's specific individual needs. It may specify accommodations, materials, or classroom instruction.

Mark1- was an electro-mechanical computer built at IBM and shipped to Harvard in February 1944.

Maker's Model – A gifted education model that incorporates strategies for the modification of content, process, product and the learning environment. (Maker, 1982).

Microsoft's Anytime Anywhere Learning – Program to ensure that all children have access to unlimited opportunities to learn anytime and anywhere and that they have the tools that make this possible.

OECD - Organization for Economic Cooperation and Development. An organisation that acts as a meeting ground for 30 countries which believe strongly in the free market system, The OECD provides a forum for discussing issues and reaching agreements, some of which are legally binding.

One-to-one – One computer per child in a classroom environment.

Pull-out Program- One of the accepted program models for delivering instruction to gifted students. Identified students leave their regular classroom for a specified period of time each week to "participate in special enrichment activities, guided usually by a district G/T teacher" (Davis & Rimm, 2011, p. 140).

Renzulli Learning- On-line program that identifies "each student's academic strengths, interests, learning styles, and preferred modes of expression…then matches Internet

resources to the student's profile" (Renzulli & Reis, 2007, p.57) and provides tools for teachers to plan, organise, and assign work.

Scaffolding- "Help that enables a learner to achieve a specific goal that would not be possible without some kind of support" (Sharpe, 2006, p.212).

Self-Regulation - Self-regulation of learning examines the process by which learners set goals, monitor, regulate, and control their learning, motivation for learning, behaviour, actions, and guide their effort to secure academic achievement.

WWW – World Wide Web is a collection of internet resources hyperlinked text, audio, and video files, and remote sites that can be accessed and searched by browsers.

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature: QUT Verified Signature

Date: November 2017

Acknowledgements

This thesis would not have been possible without the support and guidance of my supervisors, Dr. Shaun Nykvist and Associate Professor Jim Watters. I am deeply appreciative of the way in which they approached their roles and offered not only their scholarly input and time but their ongoing commitment to me and further education.

I would like to thank the participants Eamon, Hamish and Aiden and their parents for their time and willingness to share personal experiences.

This research would not have been possible without the support of my family. I thank my wife, Annette, for her support and allowing me to take up the dining table space for so many years. Your love of learning is always inspiring to me. I thank my children Ashlen and Evan and hope that I have demonstrated that commitment and dedication pays off.

Chapter 1: Introduction

1.1 Background

Molnar (1997) writes that education was built to provide two core functions. These are to "transmit culture, values and lessons from the past to the current generation and to prepare our children for the world in which they live" (p. 15). It is also within this context that Becker (2000) claims that the job of our educational system is to prepare students for life and engage students in a culturally relevant system. It appears to be a truth, universally acknowledged, that the cultures of the world have in recent years become more similar, to the point that most of us now share a global culture fused together by advances in Information Communication Technologies (ICTs) and its immediate transfer of knowledge and understandings. It may be argued therefore the leaders in this global culture are those identified as the gifted in today's schools and thus, there is a genuine and pressing need to understand how gifted students can engage with information communication technologies to achieve or fulfil their roles in a future globalised society.

Given the changing nature of society and thus educational systems, this study will investigate the experiences of three identified gifted students and how they are engaged through the use of information communication technologies in a one-to-one laptop program. It will draw upon interviews and observations with students to provide descriptions of the students' engagement with laptops, interactions with peers, motivations and achievement whilst working on class tasks. The research is important as there is currently a vacuum of studies focusing on ICTs and the needs of gifted students in schools and it will build perspective and opportunities for teachers

and institutions to provide opportunities for identified gifted students. Hattie (2010) argues that "Underachievement in gifted students is a national problem", he says, "with the proportion of Australian students achieving at the highest level in mathematics and science in annual decline since 2000, currently sitting at about 15 per cent compared to 40 per cent for those high-achieving nations" (para. 4). Furthermore, recent policy changes in education are driving both the use of technology and the needs of gifted students. In the Australian Curriculum, 2016 version 8.1[1], Technologies learning area comprises two subjects: Digital Technologies and Design and Technologies. The Queensland Curriculum and Assessment Authority (QCAA) has developed advice, guidelines and resources incorporating technologies for use in the classrooms.

Change may be a euphemism for many things good, bad or indifferent and regardless of the perspective one thing remains true; change will happen. In education, this is a reflection of its core functions. If we accept that at a fundamental level education is to prepare students for the future in a changing society then education must evolve as advances in information communications technology and society occur.

1.2 Information Communication Genesis

In a world where connectivity is promoted as a universal educational requirement all students must have access to modern learning tools and challenging curriculum to fulfil a primary function of education that is to move towards the realisation of a skill set for the next century. It has been argued by many researchers (Tomlinson 2003; Dunleavy & Heinecket 2007; Feldhusan 1982a; Gagné 2009a; Cherian 2009; Fleischer 2012) that schools need to infuse these skills to meet

[1] https://www.qcaa.qld.edu.au/p-10/aciq/p-10-technologies/year-6-technologies

community needs and student's expectations. This is important to mirror the connectivity and opportunity that modern students already have access to in the home. Anecdotally the belief is that as a vehicle one-to-one computing can provide a real-world, relevant education that can improve thinking and problem solving and ICT skills. However, whilst technological change is now occurring rapidly, even daily and possibly by the hour it has been a slow evolution into educational facilities.

In the 1940's a ripple of change began to land on the shores of education institutions with the creation of the early computer systems; Mark 1 and ENIAC. These early computer systems were found only at universities and predominately in the mathematics and science departments to aide in the calculation of complex equations. The release of the personal computer in 1981 marked the point when computers had begun their unending advance on educational institutions (Vonèche, 1983).

In the1960 paper, *Man-Computer Symbiosis*, Licklider envisaged, "A network of such [computers], connected to one another by wide-band communication lines [which provided] the functions of present-day libraries together with anticipated advances in information storage and retrieval and [other] symbiotic functions (p 7)." In 1996 this vision came true and the World Wide Web (WWW) was born. It is from this point that the push and want of computers into education grew exponentially.

Initially computers were prohibitively expensive and represented a luxury. As cost of manufacture reduced however, and the appearance of computers as a tool in the everyday world increased, so did their demand in schools. This shift to relatively low cost computing corresponds with a shift in the purpose of computers from research to instructional aide (Molnar, 1997). For the next twenty years access to computers grew over time and their use in classrooms was predominately focused on

drill and practice activities and adaptive software. Murphy, Penuel, Means, Korbak and Whaley (2001) described this software as discrete educational software that included integrated learning, computer assisted and computer based instruction activities.

Predicting the future of educational computing is akin to predicting to what will next happen in volatile world financial markets. Aslan (2011) concludes that:

> although it is difficult to predict the future of educational computing, we can foresee some of the developments that are likely to characterize the next period of educational computing, and these developments should help us in our attempts to evolve toward an ideal use of technology to support education. … we should make use of computers as the major tool for teaching and learning in a learner-centered environment. (p. 14)

Poor decisions or simple ambivalence can see excellent technologies and practices suffer whilst poor or misapplied established practices offer a safety net. Computers in a classroom need to be seen as not merely something to manage, but as something that can and will support differentiated educational outcomes for all (Chandrasekhar, 2009). Educational technology therefore can benefit from a shift in paradigms (Cherian, 2009).

1.3 Connectivity

The Australian Bureau of Statistics (2011) showed that in the 12 months prior to April 2009, the most popular use for the internet was educational activities. The vast majority (85%) of children who used the internet at home used it for educational purposes, up from 82% in 2006. A higher proportion of girls than boys used the internet for educational activities (87% and 82% respectively). Educational activities were most popular among older children. In 2009, 94% of children aged 12–14 years

and 91% of children aged 9–11 years used the internet at home for school work or other educational activities, compared with 64% of 5–8 year olds.

These statistics further show that in 2009, two in five children (42%) who used the internet at home reported that they spent two hours or less online at home per week, while 17% spent 3–4 hours online, 21% spent 5–9 hours online and 13% spent 10–19 hours online. Time spent online tended to increase with age. Of children aged 5–8 years, two-thirds (66%) spent two hours or less online per week, compared with 20% of children aged 12–14 years. A third (33%) of children aged 12–14 years spent 10 hours or more online per week, compared with 5% of children aged 5–8 years old. According to the Australian Communications and Media Authority (ACMA), in 2007, child internet users aged 8–11 years spent an average of 30 minutes online per day, with five minutes of that time spent on internet/computer based educational activities. In comparison, children aged 12–14 years spent an average of one hour and 32 minutes online per day, 16 minutes of which was spent on internet/computer based educational activities.

Distilled from an increase in connectivity, it is apparent that for students of our current education settings being online equates to being connected and being part of a much wider community (Bagley & Creswell, 2013). It is a chance to have the ability to learn flexibly, incorporate interests and go where needed, when needed in order to achieve (Gulek & Demirtas, 2005). However, questions and criticism exist as to whether mobile devices especially laptops are always used appropriately to provide meaningful or individualised differentiated learning in educational settings (Burns & Polman, 2006). The cost of infrastructure, over rapid exposure and a teacher's inability to respond pedagogically to the changing technological landscape in contemporary schools and classrooms has meant that for many it is often not the

device that fails but the ability of the system, including its teachers, to adapt (Frey & Detterman, 2004; Hooft, Swan, Cook & Lin 2007).

1.4 Gifted Perspective

Modern schools and classrooms are complex social and technical structures and depending on the model of identification, up to 20% of a school population, may be identified as having gifted potential (Renzulli, 1982; 2005). As such, meeting the educational needs of these students is and must be an important goal. However, education provisions for the gifted have been patchy at best with most programs targeted to meet the needs of the majority of students. (Jarvis & Henderson, 2014)

Schools and educational facilities are left to develop policy and processes in absence of the bigger picture and in general terms gifted students are seen as low priority (Garvis, 2009). This is further complicated by the fact that gifted students are not always motivated to achieve in line with their ability (Goodhew, 2009; Garn, Matthews & Jolly, 2010). Therefore, links can easily be made with the underachievement and disengagement of students because schools do not readily adapt programs to suit.

Gagné (2009b) argues the importance of children's school experiences in that there are catalysts, both internal and external that may have an effect on the manifestation of innate abilities or gifts as performance or talent. These catalysts include motivation, volition, self-management, events and provisions and coupled with chance, the last identified influencing catalyst, may be crucial to the success of the gifted student. Considering this, laptops may be considered as a positive catalyst to provide gifted students with the chance to learn quicker at a faster pace, reflect interest and maintain motivation.

1.5 Research Question

Through the lens provided by activity theory this study will investigate the experiences of primary aged gifted students as they utilise information communication technologies in a classroom setting. Specifically, the study will examine the experiences of students aged 11-12 who have been identified with elements of gifted and how they are engaged and motivated to achieve with a tool through the medium of a ubiquitous one-to-one laptop classroom. It will argue later that whilst there is an abundance of research on teacher ability and pedagogy regarding the gifted student, that there is a lack of research in the field that takes into account the students perspectives on what effect a one-to-one classroom has on the self-regulation of the gifted learner. Hence this study seeks to address the following research question:

What are the experiences of the gifted learner, to engage and achieve, in a one-to-one laptop classroom?

Therefore, there is a need to investigate and provide research data into the thinking and motivation of gifted students in a modern one-to-one classroom. To answer the research question, this study draws upon a social constructivist approach and applies activity theory to trace the student computer interaction in a multiple case study design.

Central to this study is the understanding of experience. If we use the word as a noun it can simply mean to have a practical contact with. If we use it as a verb we can take it from the perspective of, to be informed, to grow. Thus, it means you have gained knowledge or insight about something through that experience or event. In her 2002 case study of Swedish schools, Westling Allodi found that children's inside perspective of school can benefit our understanding of school as a social institution.

In her study, Allodi considered the children as competent informants who are able to assess their educational environments. She argues that children have important things to say and that it would benefit school and society to listen to them. From such a perspective, it is interesting to ask questions about students' experiences concerning their school situation. This is in accordance with further studies by Yonesawa, Jones, and Joselowsky (2009), who argue that students provide an excellent source of information and motivation when asked to participate and who consider young people to be thoughtful contributors to educational change, although it is not common to give them the opportunity to speak up and be heard. If we are truly trying to record student experiences, including behaviour, dynamics of interactions with others, the use of technology for learning and general approaches to activities within a classroom a strong student voice is necessary.

1.6 Research Design

This research employed a qualitative multiple case study design (Leech & Onwuegbuzie, 2009). The study was conducted in a large primary school in a metropolitan region within Queensland, Australia. The school was a coeducational facility from Prep to Year 7 (ages 5-12), with student enrolment at the time of the study at 1050 students. Four students and their parents/caregivers were invited to participate in the research. My role at the study site was that of Deputy Principal (Assistant Principal), whilst my role within the context of the research is that of participant/researcher.

The student participants and their parents/caregivers were invited to share their experiences regarding how identified gifted students engage with a tool (laptop) in one-to-one classroom and create opportunities for students to engage and achieve.

The participant researcher was the person responsible for collection and analysis of information.

1.7 Significance of this research

According to Rakow (2008) an environment that is "thematically rich and challenging" is designed to stimulate interest and motivation in gifted students (p. 44). Apart from research on engagement, there is only a relatively small body of evidence about the effect of computers in the classroom to promote this richness. There is even less evidence in terms of their effect on outcomes for the gifted student (Riley & Brown, 2001). More recently, Siegel (2013) published a paper advocating the use of technology in flipped classrooms. He argued that, "Gifted students may not be asked to view a video; they may be provided with links to various websites that will allow them to explore a given topic in more depth." The paper does not include any evidence of the student perspective of engaging in this approach to differentiation. Similarly a specialised text on the use of technology with gifted students by Lennex and Nettleton, (2015) does not address student experiences in using mobile technology.

As more and more schools begin to adopt strategies and programs to address the needs of gifted students combined with the influx of computer based education it is crucial that research be conducted to investigate the benefits of both and how they may impact on each other. Research that considers the perceptions of the students is critical.

The learning experience of the gifted student goes beyond the cognitive area and is directly linked to their emotional needs and development (Feldhusen & Wyman, 1980; Davis, Rimm & Siegle, 2011). In this regard, Tomlinson (2001) proposed that classroom differentiation should become an essential practice. It is a

strategy whereby teachers actively plan a varied approach to what students need to learn, how they will learn it, and/or how they will show what they have learned in order to increase the likelihood that each student will learn as much as he or she can, as efficiently as possible. A similar understanding has been more recently echoed by Persson (2014).

For gifted learners, three attributes have been identified as common in their learning style. They need "more information, presented both at a higher level and a faster pace" (Feldhusen, 1982a, p. 39; Heald, 2016). Gifted learners generally prefer independent self-paced learning and online courses as they enable the learner to move through the learning experience at a pace commensurate with their ability. Feldhusen and Wyman (1980) further believed that gifted education programs should not force more information down the throats of gifted students, but rather to open up as many pathways to information as possible. In conjunction with these thoughts, Renzulli (2008) believes that gifted students demonstrate high levels of task commitment when they are provided with interesting and challenging assignments that keep them engaged. It is the combination of these arguments that creates the opportunity to further address the needs of the gifted child.

From the perspective of this literature, the role of laptops and specifically one-to-one classrooms, in differentiating education for gifted students, becomes increasingly important aspect to consider. As such this study is not simply about giving a student a laptop. Rather it is proposed that within a one-to-one classroom, where a student's personal laptop is a source of differentiation, a gifted student will forge stronger pathways for engagement and learning and thus improved outcomes.

Apple Computers Inc. 2007 [2] research into one-to-one computing show students spend more times engaged in collaborative work than non-laptop students, participate more in project-based instruction, write more and access more information, and show better research analysis skills. Students spend more time with technology in a one-to-one program and as a result they commit more time and effort into the learning that occurs through their projects and collaborations. In addition students become better collaborators, direct their own learning, report a greater reliance on active learning strategies and readily engage in problem solving and critical thinking. Finally laptop students consistently show deeper and more flexible uses of technology and spend more time doing homework on computers than other students (Barrios, 2004).

However, at this time the challenge in the research of one-to-one laptop computing and outcomes for the gifted student lies in its lack on specific outcomes for identified gifted students in term of engagement, motivation and academic achievement. This research will build perspective for teachers on the potential that one-to-one computers create for achievement of the gifted.

1.8 Thesis Outline

Chapter 1 has presented the introduction to the problem, the history and background surrounding the problem, policies and approaches addressing the problem, and the nature of the study. The remainder of the thesis is divided as follows:

Chapter 2 provides a detailed review of recent literature. The background for the study is set by examining the rise and influence of computers in the modern

[2] www.apple.com/education/k12/onetoone/classroom.html

classroom and detail outcomes for computer based environments. Next the review of the literature will examine the provisions for gifted students and the implications on pedagogy. A review of the literature revealing various theoretical perspectives that may be employed in this study will conclude Chapter 2.

Chapter 3 will scrutinise the research design of the study. The theoretical perspective influencing the methodology will be detailed and explained. A synopsis of the development of the evolution of case study methodology is provided. The chapter concludes with the details of the recruitment of participants, data sources and collection procedures, data analysis and an understanding of quality and validity.

Chapter 4 provides an in-depth background profile of the three participants. These profiles offer a snapshot of each student in the classroom as well as a self-description from the participants. The chapter concludes with a summary and understanding of current academic outcomes for the students.

Chapter 5 examines specifically the use if activity theory in the classroom and provides an insight into the system dynamics. Chapter 6 discusses the findings and links this through to the central question and literature review and finally Chapter 7 concludes with a summary of the study, a discussion of the findings, and recommendations and implications for further study.

Chapter 2: Literature Review

2.1 Introduction

In the areas of information communication technologies (ICTs) and gifted students the literature directly acknowledges the curriculum design needs for gifted students and encompasses suggestions for best practice based on their inclusion in special programs that are often adrift or running in isolation from the school setting (Ivers, 2009; Jarvis, & Henderson, 2014). Shaw and Giles (2015) found in their study of gifted students in heterogeneous classrooms that students identified as gifted often receive supplemental services through enrolment in a gifted program when funds and space are available, their curriculum and instruction in regular classrooms is often provided without differentiation from that of the general population. This literature review presents and analyses the most pertinent studies in the areas of teaching the gifted students through information and communication technologies within a school context.

The aim of this study is to investigate the experiences of primary-aged students as they utilise ICTs in a classroom setting. Specifically, the study documents and analyses the experiences and outcomes of three primary aged students engaging in a one-to-one laptop class and how they utilise a laptop as a tool to improve motivation and learning outcomes. This chapter begins with an examination of the nature of giftedness (Section 2.2) and then further examines the literature that documents effective teaching and support for the gifted student (section 2.3). The scene is set by comparing scholarly and professional literature relating to gifted education, differentiation practices for gifted students and the role and importance of technology in the classroom environment to improve student engagement and

learning outcomes (Section 2.4). Next, the literature is reviewed on the links between ICTs and constructivist environments (Section 2.6) and the opportunities that computer based technology provides on motivation, student achievement and converges on the global growth and importance of one-to-one classrooms and the possibilities of these classrooms to cater more genuinely for the needs of the gifted. In this final phase (Section 2.7) activity theory will be examined to identify its suitability to map students' one-to-one interaction. This chapter will synthesise a range of issues to identify implications from the literature and their importance for this study and identified limitations and to the scope of the study.

2.2 Conceptions of Giftedness

The definition and application of the term gifted has often been a source of contention in schools and other education facilities as there is not one universally agreed upon understanding of what the term encompasses. British psychologist, Francis Galton first used the term gifted in the latter part of the 19th century to refer to adults who demonstrated exceptional talent in some area (Robinson & Clinkenbeard, 2008). In his studies he believed that children could inherit the potential from their parents and referred to these children as gifted children. Galton's view of gifted children was expanded upon in the early 1900's by cognitive psychologist, Lewis Terman who included reference to a high Intelligence Quotient (IQ). As a foundation for his research, Terman adapted French psychologist Alfred Binet's intelligence test whilst working at Stanford University to develop the Stanford–Binet Intelligence Scale. Here he began his long-term case study of gifted children, whom he defined as children with IQs of 140 or more.

When we examine these early understandings, Galton's interpretation generates the idea that a gifted person is one with a gift or a special talent

demonstrated in adulthood. Conversely, Terman's view led to definitions of gifted, which not only included high IQ, but also the notion that giftedness should be a predictor of adult achievement. However, researchers including Borland, (2009), Sternberg, Jarvin, and Grigorenko, (2011), Pfeiffer (2012) and Plucker and Callahan, (2014), have been cautious in the applications of cognitive testing alone as a measure intelligence or giftedness. Contemporary thinking highlights an IQ alone approach as outmoded and simplistic with current models attempting to conceptualise giftedness beyond normalized intelligence testing approaches.

Joseph Renzulli (1978, 1982, 1986, 1999, 2006) postulated a three-ring definition of gifted behaviour that expanded the understanding of giftedness.

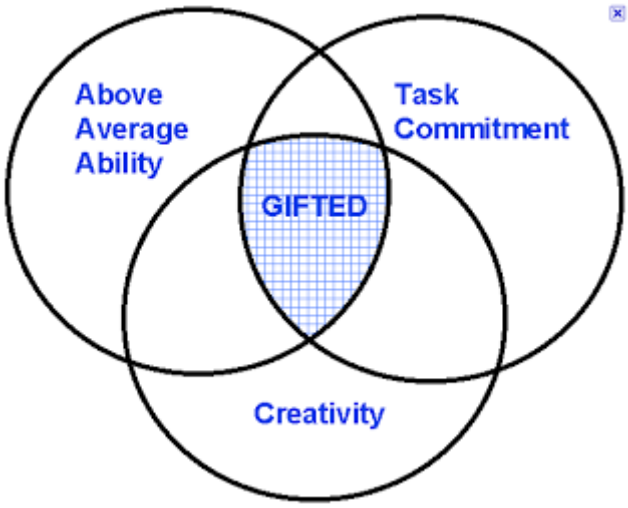

Figure 2.1. Renzulli's Three-Ring Conception of Giftedness

Renzulli (1986) and Renzulli and Reis (2002) postulated that there are three factors important for the development of gifted behaviour. These factors included above average ability, which encompasses the capacity to acquire knowledge or perform in an activity. Creativity which encompasses fluency, flexibility, and originality of thought, openness to experience, sensitivity to stimulations, and a willingness to take risks and task commitment which encompasses perseverance,

endurance, hard work, as well as perceptiveness, self-confidence, and a special fascination with a special subject. Fundamental to Renzulli's model is that only when the characteristics from all three rings work together can high achievement or gifted behaviour be witnessed. Françoys Gagné, conversely defined giftedness as the possession and use of untrained and spontaneously expressed natural abilities, termed aptitudes or gifts, in at least one ability domain to a degree that places a child among the top 10% of their age peers (Gagné, 1985, 2013).

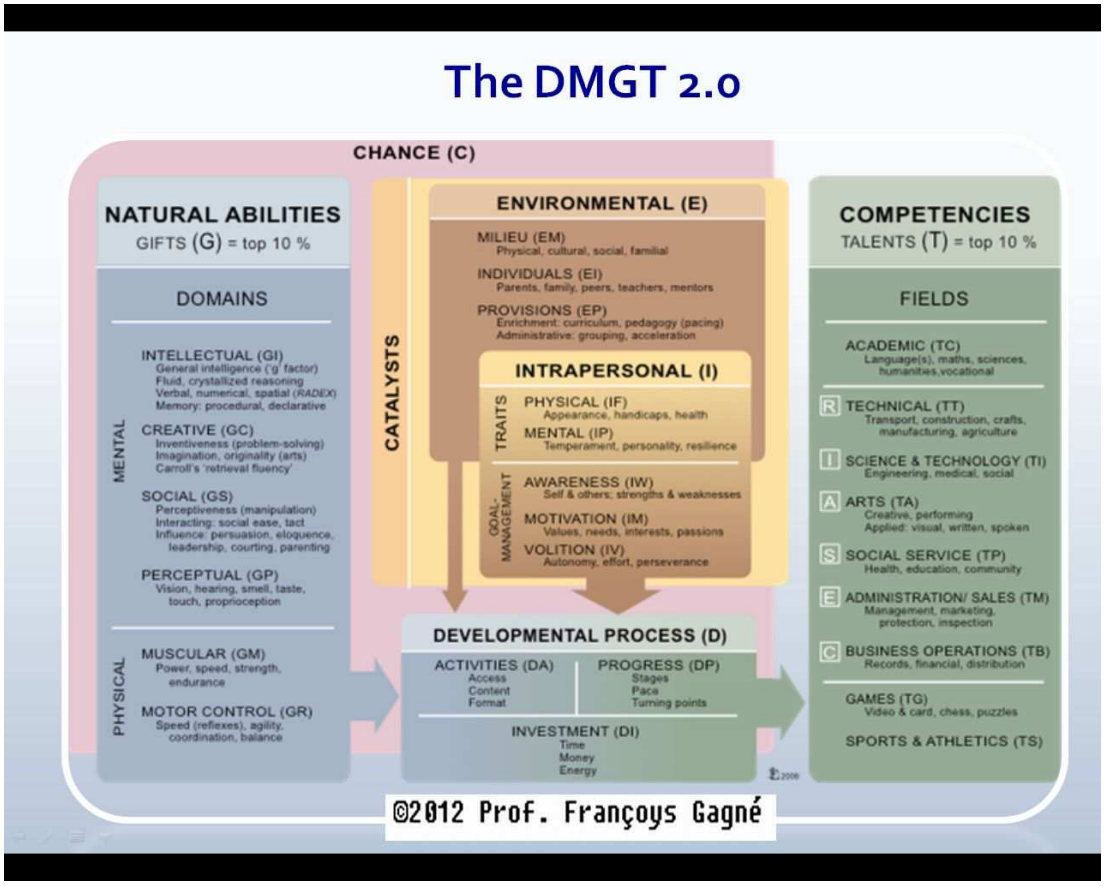

Figure 2.2 Gagné (2015) Model of Giftedness and Talent

The important aspect of Gagné's model is the nature of the environment. The central column of the figure highlights the role that the physical, cultural, social and familial context plays in talent development. It also suggests that goal management

(i.e., self-regulation) is an important intra-personal attribute that supports talent development.

It is this divergence of understanding around the identification gifted students over a long period of time that has laid the foundation for much of the confusion around the understanding and application of the term giftedness. Renzulli (2005) succinctly states, “as long as there are differences of opinion among reasonable scholars there will never be a single definition of giftedness” (p. 251)

These definitions by Renzulli, Gagné and others used in various jurisdictions and functions highlight the special characteristics of gifted students and indicate special educational provisions are needed to address their needs. However, according to Davis, Rimm and Siegle (2011), gifted students are a unique group of learners who have a higher intellectual ability or creativity than their same-age peers, the ways they manifest their giftedness varies and hence educational provision needs to be acknowledge both their general characteristics and their individual exceptionalities.

There has been criticism of contemporary models of giftedness. Ziegler (2005) has called for a paradigm shift in thinking about giftedness and proposes that, instead of focusing on multifactorial models to understand the nature of giftedness, he and colleagues (Ziegler & Stöger, 2004; Ziegler & Phillipson, 2012) argue for a systemic view of giftedness in which they propose the need to refocus on the conditions and interactions among traditional factors. Ziegler and Phillipson (2012) suggest;

> Similar to the manner in which a species adapts to living conditions in its own ecological niche over the course of its phylogeny, some individuals continue to adapt to the circumstances within a particular talent domain until they achieve an optimal working relationship between themselves and the domain. (p. 12)

It is beyond the scope of this review to explore more deeply the current debate between the traditionalist factorial perspective and the systems perspective of gifted education. For the purposes of this study giftedness will be defined as;

> Students who are gifted excel, or are capable of excelling, in one or more areas such as general intelligence, specific academic studies, visual and performing arts, physical ability, creative thinking, interpersonal and intra-personal skills. Giftedness in a student is commonly characterised by an advanced pace of learning, quality of thinking or capability for remarkably high standards of performance compared to students of the same age. Although these students are capable of outstanding achievement, the learning environment is pivotal to enabling them to demonstrate and develop their abilities. Students who are gifted are at risk of underachieving and disengaging from learning if they are not identified and catered for appropriately. (Education Queensland Framework for Gifted Education, 2004. p. 2)

This study draws on activity theory (Section 2.6) which does frame analysis of events from a systems perspective. Activity theory considers the entire activity system including environment, people and institutions beyond just one actor or person.

2.3 Gifted Education in Schools

Gifted education refers to systematic and intentional efforts to provide appropriate programs and services to promote the cognitive, social, and affective needs of gifted students (Purcell & Eckert, 2006). Students identified as gifted have different abilities than their age peers and as such require different educational experiences to satisfy and support their learning and outcomes. These experiences and abilities are accompanied by the related provisions that must be met in the educational environment if these gifted learners are to develop to their fullest

potential. When teachers do not fully understand or create an environment to meet the needs of gifted learners these behaviours may adversely affect the outcomes for the gifted child (Clark, 2008).

The Australian Curriculum, Assessment and Reporting Authority (ACARA) have formed guidelines for gifted education and state that Gifted and talented students are entitled to rigorous, relevant and engaging learning opportunities drawn from the Australian Curriculum and aligned with their individual learning needs, strengths, interests and goals. They go further in stating the school plays a critical role in giving students appropriate opportunity, stimulation and experiences in order to develop their potential and translate their gifts into talents. Jarvis and Henderson (2014, p.5) state that, "Australian educators working in a system of competing demands, perpetually limited funding, and a strong systemic focus on the attainment of minimum standards in literacy and numeracy. The challenge for gifted education is to establish and maintain an integral position in the national discourse on quality curriculum, teaching, and inclusive practices for all students."

Gifted students are a diverse group of individuals who have abilities beyond the general education classroom and require changes to the school environment (Reis & Renzulli, 2004). Therefore, when students are placed in general education classroom settings, teachers must differentiate by challenging the gifted learner in a supportive environment (Heald, 2016). Such a supportive environment reflects the level of expertise of teachers and the prevailing school culture (Lassig, 2009).

Reis and Renzulli (2004) indicate there are two ways that above average ability can be defined: general ability and specific ability. General ability includes the ability to process information, integrate experiences and, as a result, demonstrate appropriate and adaptive responses in new situations, and engage in abstract thinking.

Specific ability refers to applying general abilities to specific knowledge but also refers to the ability to sort or discard irrelevant information. If we acknowledge this model for identifying above average students, we accept that approximately 15-20 % of students may demonstrate this ability. We also accept that many students who lack appropriate learning opportunities may not achieve at advanced levels.

Principles for the education of gifted children were articulated over 30 years ago and still remain the most successful (Rogers, 2007). Gifted students are generally supported through additional programs. Most commonly these programs are based on the notion of either pull out, where students are supported in a separate room or conversely, push in or inclusion classrooms, where the classroom has a differentiated activity base, accelerated classrooms where students access a compacted or accelerated curriculum and enrichment classrooms where students are taught a more challenging curriculum in comparison to a mainstream classroom.

A majority of gifted students spend most of their day in a traditional classroom setting (Cox, Daniel & Boston, 1985; VanTassel-Baska & Brown, 2007; Kordosky, 2010). Most often these students are not coupled with instruction appropriate to their level of aptitude, and therefore, the needs of the gifted learner are not met (Australia Senate Review 2001; Kulik, 1993; Parke, 1992; Sprague & Shaklee, 2015). Davidson and Davidson (2004) and Tomlinson (2003) described the instructional practices in general education classrooms as repetitive, unchallenging, and restrictive for gifted students. Other scholars have argued that although the various approaches and strategies that address how to modify the curriculum for gifted students are prevalent, well-intentioned teachers may not be using those teaching practices **(**Hong, Greene & Higgins, 2006; Tomlinson, 2003; Webb, Gore, Amend, & DeVries, 2007). There may be possible consequences of not providing

challenges for gifted learners. These consequences include boredom, behaviour problems, and disenchantment with school in general. Thus, the goal for teachers is to meet gifted student instructional needs while fully developing their abilities, creativity, and interest without losing motivation.

Overt thirty years ago, Maker (1982) advocated the adoption of educational practices that provided tailored and appropriately challenging educational experiences for gifted students. From this early work her model of practices are widely adopted in many countries and she continues to refine her model (Maker & Schiever, 2010). Furthermore, her model of differentiation has been influential in guiding practices for teachers to implement with gifted students and is advocated by many Australian jurisdictions (Munro, 2012).

Renzulli and Reis (2002) reported that gifted students must be taught the core curriculum along with all other students; the curriculum must be differentiated to fit the learning needs of each gifted child. Modification or differentiation of instruction at the program or curriculum level not just individual lessons is crucial for success of the gifted student. This differentiated curriculum must focus on complexity and depth.

In an attempt to meet the needs of the gifted, Moon, Swift, and Shallenberger (2002) tested the effectiveness of self-contained classroom curriculum that was differentiated for highly intellectually gifted students. Their findings demonstrated that the self-contained classroom provided a challenging learning environment for highly intellectually gifted students. The research further showed that the responses of individual students to this more challenging environment varied considerably, creating different emotional and social outcomes for specific students at different times during the school year. The results suggest that modified programming for the

gifted can have differential effects on individual students and further highlights that gifted students require educational experiences that provide challenge in the depth, breadth, and pace of instruction. It is at this pinnacle that one-to-one laptop programs facilitated by the use of information communication technologies tools may produce a positive impact for the gifted child and create a platform for further research. Before exploring the use of ICT as a tool, the principles informing differentiation practices are now explored.

2.4 Differentiation and the Challenges of the Gifted Child

Advocates of differentiation assert that the needs of gifted learners are best met by a curriculum that integrates advanced content, product development, problem solving, and high level processes (Tomlinson, 2003; Brulles, & Winebrenner, 2012). Bloom (1956) and Vygotsky (1978) supported differentiated instruction as a strategy to maximise students' growth (Coleman, 2003; VanTassel-Baska & Brown, 2007). These researchers provided a working knowledge for educators about students' cognitive development. By adopting these practices in the general education classroom, I propose that teachers will be better able to serve gifted students.

Purcell and Eckert (2006) defined a differentiated curriculum, as the process that teachers employ to improve student learning by matching various components to characteristics of students, and has been viewed as most effective and efficient when changes are made in the depth and breadth of student learning (Delisle, 2006). Advocates of gifted education have declared that gifted students require a curriculum that is enhanced by activities that are differentiated from the regular curriculum (Croft, 2003; Davis & Rimm, 2004; Tomlinson, 2003).

Across the plethora of educational literature, many guidelines exist for implementing differentiated instruction in the classroom. Diezmann and Watters (1995) found that there were three major needs required for a successful enrichment program: identification strategies, careful nurturing, and programming. Therefore, when students are placed in a general education classroom setting, teachers must differentiate by challenging the gifted learner in a supportive environment (Parke, 1992).

Tomlinson (2003) has further defined differentiated instruction as a philosophy that encourages teachers to plan strategically in order to reach the diverse learners in the classrooms. Under her umbrella of beliefs, she states that teachers ought to fine-tune their instructional practices to meet students' diverse readiness levels, learning styles, and interests rather than provide a "one size fits all" approach to teaching and learning. Borrowing heavily from the Maker Model (Maker 1981, 1982, 1986) of a differentiated curriculum, she outlines specific factors necessary for implementing differentiated instruction; she explained that teachers must differentiate content, process, and product according to students' readiness, interests, and learning profile. In this model teachers offer different approaches to what students learn. The aim is to remove the ceiling on what is learned, and use the student's abilities to build a richer, more diverse and efficiently organised knowledge base (content). Students learn, by promoting creativity and higher level cognitive skills encouraging the productive use and management of the knowledge the students have mastered (process). Students then demonstrate what they have learned, by facilitating opportunities for gifted students to produce a product that reflects their potential (product) or talents. As such, teachers are then creating a learning

environment which encourages students to engage their abilities to the greatest extent possible. Figure 2.3 below illustrates this structure.

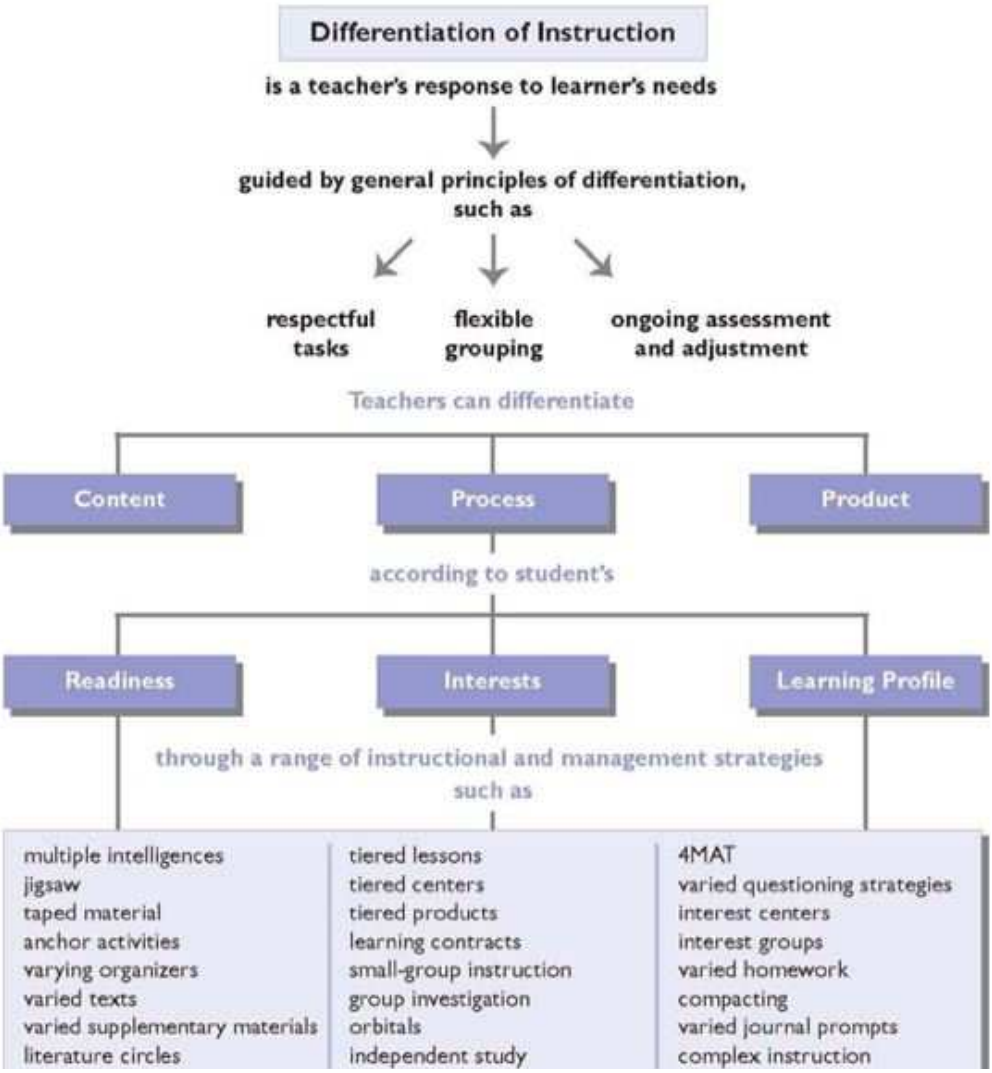

Figure 2.3 (2003) Tomlinson's Differentiated Instruction

Tomlinson (2003, 2014) defined content as the input of teaching and learning, and as a concept it envelopes two ways that teachers need to think when

implementing differentiation. First, teachers need to think about “what” is taught. Second, teachers need to think about “how to give students access” to what they need to learn. Through this process of explicit teaching where the teacher can explain exactly what students are expected to learn and demonstrate the steps needed to accomplish the task, the teacher is able to design lessons that help students achieve mastery.

Process refers to the activities that will lead to mastery (Maker, 1982; Tomlinson, 2003; Maker & Schiever 2010). Diverse activities include independent studies, contracts, compacting, or tiered assignments. At the heart of this concept is that if a process is differentiated, the teaching style will reflect the various learning styles of the students and as a result the teacher maximizes academic learning time and thus contributes to the growth of all students in their outcomes. Product refers to a demonstration of what students have learned and can take on various authentic forms. According to Tomlinson (2014), when differentiating the product for gifted students, it is recommended that criteria for selecting product options be based on the research regarding appropriateness for gifted learners.

As part of this differentiation process, the teacher must consider the readiness, interests and learning styles of students in planning for differentiated instruction. Tomlinson, (2003) defines readiness as a student’s entry point relative to a particular understanding or skill. It is particularly stressed that, unlike ability, readiness can vary widely over time, topic, and circumstances.

Paramount to the understanding of readiness is that students whose readiness is low may require extra support in the form of one-on-one or small group instruction, modification of time frames, as well as the use of more structured activities. Equally instruction for more advanced students may require compacting or acceleration and

as such students with more developed readiness may skip practice and material they already know and advance to other material. These materials engage students in activities that emphasize problem solving, the comparing and contrasting of data, and the ability to search for cause and effect. Tomlinson posits that when modifications are made in this way and students are provided with the opportunity to structure knowledge in a variety of ways, they may reach their potential.

Since Tomlinson's seminal work in 1999, *The Differentiated Classroom*, Tomlinson (2003, 2014) further proposes that interest is another characteristic that guides differentiation and is defined as a child's affinity, curiosity or passion for a particular topic or skill. From this literature it is clear that not only do students bring previous knowledge and experiences to school, but they also bring their own interest in a particular area. They come to school with the need to further develop and explore their interests. Therefore, teachers are encouraged to provide learning opportunities for exploration of the interest as well as offer opportunities to develop new interests. It is within this differentiation paradigm of new learning opportunities and interest that ICTs have been identified as a way that may provide the platform for student growth and improved achievement. In their 2005 study of teaching in the one-to-one classroom, Owen, Farsail, Knezek and Christensen found that,

> Students don't have to wait for teachers to convey information as much of it is available on the internet, forcing a focus on the changing role of the teacher. There are opportunities for differentiated instruction and engaging learning but only if we think differently about our learning environments. (p. 14.)

These early findings were echoed in the 2007 study of Zucker and Hug of one-to-one classrooms. In their research teachers reported that they are better

able to meet the needs of students that are gifted as they are able to spend more time individualising instruction for students.

Finally, in the 2012 study on best practices of gifted education Periathiruvadi and Rinn found that "technology not only allows teachers to provide differentiated instruction for gifted children and adolescents, but also serves as an educational and creative outlet for some of the best and brightest minds in the world" (p. 153).

2.5 Computer Based Environments and Self-Regulation

Historically the integration of new technology into education settings, from calculators to computers, has been steep with ideals and vision for the future of education including that of differentiation. In looking back to 1997, in his American Federal Reserve speech, Alan Greenspann touched on this point and said,

> We need to be looking forward in order to adopt our educational system to the evolving needs of the economy and the realities of our changing society. Those efforts will require the collaboration of policy makers, educational experts and importantly our citizens. It is an effort that should not be postponed. (p. 4)

Largescale one-to-one initiatives such as Microsoft's Anytime Anywhere Learning and the one laptop per child program and similar programs in the US (Maine, Henrico County Virginia, New Orleans Louisiana and pilot programs in Texas, Florida, New Hampshire and California) have created a shift in educational paradigms. Similarly the 2007 Rudd Government National Secondary School Computer Fund which held the specific aim to "make every classroom 'a digital classroom' by providing Australian schools with fibre to the premises, connections which will deliver broadband speeds of up to 100 megabits per second" mirrors the

shift in education thinking (ALP, 2007, p. 4). These programs provided the foundations to move into the digital economy of the future, and have reinforced that that for today's learner computers and mobile technology are no longer negotiable; they are must have devices. However, an underlying concern is that the technology may be ahead of the application. Students are already using computers and the instant communication and learning opportunities they offer but educational systems may be failing to recognise and adapt.

In the last decade billions of dollars around the world have been spent supporting this ideal in education however, the results of that endeavour remain uncertain (Cherian, 2009). In recent years, the plethora of computer based teaching resources has grown dramatically due to easily affordable mobile phones, tablets, computers MP3's and software apps (Sheffield, 2007). ICTS are impacting all of our lives, and especially the lives of students, in new and intensifying ways. Once seen as an isolating influence due to cost, technologies are now recognised as a principal way to stay in touch and take control of one's own learning. Multisensory, ubiquitous, and interdisciplinary, communication technologies are integrated into nearly everything we do. It gives students a public voice and a means to reach beyond the classroom for interaction and exploration (Johnson, Levine, Smith & Stone, 2010). An Organisation for Economic Co-operation and Development [OECD] (2010) report into assessing the effects of ICT in education, found that technology can provide the necessary tools for improving the teaching and learning process, opening new opportunities and avenues. In particular, it could enhance the customisation of the educational process, adapting it to the particular needs of the student and support the personalisation strategies in teaching and learning a discussion of which is beyond the scope of this thesis.

Within this customisation and tailoring the plethora of resources and relationships made easily accessible via the Internet is progressively challenging us to re-examine our roles as educators in a modern classroom. This understanding of resources and challenges is reflected in both the Global Technology Information Report (2012) and the Horizon Report (2011) that emphasises personal access to the Internet from mobile devices is on the rise, the growing set of resources available as open content, and a variety of reference and textbooks available electronically, students' easy and pervasive access to information outside of the classroom resources continues to encourage educators to take a careful look at the ways we can best serve learners.

However, whilst students and their educational experiences are evolving in response to ICTs, educational practice and the materials that support it are changing slowly. Schools are still using materials developed to teach the students of decades ago, but today's students are very different in the way they think and work (Johnson, Smith, Willis, Levine, & Haywood, 2011). The 2011 Horizon Report that seeks to identify and describe emerging technologies likely to have considerable impact on teaching and learning, suggests that schools need to adapt to current student needs and identify new learning models that are engaging to younger generations. Teachers feel that a shift to a more learner-centred model focused on the development of individual potential instead of the imposition of a body of knowledge would lead to a deeper and more sustained learning across the curriculum. To support such a change, both teaching practice and the tools used to measure improvement in the classroom must adapt. Assessment in particular has not kept pace with new modes of working, and must change along with teaching methods, tools, and materials.

The creation of 21st century classrooms has delivered prospects for students to use various forms of technology to connect to information, their peers, and other classrooms and students throughout the world. However, classroom integration has not kept pace with increases in available technology tools (Keengwe, Pearson, & Smart, 2009; Keengwe, Schnellert & Mills, 2012).

2.6 One-to-one personal computing

One-to-one computing essentially involves providing every staff member, teacher and student with a portable laptop, notebook or tablet PC or connected device for continuous use both in the classroom and at home. Over the last 20 years there has been a noted and dramatic increase in the focus on laptop and one-to-one portable device initiatives. (Bebell & O'Dwyer, 2010). A three-year longitudinal study by Gulek and Demirtas (2005) examined the impact of participation in a laptop program on student achievement. By following 259 middle school students via a cohort's model it was demonstrated that students with a laptop spent more time engaged in collaborative and project based instruction than non-laptop students. The research suggested that compared to their non-laptop counterparts, students in classrooms that provide all students with their own laptops spend more time involved in collaborative work, participate in more project-based instruction, produce writing of higher quality and greater length, gain increased access to information, improve research analysis skills, and spend more time doing homework on computers. It demonstrated that in comparison overall grade point averages, the substantial impact of laptop use on student learning outcomes. It was further demonstrated in their study that students participating in a one-to-one program earned significantly higher overall grade point averages as well as specific test scores in writing, language arts

and mathematics. Penuel (2006) in a synthesis of research on laptops in education concluded that,

> Laptops provide students with frequent and immediate access to the internet and educational software placing technology in an integral position in relation to student learning and teacher instruction. There is wide access to resources to support student learning and tools to plan and organise learning. Students can communicate with their peers, teachers and the wider community and students can undertake collaborative tasks. This increased availability results in increased computer skills which *potentially* can transform the learning environment and improve student learning outcomes. (p. 7)

In a similar qualitative study by Silvernail and Gritter (2007) it was reported that students using a laptop felt more organised completing their work more quickly and at a high quality. These results were echoed and further described in a similar study in 2006 by the Metri Group. The Metri Group (2007) conducted a review of one-to-one learning environments and found that students who engaged in these initiatives achieved significantly higher grades across a number of key learning areas than students in non-one-to-one classrooms. It was also reported that significant improvements were seen in student learning. In essence, these reports depict that one-to-one laptop initiatives significantly and positively influenced learning outcomes with the educational setting. Therefore, research reported in the literature can and does support the proposition that through the use of technology gifted students may achieve improved results across a number of areas (Siegle, 2005; Bluman-Pardo, 2009; Willis, Steel, & Seriki, 2015).

However, a major consideration of potential outcomes of one-to-one environments with the needs of the gifted is the importance of self-regulation. Self-regulation can have multiple meanings. Psychologists consider self-regulation as the

ability to act in your long-term best interest, consistent with your deepest values. The concept can also be used synonymously with stress management when referring to strategies to overcome anxiety and stress when you're down. In education, Zimmerman (2002) defines self-regulation as “the self-directive process by which learners transform their mental abilities into academic skills” (p. 65). Van Deur (2004) states that it is an integrated learning process, consisting of the development of a set of constructive behaviours that affect one's learning and finally Moore (2005) states that, “self-regulation plays a major role in the successful academic performance of gifted students and that successful, self-directed, and motivated learners take an active role in their learning process” (p. 42). Moore notes that not all gifted learners are self-regulators. Stating the opposing characteristics of gifted learners such as self-criticism, boredom, behavioural outburst and other negatively viewed behaviours must be carefully balanced and considered in any program. The research from Zucker and Hug, (2007) found that one-to-one programs had impacted and changed teacher’s instructional practice,

> The one-to-one laptop program can change the practice of teachers changing the way they organise classroom activities. Teachers rely less on textbooks and many say they are better able to meet the needs of students that are struggling and those that are gifted. With the laptops teachers are able to spend more time individualising instruction for students. (p. 13)

Stettler (1998) has identified four models of learning with technology for the gifted student. These models are of particular importance to this study as they provide a reference point for future observations. Gifted modes identified in her work include:

- Acquirer of information — for the mastery of course knowledge and skills in a sequential fashion using adaptive interactive programs;
- Retrievers of information — to extend core knowledge and skills. The world Wide Web is important technology based on resource in this regards;
- Constructors of information — in order to produce information through extension of core knowledge and skills and requires higher level syntheses to produce information; and
- Presenters of information — The student become critical uses of technology and communicates information that has been constructed and produced by them.

The proportion of time a student may spend in each mode changes depending on the skills interests and background knowledge the students brings. For the purposes of this study as students work within a system each of these models should be discernible. A one-to-one program may create an environment that supports the gifted learner and allows for self-exploration without harsh penalties and allow gifted students discover for themselves their interests, strengths, and weaknesses and as such improve academic outcomes.

According to Rogers (2007) gifted learners generally prefer independent, self-paced learning and online courses are ideal as they offer advanced, complex content that can be self-paced. Online and individualised learning has shown substantial academic effects, including the accurate retention of greater knowledge for gifted students. Similarly, Pyryt (2003) believed that a computer allows students to choose whether they read/listen to text, watch a video or interact with the software. Dunleavy, Dextert and Heinecket (2007) further report that networked computers positively impact learning environments,

> Our results indicate that the one-to-one students to networked laptop ratio contributes generally and significantly to the effectiveness of the learning environments per the design criteria of being more learner-, assessment-, community- and knowledge-centered. (p. 18)

The interaction involved in the use of a mouse and keyboard, different windows and tabs, and linking to different sites and hypertext is particularly beneficial for students with different learning styles. Thus, computer technology enables a match between the format of the content and the learning style of individual gifted students and this aligns with the principals of constructivist environments.

2.6 Constructivism

There are many theories of constructivism but the Piagetian and Vygotskian models predominate. The Piagetian model suggests that a constructivist classroom must provide a variety of activities to challenge students to accept individual differences, increase their readiness to learn, discover new ideas, and construct their own knowledge. A classroom based on this approach would encompass concrete learning experiences, such as drawing, role plays, model building and excursions that views hands-on opportunities as essential and building blocks for more sophisticated tasks. A Vygotskian' model necessitates that school learning takes place in a meaningful context, and parallels learning that occurs in the real world. This model of classroom learning highlights creating one's own concepts and making knowledge one's property. The Vygotskian classroom stresses assisted discovery through teacher-student and student-student interaction.

When comparing these models both acknowledge building constructs of knowledge. As such it can be argued that the guiding standard of constructivist learning theories is the learner's own active initiative and control in learning, and

personal knowledge construction, that is, the self-regulation of learning. From the pedagogical point of view, the learner's learning activities should be directed at examining held prior conceptions and relating it to the new knowledge. In a review of Florida, schools Barrios (2004) concluded that the learning environment should provide the learner with opportunities to test and try out a new conceptual understanding in various applied circumstances like problem solving or comparatively an ICT rich environment. In her findings she states that, "teachers must create instructional environments in which students use higher-order cognitive skills to construct meaning or knowledge, engage in disciplined enquiry, and work on products that have value beyond school" (p.7).

The major premise of Vygotsky's theories was the fundamental role of social interaction in the development of cognition (Vygotsky, 1978). This social base for the construction of knowledge is diametrically opposed to notions of didactic teacher-led or transmission models of learning. Knowledge building is simply where individuals learn through shared experience and wisdom, thus internalising knowledge derived from higher-order thinking processes and cognitive strategies. It could be suggested that there are clear parallels between the notion of knowledge building and the description of surface and deep learning (Biggs, 1987, 1993; Ramsden, 1992). Knowledge is arguably deepened and thus made more meaningful to the individual learner through its being built through interaction with others.

Vygotsky (1978) believed that children construct knowledge or understanding as the result of thinking and doing in social contexts and that thinking cannot be separated from the social setting. Consequently, the child was identified as social from the beginning and that development occurred as a result of social interaction. The work of Vygotsky further identified language as the critical link between the

social and an individual's mental functioning (Berk & Winsler, 1995) and that within Vygotsky's (1978) general law of cultural development, higher order thinking processes can be seen as appearing on two planes. According to Vygotsky (1978);

> every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological), and then inside the child (intrapsychological). (p. 57)

The zone of proximal development (ZPD) accounts for movement between these two planes (Blanton, Moorman, & Trathen, 1998). According to Vygotsky, ZPD is referred to as "the distance between the actual development level as determined by individual problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Essentially, ZPD refers to the "zone of activity in which a person can produce with assistance what they cannot produce alone" (Pea, 2004, p. 426). The work of Vygotsky, and in particular his focus on social interaction, has been extrapolated by numerous researchers and in particular the work of Bereiter, Scardamalia, Cassells and Hewit (1997). Bereiter et al. (1997), theory of knowledge building argued that theories, hypotheses, and other similar intellectual artefacts are *objects of inquiry* to be scrutinised, improved and put to use as participants engage in progressive discourse analogous to scientific enquiry. More recently Scardamalia and Bereiter (2010) consolidated this understanding with simply stating, "real ideas, authentic problems." Real ideas are ideas that originate from the participants in knowledge building, not copied ideas; and authentic problems are problems whose solution makes a contribution to community knowledge, not problems whose only value is in the learning that ensues.

2.7 Activity Theory: A Theoretical Framework

Activity Theory has evolved from the body of work on the interpretation of learning by Vygotsky (1978), Luria (1976) and Leont'ev (1978, 1981). It is distinguished for its platform of understanding of dynamic social interactions that are mediated by technology on a number of levels including the objective, the ecological and the social cultural. As a systems theory it considers a wide range factors working together to impact an activity and thence it provides a broad outline for relating the structure, development and context of computer-supported activities in educational settings.

Leont'ev (1978) expected that human processes can be scrutinised from the viewpoint of three different levels of analysis specifically the activity and motivation, goals and achievement. It allows the researcher to understand the relationships among all learning experiences and it generates insights into the actions of individuals and the influence of the context on that individual at different levels.

An activity consists of a subject and an object, mediated by a tool. A subject can be an individual or a group engaged in an activity. An activity is undertaken by a subject, utilising tools to achieve an object (objective), thus transforming it into an outcome (Kuutti, 1996). Tools within an activity can vary widely and may consist of a way of thinking, a culture or be physical or psychological. Kaptelinin (1996) considered computers as special mediating tools. Whereas an object can range in scope from a material object, to a conceptual plan or totally intangible (a common idea) as long as it can be shared by the activity participants (Kuutti, 1996). Activities always take place in a certain situation with a specific context. Engeström (1987) formulated activity context as a network of different parameters or elements that

influence each other. Engeström's model of an activity system (1987) is depicted by Figure 2.4.

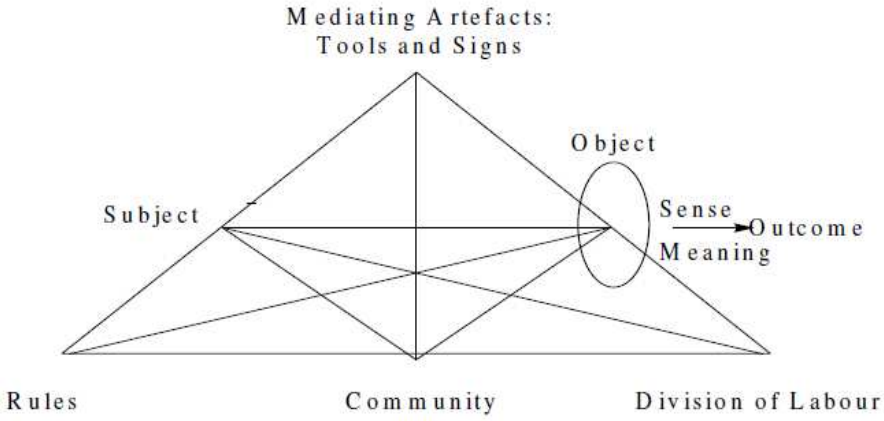

Figure 2.4. Activity Theory Overview.

Activity theory is considered from the hierarchical structure of activity. Each activity is conducted through actions of an individual, directed towards an object or multiple objects. An action is a single task with a goal performed to achieve a result relevant to the overall activity and actions are performed by a sequence of operations.

Kaptelinin (1996, 2003) has applied activity theory to the educational use of ICTs for the reason that it ideally focuses not only on the technology but also on the psychological aspect of the activity. Activity theory as a result is not only governed by the understanding that the learning experience is an activity, but viewed in parallel as a sequence of activities within the experience itself (Bodker, 1996; Kaptelinin, 1996). In this study on gifted students and their experiences in a one-to-one classrooms, the environment in which teaching and learning transpire, will be considered as an activity which can be analysed in terms of activity theory (Jonassen & Rohrer-Murphy, 1999).

For this research the adaptation of activity theory clearly identifies the appropriate aspects of the classroom. The tools of teacher, peers and laptops are

identified as well as the participants, rules and outputs as they work in a classroom community.

2.8 Suitability to this Research

Jonassen and Land (2000) claim that activity theory is ideal for analysing a constructivist approach to learning, such as a one-to-one environment, as the assumptions underpinning activity theory align to those of constructivism. Individuals involved in a particular activity are simultaneously members of other activity groups that have different objects, tools and social relations (Engeström, 1987; Sannino, Engeström, & Lemos, 2016).

In this perspective, one-to-one laptop technology is not declared as the object of learning but as a tool to support students' learning activities. This viewpoint allows for the development of more useful learning environments and interpretations of students' experience in these experiments. Only through understanding of the distributed nature of knowing can meaningful learning contexts be fostered (Barab & Plucker, 2002).

The aim of activity theory is to understand the harmony of consciousness and activity. It combines a strong philosophy of mediation of internal and external artefacts, history and collaboration. Describing essentials of the activity describes the context of that activity. In activity theory, activity is a precursor to learning. Knowing can only be interpreted in the context of doing (Rohrer-Murphy & Jonassen, 1999). Individual actions are always situated in a meaningful context and are impossible to understand in isolation without the meaningful context as the unit of analysis (Kuutti, 1996). An activity always contains various artefacts such as procedures, rules, methods and laws through which actions on objects are mediated.

Artefacts are created, manipulated and translated during the development of the activity and carry the historical aspect of the development. They are also the outcomes of previous actions on objects (Bødker, 1996).

In activity theory, all activities are mediated by culturally distinct tools. Because activity is mediated, this has important implications for one-to-one learning as it redefines the nature of learning. Instead of viewing learning as the rational abstraction of mental representation from one's own experience, learning based on the activity theory is now re-conceptualised as learning to participate in a cultural practice (Vahey, Enyedy & Gifford, 1999). Instead of designing learning based on teacher-centred or student-centred approaches in an activity theory perspective, students move through the activities and progress from being partial participants, who are heavily dependent on the material mediation of tools, to full participants, who are able to more flexibly use the cultural tools of the narrative practice (Vahey, Enyedy & Gifford, 1999). This aligns tightly with the understanding of the needs of gifted students as outlined in section 2.4

Another benefit of applying activity theory to one-to-one personalised learning is concerned with the interface of the application. The interface of the device is in constant development, changing the appearance as the user and user context develops. In the activity theory perspective, the interface and the computer artefact, such as the laptop device, are mediators of learning. Activity theory also assumes an asymmetric relation between people and things, in contrast to traditional symmetric relations offered by cognitive science or other computer science approaches, where computer programs and human behaviours are modelled using the same language and methods (Bødker & Petersen, 2000).

Instead of designing learning applications in isolation, using activity theory enables teachers to make important features of human endeavour stand out through the hierarchical structure of activity. This allows them to focus on the context of use. Computer artefacts can only be understood in context as they are embedded in meaningful activity.

An activity is not a homogeneous entity. It comprises a variety of disparate elements, voices and viewpoints (Engeström, 1987; Sannino et al., 2016). Activities are not inert or unyielding, they are constantly evolving. To understand a phenomenon means to know how it is developed into its existing form (Kaptelinin, 1996). This applies to all the elements of an activity. The current relationship between subject and object includes a condensation of the historical development of that relationship (Kuutti, 1996).

The structures and behaviour of today's learning reflect the culture and circumstance-specific historical development (McMichael, 1999; Karanasios, Allen, & Finnegan, 2015). Chronological analysis allows existing and promising organisational structures to be examined as the result of their development. This means that we must also describe and analyse the development and tensions (interactions between subjects) within the activity system. It is the author's belief that by attempting to improve the user interaction by exploiting information relating to users, devices and environments through the notion of awareness using activity theory can bring about effective one-to-one learning. Context awareness, that is an awareness of the past actions, plays a crucial role in reducing the user's explicit input. Activity theory offers a framework for the design of context-aware systems by providing guidance on what elements of context to take into account.

This approach qualifies teachers to construe the situation of user behaviour in the application. This enables minimisation of explicit teacher input and becomes personalised for the individual user. Minimising explicit input would enable teachers to provide better usability for our one-to-one laptop learners. There has been limited research into the experiences of gifted students that draw upon activity theory to gain a better understanding of the context specificity of gifted learners. In fact searches of the databases such as EBSCO using 'activity theory' and 'gifted' as key words retrieved very few (none) relevant references. As such using activity theory enables the analysis of key elements of context that can influence user activity, and the explanation of how elements influence the user's ability to have effective experiences in the actual situation.

2.9 Summary

This chapter has provided evidence of the complexity of giftedness and adjustments that must be made in the classroom to support them. Seminal work from Tomlinson , Vygotsky , Renzulli and Leont'ev support the research study, demonstrating that gifted students are special and require differentiated practices which challenges, provides higher order thinking opportunities, collaboration where necessary and integration around real problem solving. A review of the literature from Penuel, Shaw, Giles, Collins and Taylor has also demonstrated a strong argument that there is potential for one-to-one laptop programs to cater for the gifted child, achieve high levels of student engagement and improve outcomes when examined through activity theory framework.

Computer based education such as constructivist learning facilitated through a one-to-one laptop classroom has demonstrated high potential to support student educational outcomes by providing students with a tool to differentiate the way in

which they explore and engage with the curriculum. Studies cited have shown that for the general students' academic outcomes are improved for those that are using laptops however, that there is a gap in the literature for evidence supporting use by the gifted.

Differentiation, instructional and curriculum, benefits students with a wide range of ability levels (Tomlinson, 2014). At the core of implementing a modified curriculum for gifted students within the regular classroom is the recognition that variation of instructional strategies is needed. It was proposed that a differentiated environment based around constructivist theories such as a one-to-one laptop classroom when examined with activity theory to identify how students interact with a tool to support learning will provide positive learning experiences and outcomes for the gift student.

This review and the framing it has provided, that focus on the experiences of gifted students when access is provided to useful tools and the environment adjusted to give them autonomy becomes an important issue. Hence the aim of this study is to seek an answer to the research question: What are the experiences of the gifted learner in a one-to-one laptop classroom?

Chapter 3 details the research design and data collection and analysis methods used to examine the research question. It describes the methodology and design for the research study through a multi case study approach with both inductive and deductive phases.

Chapter 3: Methodology

3.1 Introduction

Through the lens provided by activity theory and from a student perspective this study aimed to investigate the experiences of the gifted learner in a one-to-one laptop classroom environment. Analysis of the literature reviewed in Chapter 2 indicated that there is a need for classroom teachers to differentiate instruction for gifted students in the general education classroom. Section 2.4 explored seminal studies of gifted education and highlights the challenges of catering for students in the classroom. The literature also emphasised that in the absence of differentiated learning experiences, gifted students potentially experience environments that may not challenge their academic needs.

The literature also revealed in section 2.5 that computer based environments may provide an avenue for improved self-regulation against a constructivist backdrop. Additionally, the review depicted (section 2.6) that current education reform movements in gifted education including the improved access and use of information communication technologies have resulted in increased responsibility on the part of the classroom teacher in meeting the needs of gifted students. The advent of ICTs potentially creates enhanced pathways and improved outcomes for the gifted (Hong, Greene & Higgins, 2006).

The corpus of research reflects that there is a general trend in this research area to be quantitatively based and that the experiences of the student are underrepresented. Qualitative research is needed if educators are to identify practices that maximise achievement of gifted students in the general education classroom

setting (Matthews & Kitchen, 2007). A qualitative approach was employed with the major research question to be investigated by this study being:

1. What are the learning experiences of the gifted learner in a one-to-one laptop classroom?

In light of this understanding this chapter has a dual purpose. First, it will outline and justify the methodological approaches adopted in this study. Second, this chapter will establish a rationale for the research design.

3.2 Methodology

Crotty (1998) claims that methodologies relate to the "strategy, plan of action, process or design lying behind the choice of using particular methods and linking the choice and methods to desired outcomes" (p. 3). He states further that, "methods convey the techniques or procedures used to gather and analyse data related to some research questions." Creswell (2015) supports this understanding and believes that to increase the validity of social research it is important to clarify the research approach. This section, therefore, explains and justifies the adoption of a multiple case study approach in this study.

3.2.1 Theoretical perspective

Crotty (1998) has detailed a framework to social research consisting of four stages: epistemology, theoretical perspective, methodology and methods, a summary of which is represented by Figure 3.1. This transparent yet powerful framework enables the researcher to build a theoretical basis for the research study.

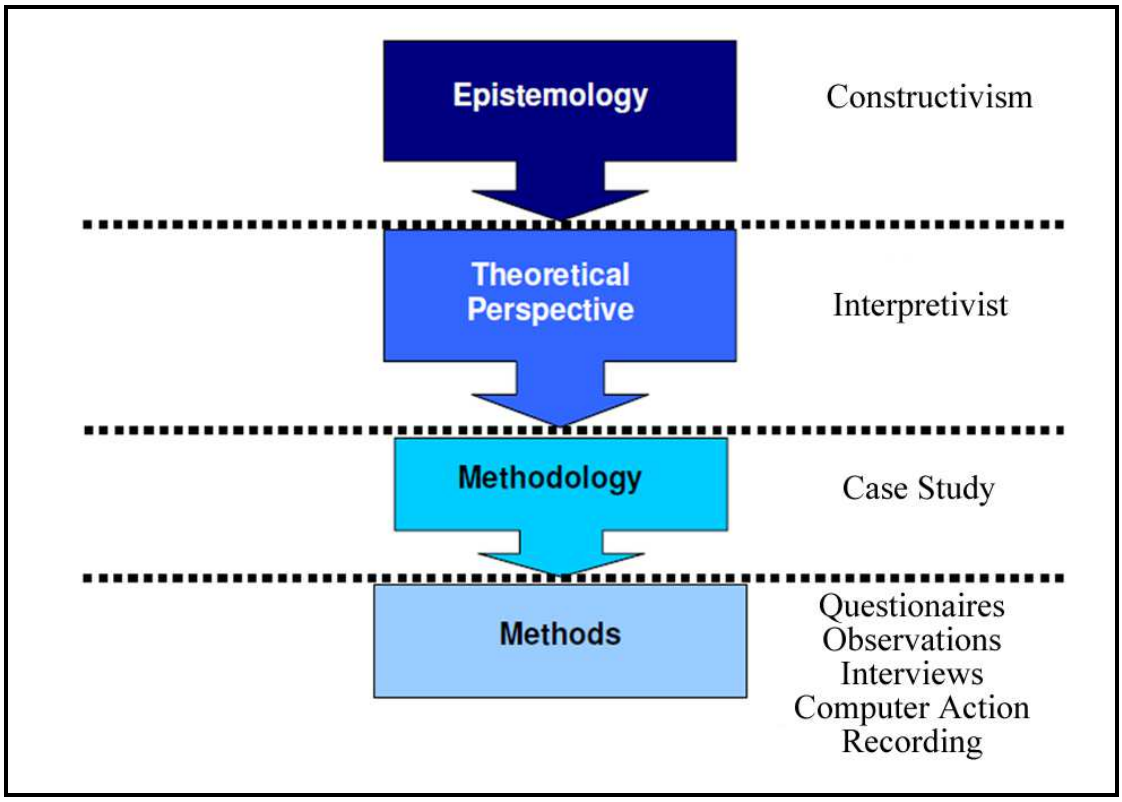

Figure 3.1. Methodological Framework.

There have been a plethora of studies that have reported research on student classroom experiences. Three examples, representative of the scope of students, are presented. A German study by Voss (2009) reported the use of the critical incident technique (CIT) to categorise positive and negative student□lecturer interactions, to reveal quality dimensions of the lecturer, and to reconsider which attributes of the lecturer are likely to cause satisfaction and which dimensions mainly lead to dissatisfaction. Prosser, Trigwell, Hazel, and Waterhouse (2000) adopted a quantitative methodology to explore variation in physics conceptual understanding and achievement to identify student experiences of learning physics. Järvenoja and Järvelä (2005) used a qualitative case study approach to understand the sources of emotional and motivational experiences of secondary school students in Finland. The aim of this type of inquiry is the reconstruction of reality for the participants, aiming for consensus but open to new interpretations based on the development of

information (Guba & Lincoln, 1994; Lee, 2012). Exploring classroom experiences of students through case studies is a well-established methodology.

This research adopts constructivism as its epistemological perspective which is seen to be consistent with the research nature and its aim and objectives. In conjunction, as the nature of the proposed research is primarily exploratory and descriptive, an interpretivist theoretical perspective will also be applied (Crotty, 2003). Specifically, a qualitative case study methodology based on Yin's (2003) model for comparative case study using multiple sources of evidence will be applied utilising a range of interviews questionnaires, observations and video feeds to elucidate rich and meaningful data for analysis. Through this approach the researcher is guided by activity theory as a framework.

3.2.2 Qualitative research

Qualitative research has been defined as a wide approach to the study of social phenomena. It seeks to understand or interpret a phenomenon such as the interactions, relationships, and approaches experienced by students in a classroom from their perspective (Creswell, 2015). Qualitative research aims "to understand the world from the perspectives of those living in it" (Hatch, 2002, p. 7). In Merriam's terms, this process is inductive and "richly descriptive" (Merriam, 2009, p. 5). Marshall and Rossman (2006) advanced the understanding of qualitative research by stating that the method is usually categorised into three main areas: (a) society and culture; (b) language and communication; and, (c) the lived experiences of individuals.

Qualitative research enables us to make sense of and explain the word around us. It gives insight into constructed reality and the chance to describe and explain the world from a social context. However, one obstacle to sharing this insight to the

wider community is the written analysis. Kneale and Santy (1999) state “the research reports need to be clear, intelligible, relevant and generate interest for the reader” (p. 24). Furthermore, Kneale and Santy believe that, “the reader also needs to understand the language of research and the way in which such papers are written” (p. 24). Merriam (2009) distinguished five types of qualitative research. They include case study, grounded theory, ethnography, narrative, and phenomenology.

While the ethnography study and narrative analysis traditions were appropriate in some ways, the case study tradition was chosen as most appropriate because the aim of the study was to develop an in-depth understanding of the experiences of gifted students in a one-to-one classroom. A particular focus was on the dynamics of interaction between peers and teachers, use of technology, motivation, and achieved learning outcomes.

3.2.3 Case Study

The case study approach was chosen because the goal of the study is to showcase the real life experiences of gifted students as they engaged in regular classroom learning. As described by Gall, Borg and Gall (2005) case studies research can be conducted for one of three purposes: to produce detailed descriptions of a phenomenon, evaluate a phenomenon or develop possible explanations of a phenomenon. The purpose of case studies is to provide a richly detailed description of the experiences of participants.

Three features are highlighted in case study research (Merriam, 1998; McMillan, 2004). Case study research is particularistic, or focused on a particular case and is thus an “intensive, holistic description and analysis of a single unit” (Merriam, 1998, p. 12). Case studies are appropriate when questions of “how” or

"why" are involved. They are particularly useful when "the boundary between the phenomenon and the context are not clearly evident" (Yin, 2009, p. 18).

The information that is gained from individual gifted students is considered a case. Case study research also draws on multiple sources of data and thus involves thick descriptions that illuminate the complexity of the phenomenon and can show the multiple influences on it, such as personality, social context, or support. Case study research is also heuristic, in that it brings about understanding and reveals the context of what happened and why which is central to the research intent of experiences as defined in Chapter 1. Merriam (1998) argued that "Case study is a particularly suitable design if you are interested in process" (p. 33).

However, it is noted that that a single case study in isolation will not generate the data needed to adequately address the central research question which detail the experiences of the gifted learner in a one-to-one laptop classroom. The general methodology used for gathering and analysing information is the multiple case study procedure defined by Yin (2009). This procedure he proposes uses multiple case studies as replications, not as a sampling process. He argues, "Multiple cases resemble multiple experiments" (p. 39). Results of each case study will be compared to a framework set out by an existing theory. The theory allows "analytic generalisation" rather than statistical generalisation (p. 38). Statistical generalisation is neither possible nor desirable in this type of study.

Yin further indicates that when choosing a theoretical framework for this procedure, three concerns must be addressed. First, the purpose of the study needs to be addressed by the components of the theory. Second, the theory provides a "full but realistic range of topics that might be considered a "complete" description of

what is to be studied (Yin, 2009, p. 36). Third, the theory includes the topics that will provide the important aspects of the phenomenon.

Employing “a wide range of interconnected interpretive practices” (Denzin & Lincoln, 2011, p. 7), the views of selected students was gathered through interviews, classroom observation (either direct or participatory, and on- or off-line), field notes and reflective conversations about the learning context. Examples of ways of working, tasks and assessments and learning design patterns were also collected, in order to gain a rich picture of approaches to student learning from the teaching perspective.

3.3 Methods

This section provides details of the research design, participants, data sources and analysis and discusses any perceived limitations or constraints.

3.3.1 Context

This qualitative project was undertaken via a case study approach and was carried out within the natural setting of a primary school. The school is a moderately large primary school in a metropolitan region within Brisbane, Queensland, Australia. It is a coeducational facility from Prep to Year 7, with student enrolment at the time of the student being more than 1000. The student body has a fairly equal distribution between boys (515) and girls (535). Less than 1% of student body identify as Aboriginal or Torres Strait Islander. Approximately 38% of student body identify English as a second language that is spoken at home originating from eight different languages. The school was selected because the researcher has access on a day-to-day basis. The principal provided support for the proposed study seeing school

culture benefits from professional discussions and professional development for teachers.

The school had a long history (5 years) and experience with one-to-one laptop programs and the school had an awareness of various differentiation practices such as extension, curriculum compacting, subject acceleration and year level acceleration. The teacher was experienced in using laptops and teaching in a one-to-one laptop environment. The researcher was an administrator of the school and had access to this school site on a day-to-day basis. The case involved monitoring three students over a period of 10 weeks whilst they engaged in a series of science learning activities centred on the use of one-to-one laptops.

3.4 Student Participants

Generally, qualitative sampling focuses on small samples or possibly even single cases. Such narrowing and refinement will allow for an emphasis on in-depth understanding (Marshall & Rossman, 2006; Patton, 2002). Due to the qualitative nature of the case study, the research question proposed and the aim of gathering rich data, purposeful sampling was used to select three students to participate (Merriam, 2009). Purposeful sampling is where "researchers intentionally select individuals and sites to learn or understand the central phenomenon" (Creswell, 2015, p. 214). This selection technique was applied as the researcher had specific knowledge of the population, site and conditions of the proposed research.

Student selection for the study was guided by the following criteria considerations:

a) students completed aptitude tests to measure a student's potential to perform well academically. These tests assess performance in school based tasks;

b) students who had been identified as gifted using school based instruments including a WISC 4 in line with Education Department policy;

c) the students were drawn from the year 6 cohort, 11 years of age;

d) students who were likely to engage in planned interviews; and

e) the students (and parents) who agreed to participate in the study.

The students who were finally selected had previously been identified as gifted and were experienced in the use of computers in a one-to-one program.

3.4.1 Parents

Parents were initially approached as is ethically expected and responded enthusiastically to the invitation for their children to participate. As the students' first point of support it was hoped that they would offer a unique insight into the student's ability, thoughts and experiences. Parents of the participants were fully informed, in writing about what is expected in the study and time commitments. They were also informed that they could withdraw at any time.

All participants were assigned a pseudonym to protect their identity.

3.5 Data Sources

Qualitative case study research may yield large amount of rich data. According to Yin (2009) in order to maintain a quality case study there are three principles of data collection:

1. Use multiple sources of data (3 individual case studies) in order to construct validity through convergence or triangulation;
2. Create a case study data base for retrieval of data;
3. Maintain the chain of evidence to increase reliability of the entire case study from inceptions to logical conclusion;

The data for this study were obtained through interviews, surveys, classroom observations, documents and video recordings. The data allowed in the development of understanding of how students created pathways for learning in technology rich classrooms. At the conclusion of each interview the transcript was checked by the participants for accuracy. Some de-identified data were collected from the whole class. The table below outlines what data were gathered in each phase of the study.

Table 3.1

Research Phases

Research Question	Phase 1	Phase 2	Phase 3
What are the learning experiences of the gifted learner in a one-to-one laptop classroom?	Pre- interview Survey Students and Parents Perceptions identified from first round of data analysis of pre-interviews	Interview, observation and video of students	Post Interview Survey

One of the most prevalent research techniques used to gather qualitative data is the interview (Creswell, 2015; Ponterotto, 2002). As a broad strategy, the interview can be used to pose open ended, emerging questions to one or more participants, record their answers and gather life descriptions. As a qualitative tool it may be further proposed that interviews, depending on their design and purpose, range on a spectrum from being a relatively unstructured chat, to a semi structured

interview based on a central focus, to a highly standardised, organised questionnaire (Knox & Burkard, 2009; Siedman, 1991).

To elicit full and rich descriptions from the interviews, Yin (1994) believes the following skills are critical for a researcher: have a concrete understanding of the issue being studied; be adaptive and flexible so one can respond to a variety of situations; have the aptitude to ask good questions and to interpret the responses; be a good listener; and. an ability to be impartial. To elucidate rich feedback and understanding these skills are pivotal to the success of the program

Semi-structured interviews based on three sets of open ended questions formed the foundation of data gathering for this research (appendices A-G). One set of questions was asked prior to the focus on a key learning area. Another set of questions was asked in two later interviews conducted in weeks 3 and 8. The focus of the questions was to generate descriptions of the experiences of the student during work in a key learning area. The final set of questions was asked on completion of the observations. Most interviews lasted approximately 20 mins each and adhered to the following procedure:

1. My role as the researcher was explained as well as the confidentiality of the interview. Consent was subsequently obtained for the students to be interviewed from both the students and their parents. Their role as the interviewee was explained including the right to not answer any questions or not to be interviewed.
2. Participants were contacted prior to the interview and a time that was mutually beneficially was arranged. Participants were also informed that their responses would be taped and transcribed.

3. Different sets of questions were used for the parent and student. Student questions focused on the individuals experience through the process. Parent questions focused on whether there have been any noticeable changes in motivation and work habits.
4. As interviews progressed questions based on responses were adapted to probe deeper to draw out further information.
5. Interviews were transcribed and member checked for consistency and trust building.

3.5.1 Direct observation — including software capture

As each student worked in class through specific key learning areas with their laptop, software was utilised to track and monitor the way students completed classroom activities. This was used later to discuss strategies students employed to solve problems and ask questions relating to the work. Protocols for the use of software that captures students' ways of working were fully developed. Observations were undertaken with students knowing when they are being monitored through the AB Tutor software that recorded students using their computer in real time.

3.5.2 Surveys

Structured surveys use a mix of open and closed ended questions to support theories and concepts and where participants have freedom to express their views in response to the question asked without any influence (Creswell, 2015). For the student the initial focus of the questions was on the background of the student learning experiences previous to the involvement of one-to-one class. These questions also drew information from the home environment regarding laptop use in the home and parental interest in specific learning areas. For the parent these questions focused on their understanding of programs for the gifted and identifiable

changes of their child through the involvement of the research (appendices A – Parent Pre-Project, C –Parent Initial Survey and G- Parent Post Project). For the purpose of this research the question reflected those from the directed interviews and will provide an opportunity for triangulation of responses by comparing the responses elucidated.

3.5.3 Data analysis

Saldana (2009) states the two major approaches when analysing qualitative data, draw on inductive or deductive strategies. Conversely Merriam asserted that although "all qualitative data is inductive" (2002 p. 14), data analysis should be specific to the type of qualitative research being conducted.

Merriam (2009) explained that data collection and analysis in qualitative studies should occur simultaneously and throughout the study. Similarly Creswell (2015) states that in case study research, data analysis involves detailed descriptions of the case and setting and advised that researchers follow three key steps when analysing data for a case study:

1. Establish meaning by recapitulating data.
2. Established patterns and relationships between the patterns.
3. Developed "naturalistic generalizations" (Creswell, p. 154) from analysing the data.

Two distinct phases were applied to the data analysis in this study. During the first phase an inductive approach was applied to the subject interviews and surveys in the understanding that as the research progressed the research emphasis was adapted to yield a richer understanding of the experiences of the participants. As this study used multiple sources of data in order to complement each other and provide opportunities to develop converging lines of inquiry, it was necessary to undertake a

triangulation of the data to increase the reliability of the data and the process of gathering it.

Following established procedures (Burnard, 1991, 1996; Gibbs, 2007; Hsieh & Shannon, 2005; Rubin & Rubin, 2005), data analysis began following completion of the first phase. That is, parent and student surveys and interviews were immediately transcribed and analysed to identify themes and relationships (See Appendix H). Analysis of the textual data (transcripts) from the interviews in phase one was systematically undertaken by reading through the written material many times, and as many headings as are necessary were written in the margins to describe all aspects of the content. The categories identified were then compared and the common emergent themes grouped together (Appendix H).

Phase two framed around activity theory and the cognitive needs of gifted students. This is a deductive phase. In section 2.7, activity theory was detailed as a framework that allowed me to differentiate the whole structure of the classroom and associated learning activity as interdependent activity systems, and to examine how different activity systems predisposed and affected each other in the wider classroom context. In short, according to activity theory, learning takes place when the subjects are engaged in constructing knowledge through a mediated process. Systems are realised and identified when participants of the system are collectively engaged with a tool for an outcome. In this phase the lens of activity theory provided structures to the classroom experiences (emergent themes) unearthed in phase one and conclusions drawn of how those experiences were created.

The principle components of this framework are presented in Figure 3.2

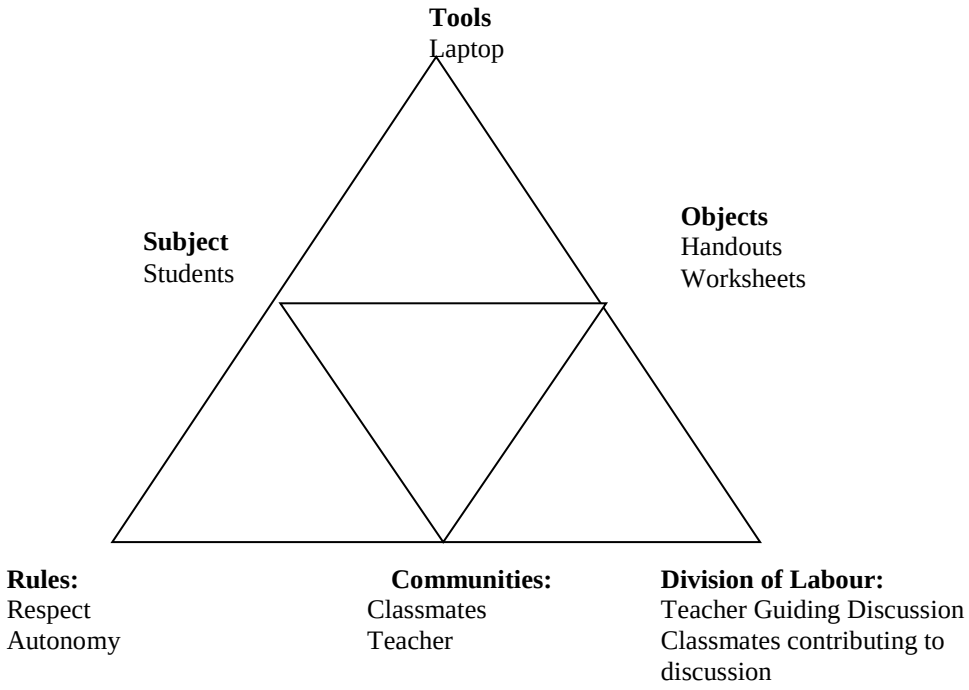

Figure 3.2. Jonassen and Rohrer-Murphy's Adaption of Activity Theory.

3.6 Implementation of the Study

In summary the study followed the three phases of implementation outlined below.

Phase 1 – Prior to Research

Initially the study began with the researcher gaining familiarity within the one-to-one laptop classroom environment. Visits were scheduled to the classrooms of possible participants to ensure the researcher's presence in the classroom had been normalised. This enabled the researcher to gain a more complete understanding of the culture and nuances of the classrooms and establish a greater trust relationship with possible participants. This led to a seamless transition from observer to participant observer.

An electronic voice diary was utilised to capture anecdotal notes as well as informal interviews with consenting participants, this served more as a reference for

the researcher at this stage of the process as well as allowing the researcher opportunity to practice interview techniques. Initial parent and student surveys (appendices C and D) were completed during this phase.

Phase 2 – Implementation and Data Collection

The second part of the study focused on gifted students and how they build the confidence, autonomy and set in place effective relationships that position them to achieve enhanced outcomes through the use of a laptop classroom. Students were asked to work using their laptops in one Key Learning Area and the processors recorded. Semi-structured interviews were conducted at strategic times. Each student represented an embedded case within a multiple case design. Individual reports were written separately and then cross case comparisons occurred and conclusions drawn.

Phase 3 – Analysis

Central to this phase was the completion of the post experience interviews focusing on the success of the program in addressing the needs of gifted students through a constructivist environment. During this phase an adaption of Jonassen and Roher-Murphy's (1999) adaption of activity theory for analysis of constructivist environments was utilised.

3.7 Quality Assurances

Some qualitative researchers argue that we should not use terms such as validity and reliability but instead consider trustworthiness, credibility or soundness of the research in relation to the methods used and integrity of the findings (Morse, Barret & Mayan, 2002). Patton (2002) states that validity and reliability are two factors that any qualitative researcher should be concerned about while designing a study, analysing results and judging the quality of the study. To this end nurse

educators synthesised a list of ways to ensure trustworthiness (Noble & Smith, 2014). These include;

- Accounting for personal biases which may have influenced findings;
- Acknowledging biases in sampling and ongoing critical reflection of methods to ensure sufficient depth and relevance of data collection and analysis;
- Meticulous record keeping, demonstrating a clear decision trail and ensuring interpretations of data are consistent and transparent;
- Establishing a comparison case/seeking out similarities and differences across accounts to ensure different perspectives are represented;
- Including rich and thick verbatim descriptions of participants' accounts to support findings;
- Demonstrating clarity in terms of thought processes during data analysis and subsequent interpretations;
- Engaging with other researchers to reduce research bias; and
- Respondent validation: includes inviting participants to comment on the interview transcript and whether the final themes and concepts created adequately reflect the phenomena being investigated;
- Data triangulation, whereby different methods and perspectives help produce a more comprehensive set of findings.

Hence, these synthesised understandings of trustworthiness form the operational basis for data gathering in Chapter 4.

3.8 Validity

Ideally investigators using a qualitative approach must consider validity issues throughout the process of inquiry, particularly in the planning and analytic phases. What becomes most important is to determine the "validity ideals of a particular study (criteria), employ the optimal methodological techniques, and to critically present the research process in detail. Validity cannot be assumed, and presentation of research findings must invite the opportunity for critical reflection by consumers" (Whittemore, Chase & Mandle, 2001, p. 527). Validity can be delineated into three main components of construct, internal and external, and must be addressed to ensure the intent of the study.

Construct validity is addressed in this study through the use of triangulation, or using multiple sources of evidence, for each case (Merriam, 1998; McMillan, 2004; Yin, 2009). Validity was further verified through member checking, or having parents and students review the transcripts and notes from the interviews as well as the final case study drafts, to report any errors or to provide elaboration. Internal validity can be addressed by analytic generalization to rival theories, as well as through pattern matching (Yin, 2009).

External validity deals with the generalizability of the results, and is usually a failing of case study research due to the small number of subjects (Denzin & Lincoln, 2005; McMillan, 2004). External validity is addressed in this research through the replication logic of the multiple-case study design (Yin, 2009. In this research each participant represents an individual case. The approach is replicated for each participant and the results recorded.

3.9 Reliability

Yin (2003) suggests that to enhance qualitative reliability qualitative research should document all procedures, document as many steps of the procedures as possible and setup detailed case study protocols. Similarly, Gibbs (2007) suggests several reliability procedures in including transcript checking, check the persistence of the meaning of codes and coordinate and cross check coders (Appendix H). The operational elements and details of data gathering methods as well as the maintenance of a chain of evidence (Yin, 2009) will be reported and a reflection of the inquiry process will be included in the research report.

3.10 Limitations and Ethics

Bloomberg and Volpe (2008) stated that "we are morally bound to conduct our research in a manner that minimises potential harm to those involved in the study' (p 76). The researcher is not only concerned with writing an intellectually challenging and compelling argument but an ethical one.

3.11 Limitations

There are several limitations of the case study approach, including that the subjects were chosen purposefully and non-randomly, so results are not generalisable to broader populations. However, case study data are analytically generalisable to theoretical perspectives. Thus, a case study is able to provide reliable information about the phenomenon and thus contribute to developing a deeper understanding. Individuals remembering and interpreting details through their own lenses, so bias permeates the study: this is "one person's interpretation of someone else's interpretation of what's going on" (Merriam, 1998, p. 202). The researcher's choice of questions could present bias, and the researcher's very presence potentially alters the subject's behaviour (Merriam, 1998; Yin, 2009; Denzin & Lincoln, 2005). The

questions asked are based on previous research; however, if left completely open-ended, the subjects may choose to illuminate different factors related to their success.

3.12 Ethical Considerations

This research project carried a low risk of harm to participants under the principles of the National Statement on Ethical Conduct in Human Research (2007). The project received ethical clearance from the university Human Research Ethics Committee, Certificate number **1200000335** and was conducted without variation from the approved protocol.

Participants voluntarily took part in all phases of the research and were provided with detailed information about the study to facilitate their decision making to either participate or not participate. Participants had choice to withdraw from the study at any time without comment or penalty.

Whilst there was potential inconvenience and disruption to the operation for the school these disruptions have been acknowledged and managed by the school. Although the researcher had access to the school site on a day-to-day basis, the logistics of organising access to staff and student was directed by the school principal in liaison with the researcher and included approved access to student performance data.

The major risk for this study was that of confidentiality. Written consent was obtained for the extended use of data. Participants were advised that they could withdraw from the study at any time without comment or penalty.

The risks involved in this study were minimal and within the normal risks associated with school based research in areas of curriculum and pedagogical studies. All data were de-identified subsequent to the completion of the consultancy aspect of

the project and no names or identifying details of the school, teachers or students are reported.

3.13 Summary

This chapter has provided a review of the purpose of the research study and the guiding research question. It examines and proposes the use of multiple case study as a robust qualitative method.

A detailed research design was also provided in this chapter. It encompassed the participants, setting, data collection, data analysis and ethical considerations. Of major importance in this chapter are the clearly delineated inductive and deductive phases of the research. These functional foundational procedures were used to distil the collection and analysis of the data and emergent trends to enable greater understanding of the experiences of gifted students in one-to-one classrooms.

Chapter 4: Profile of Participants

As stated in Chapter 1 the overall aim of this study was singular in focus. Through the lens provided by activity theory and from a student perspective this study aimed to investigate the experiences of the gifted learner in a one-to-one laptop classroom environment.

This chapter profiles the participating students within a one-to-one learning environment and details their experiences over a ten-week period. The chapter will provide some family background and parental perspective of the students as well as a student based perception of their experience and comparison of school and achievement within the laptop classroom as compared to their experiences in other classrooms. Activity Theory will then be applied in subsequent chapters to the data generated.

All participants have been assigned pseudonyms selected to protect identities and provide confidentiality. Eamon, Hamish and Aiden were all identified gifted students at a Brisbane metropolitan state primary school. All three participants were 11-year-old males and had been attending the school for at least four years. Both parents of each student attained university degrees of bachelor level or higher in a range of disciplines.

As previously discussed in Chapter 3, this research utilised a multiple case study approach. The primary data sources were:

1. Semi-structured interviews conducted students and parents;
2. Surveys of both parents and students which provided back ground information;
3. Both computer and video recorded in-class observations and:

4. In-class response tool (i.e., Engage-O-Meter).

Documentary artefacts were considered a secondary evidence data source, and included school records, assessment reports and results from external testing providers and competitions. Documentary evidence was analysed in conjunction with interview transcripts as described in Chapter 3 in order to gain a rich and detailed understanding of the participants and their experiences.

This research sought to catalogue the perspectives of gifted students in a one-to-one laptop classroom environment and what effect this has on their motivation and achievement. Specifically, the research sought to answer the following research question:

What are the experiences of the gifted learner in a one-to-one laptop classroom?

4.1. Classroom Setting

The school is one of the oldest schools in the city and many classrooms within the school do not meet the space available of modern or newer designed schools. The classroom is of an older style in that it is small with a breakout room attached through a double door at the back of the classroom. It has new desks that are used flexibly in rows or clustered together in groups of four to six making for a more cooperative learning environment. Each student had a laptop which they owned sitting on the desk beside them. The teacher does not use an interactive whiteboard however, she does have a wall mounted projector in what could be described as a permanently attached arrangement to her laptop for visual sharing of the current work. ABTutor was used as control software to access all the student's laptops at any time and includes simple functionality of locking students out of their desktops with the click of a button. The software also has a range of extended functionality that can view all students' work at one time through the

depiction of thumbnails, can share a student's work to the rest of the class as an exemplar and has an instant message capability to provide just in time feedback to students as they are working. The room had on display many examples of student work and exemplars outlining expectations. Figure 4.1 depicts the classroom illustrating the arrangement and types of desks and student orientation with respect to the teacher at a point in time.

Figure 4.1. Classroom Configuration of Desks and Spatial Layout.

4.1.1 Parents beliefs and experiences

The research question focusses on the experiences of gifted learners in a one-to-one classroom. In the context and backdrop of greater teacher accountability and demand for student achievement it is maintained that the experiences of parents shapes

and informs the decisions made for their children (Epstein & Sanders 2002; Hill & Taylor 2004). As such to understand and provide rationalisation for parental choices and to some degree student outcomes then it is necessary to examine and detail the students' history and experiences. Therefore, the profile of each student includes a parental perspective on their study, behaviour and organisational habits followed by a student self-description and assessment. This information was supported by interview transcripts and survey responses.

All parents were well educated and have had different experiences, both positive and negative, regarding their children's experiences at school. The background survey of the parents provided rich and deep information on all the students. From the pre-intervention open ended surveys and follow up interview all parents reported that their child enjoys school, however, when asked to provide detail to the extent to which their child enjoyed school the answers were quite varied and tended to draw upon and highlight the social aspects more so than the academic outcomes. When asked about the happiness of their child attending school, parents responded;

> Eamon is happy and enthusiastic to go to school nearly every day and looks forward to being with his friends. To my knowledge he has never complained that school is boring but on the flip side he doesn't think that it is challenging. (Eamon's mother)
>
> Hamish has historically been ambivalent about school. Generally, as a parent, I haven't felt that so far school has met his individual educational needs particularly well. He has been happier at school this year in the laptop class. (Hamish's mother)
>
> Aiden is typical of a Grade 6 boy, and thoroughly enjoys the subjects he is interested in, and does not enjoy subjects that he is not interested in. He

> enjoys the social milieu of the schoolyard but is never academically challenged. (Aiden's mother)

All parents have similar concerns regarding the way in which their child is challenged in the wider school context. They feel positive about school but there are undertones and concerns of underperformance or complacency/disengagement of all students from a parent perspective. For example, the father of Eamon and Hamish noted that the level of challenge had increased this year, an observation not evident in the comment of Aiden's mother;

> Assuming challenged is a positive term in this context, Eamon generally finds the work interesting although the mechanical aspect of tasks (e.g. writing) he finds frustrating. He has been more 'challenged' this year than previously and he appears more dedicated to his performance and outcomes. (Eamon's mother)
>
> Hamish is more challenged at school this year than in previous years. I still feel that he could be challenged more in mathematics in particular. I would also, very strongly, like to see a more consolidated G&T program in the school with better communication between the teachers and parents. (Hamish's mother) He sees through' some of the school structures that are set-up and is at times cynical about the school processes. (Hamish's father)
>
> Aiden does not feel any pressure to perform to his academic potential in many school subjects. He finds it easy to achieve adequate marks with a minimum amount of application. (Aiden's mother)

With the exception of an experience with a multi-age year 1-2-3 classroom for Aiden, another trend identified in the data was that the other parents believe that their child has not been challenged in previous classroom settings. Frustrations are quite evident in all responses when the parents were asked if the parents felt their child had been challenged at school.

> In early years definitely not. This lead to Eamon to become used to the idea that he can achieve without effort - a strategy that he is struggling to reverse. (Eamon's father)
>
> Probably the major issue with this is that by the time tasks became more difficult and achieving without effort was not possible the behaviour pattern was ingrained and failure to achieve hit his self-esteem very hard. I'm not sure how much faith he has in his abilities any more but it seems to be improving this year. (Eamon's mother)
>
> No. My child (Hamish) had a pre-school aged (5 years and 3 months) Stanford Binet assessment done, at the recommendation of his pre-school teacher. The most important thing I perceive for an intelligent child to be properly challenged is that the teacher likes the child, develops good rapport with them and understands the 'G&T profile'. In the past some teachers refused to challenge my child until his day-dreamy behaviour improved. I always argued that his behaviour would improve if they raised the academic stakes to the appropriate level. (Hamish's mother)
>
> Most teachers do not want to have these types of conversations and are defensive when talking to a parent whom is advocating for greater challenges for a G&T student. (Hamish's father)
>
> He (Aiden) was most motivated to learn when he was in a multi-age class of Grade1, 2 and 3 students when in Grade 1. Since then, not at all I believe until this year. (Aiden's mother)

All parents indicated strong routines and ground rules regarding making allowances for their child's learning at home. One family goes to extraordinary lengths to ensure that their child has enough stimulation to maintain interest.

> With Eamon homework is given first priority in the time budget.
>
> With Hamish he studies Latin twice a week and takes private cello lessons. I scour the libraries and bookshops to keep him reading. I only work part-time,

> partly because I think gifted children are more demanding and more emotionally sensitive.
> Aiden is required to complete homework tasks before playing games or doing extra-curricular activities. He does a lot of non-academic activities, to broaden his social circle and help with his social skills.

All parents indicated strong and reasoned views when asked, “How they believe programing for their child in regular classrooms could be improved?” Of note is the firm belief that clustering with likeminded students is key to their child’s enjoyment and academic achievement. How this clustering could occur and possible limitations were expanded upon by Eamon’s parents who expressed concerns about the definition of “like minded”. Special interest groups were seen as a possible solution. Aiden’s parents also noted the challenges of establishing effective clustering. Hamish’s parents while also advocating clustering argued for adult mentors.

> I think clustering with likeminded students can be a good idea because it combines the extended or accelerated learning with a social base so the child does not feel different or segregated. The potential problem I see is that the criteria for defining "like minded" can be complex and either too broad, defeating the purpose, or too narrow, destroying the social benefit. Special interest groups can provide a way to counter the problem of identifying likeminded students. If the group's activities are tailored to include curriculum targets then this can also take a lot of the tedium out of some of the more mundane skills the student are required to gain. For example a robotics group, in addition to the obvious technical skills, could learn research techniques, writing and presentation skills, artwork, mathematics, science etc. all in a setting that the children are enthusiastic about. I also believe a skilled teacher who can recognise a child's particular strengths, interests and learning style, and who can tailor their efforts accordingly is paramount. (Eamon’s Parent Survey)

> Clustering seems key. I do not believe there is any deleterious effect on the children of lower ability in differing classes and feel that children like my son do things in such a different process (for example his mathematics) that they aren't beneficial as role-models of 'process' for the average-ability kids. I fantasise about G&T kids having an adult mentor within the school who is a strong advocate for their particular 'special needs' and who would meet them weekly. Some greater celebration of academic achievement would please me. Pull-out classes would be great. A passionate Guidance Officer would be key. (Hamish's Parental Survey)
>
> Clustering with similar abilities, challenging students to produce work with deeper learning, rather than extending them to higher year level work, somehow require them to produce better work than less able students to achieve higher marks.(this is really hard, no easy answers here, I'm afraid I'm pretty clueless.) (Aiden's Parental Survey)

All parents indicated positive responses from their child regarding the use of laptops at home for school purposes. There is a distinct and ever present connotation however, regarding distractions and temptations the device may create. For example the father of Eamon, in response to a question about the use of laptops at home highlighted his concern about computer games as a distraction at home; "Generally very positively although the internet and games can sometimes present too much temptation when there is a specific task to be done."

The mother of Hamish acknowledged the extent to which the laptop was motivating him;

> He is more motivated than I have ever seen him to complete his homework. The laptop has also been a vehicle for him achieving total independence from his parents in regards to his homework. He is very savvy at accessing information that

> he needs using computers. It has freed up his time to pursue things in greater depth and detail.

The mother of Aiden similarly commented regarding enthusiasm and temptations by commentating:

> When he is focused Aiden can complete work with enthusiasm and quickly. However, he often takes longer to complete tasks on the computer than he would if he were completing work in a traditional format as he can be very easily distracted and plays games when meant to be working. I often need to print out homework tasks for them to be completed in a more timely fashion.

The strongest response from parents came when asked regarding the laptop for the use of entertainment at home signalling that all of the children can become obsessive especially in regards to computer games. However, both Eamon's and Hamish's parents acknowledge that they put limitations on gaming.

Eamon's Mother stated that, Eamon loves playing games, "He would spend his whole weekend playing games if we did not prevent it." Hamish's mother stated that Hamish tends to become obsessive about it.

> We are very diligent about making sure he is exercising and playing with friends as priorities and his time for computer games is monitored and limited. If a friend from his laptop class come over my rule is that they have to play Lego, swim, play basketball etc. for all of the playtime available and then for the last 30 minutes they can play computer games.

> Aiden is almost obsessed with the computer, and will spend a long time playing unless monitored.

Finally, when asked if they believe the use of the laptop in class was a motivating factor and supported independence, all parents believed that as a tool the laptop has provided their child with an opportunity to be more self-reliant and engaged.

> Eamon is more engaged than ever and I believe that this can be contributed to the laptop and the way of working within the classroom.
> Hamish loves the opportunity to go it alone and not be reliant on others.
> Aiden is very motivated regarding the laptop. I don't think he will ever stop being obsessed with games and distractions but he is certainly more focused on work.

Table 4.1

Summary of Parental Contextual Perspectives

Assertions	Enthusiastic	Lack of challenge	Home support (strong routines?)	Support for ability grouping	Support for laptops/ICT	Monitors and limits the amount of use	Concerns regarding distraction
Eamon	✓	✓	✓	✓	✓	✓	✓
Hamish	✓		✓		✓	✓	
Aiden	✓	✓	✓	✓	✓	✓	✓

In summary, the perceptions of the parents greatly influence the decisions and expectations and hence the experiences of their children. Table 4.1 above shows clearly that all parents believed that their child has shown a greater degree of enthusiasm for school with their inclusion in the one-to-one program. All parents regardless of background also believed and showed support for the use of laptops in the classroom as a means to differentiate and individualise learning and state that strong routines are a

must. Two families spoke directly about the lack of challenge posed for their child across their general schooling history with only small variance. All parents monitored the use of computers and limited access time due to concerns about obsession or distraction.

4.2 Observations

The following observations of the students and the class took place over a 10 week term. These initial visits built up trust and rapport between the researcher, the class and the identified students. Throughout the course of the study each student was observed during the lessons for periods of up to 40 minutes on at least 3-6 occasions. Observations by the researcher were made once prior to the commencement of the investigation and the rest during the students work on their science key learning area.

4.3 Case One: Eamon

Eamon is an 11-year old boy and is the eldest of two children. He is tall for his age and presents as a very earnest young man who is generally quick to engage in verbal dialogue and debate no matter what the topic or who is involved. He is respectful to everyone regardless of age and has a distinct sense of right and wrong. His mother is a teacher and his father is a software programmer.

4.3.1 In the classroom

Eamon was observed on five different occasions in the laptop classroom. The following vignette is a snapshot that is representative of his behaviour.

Eamon sits at his desk in a casual but comfortable position. He generally appears to listen to what the teacher has been saying but also listens to the other students at his desk. He becomes a little distracted and looks at another student's laptop and seems to

disengage from the teacher's discussion but with a simple word he is brought back into the fold. This is Eamon in the classroom: helpful to peers; generally focused but quick to come to the aid of others regardless of its importance or significance to the current situation.

Eamon is enthusiastic about school and looks forward to being with his friends. He is an attentive listener and loves to debate classmates, friends and teachers. He generally achieves at a B level across most areas however, this fluctuates with his interest in the current topic. He is an avid reader and an excellent orator having the highest oral score of the three case study students in the psychometric testing.

4.3.2 Self-description

Eamon is quick to engage in discussion regarding himself. He does not appear very self-conscious discussing his thoughts and his place in space openly. Eamon enjoys school when it's challenging and is generally a happy person. When interviewed he particularly argued that learning is about experiencing new ideas that have some value in life.

> I find school enjoyable because I like to find that things are challenging because I like the challenge of it because easy topics are boring. I find that whenever a teacher introduces a new topic that we are going to learn about I always like to think, well, this is new topic, I will learn something here and get a get like an experience in it. So I like finding out that this is how most people would do it if they were in this certain area and I like how the teachers give a range of different problems just for one subject. So they would give more and more reasons why this topic would be used in life.

Adam Knights

He believes his greatest strength is thinking deeply and being responsible towards his family and others. He also believes he has a very dry sense of humour and readily links this to his father. Eamon perceives his academic areas of strength are mathematics and science as these most stimulate him and will talk and debate for as long as allowed regarding scientific fact and investigation. Eamon is surrounded by students who have similar interest and abilities. Within his peer group he doesn't think he stands out as we are all the same.

When asked about what engages Eamon at school he acknowledged the role of the teacher and also working with groups of similar ability. He was very aware and went to great lengths not to make others seem less able but enjoyed classroom work the most when surrounded by like minds and understood him.

> I like mathematics on the computers in how they have different rotation groups and how the teachers fit people with other people in their learning achievements and such so rather than everyone learning Pythagoras theory or gravity, momentum and energy while people are still trying to figure out ratios so the teachers split them up into different groups so the more relevant stuff to the child's learning capabilities doesn't confuse the learner.

When asked how he perceived himself as a student academically he readily admitted that he sometimes is a little disorganised but generally manages to pull it together. He also admitted that this may not be his best work when he does this.

When asked about how he felt when using laptops in the classroom he was very excited to point out the opportunities that exist especially in making the learning fun and engaging.

> I really like using the laptops and especially in science as I like the hands on approach. I do like the learning objects (video games) because the learning

> objects **apply a sense of fun** into the subject so effectively the student doesn't get bored and not really learn from the topic or the learning activity.

He believes that school is different this year because he has more peers at his own level and also because he has more freedom to investigate things with the computer based learning environment:

> I am **definitely more focused this year.** My expectations of myself are to be in the top groups for Mathematics and English. I like being able to choose how I do things and how I investigate problems with my laptop. I also like having **people who understand things around me**.

When asked about the future he believes that he will be at university and studying. He also believes that he may like programming or a science based course.

4.4 Case Two: Hamish

Hamish is an eleven year old boy and is the eldest of three children. He is an exceptionally tall young man who has a capacity to gravitate towards impulsivity and basic attention seeking behaviour when outside of the classroom. He is very quiet and thoughtful when spoken to and is slow to respond, often not looking up from the ground in front of his feet. His parents are both professionals with his mother a veterinarian and his father is an engineer.

4.4.1 In the classroom

Hamish was observed on four different occasions in the laptop classroom. The following vignette is a snapshot representation of his behaviour. The lesson was numeracy and writing basic equations for word problems.

Hamish sits forward with a noticeable foot tapping under his desk in the classroom. He seems nervous and is constantly watching everything in the classroom at once and appears to be paying little attention to the teacher. He is distracted by

something in his pencil case next to his computer for a few minutes but then refocuses and joins in the classroom discussion. This is Hamish in the classroom: easily distracted; wanting to be part of everything; and yet, able to assimilate back into the learning quickly and with confidence.

Hamish is very enthusiastic about school and lives for the social aspect of school life. He is an attentive listener when things spike his interested, but generally needs to be reminded of expectations. He generally achieves at an A level across most areas however, this fluctuates with his interest in the current topic. He is an avid reader and has the highest working memory score of the three students in the psychometric testing.

4.4.2 Self-Description

Hamish is slow and considerate when answering questions regarding himself. He appears highly self-aware as if suddenly his arms and legs and too long for him to sit comfortably. He enjoys school and understands what challenges him most. Below he highlights the importance of challenge that he attempts to achieve through thoughtful, creative and innovative activities;

> I like school most when you have to think. I mean when you can go into depth. Instead of people telling you what to do, you can challenge them why they should do something and really investigate it. I really enjoy activities where I can be creative and customise things like in art or science. In these I don't have to pay much attention I can just do it. However, I think I am motivated most by something that is difficult or hard for me.

Hamish believes that he is doing well at school and it is something to be enjoyed. He claims that he has always made friends quickly and has no problems relating to people;

> School is something that should be enjoyed, not dreaded. This is because if you don't want to do something, you don't do it well. I think I am doing adequately at

> school. I know because in my report card I never get a B except for sport and I have lots of friends here as well.

When asked about his personal goals for this year he went quiet and said that he wants to be more organised. He also thought that this year had been different for him so far because he was more in control of how he accomplished things. Hamish made note that using a laptop made things a lot more fun and a lot easier. When Hamish was asked about his academic ability he was shy to admit that he thinks differently to others and that sometimes others do not understand him very well or his point of view.

4.5 Case Three: Aiden

Aiden is an 11 year old boy and is the middle child of three children. He is solid and continuously has a sly grin and look of expectation in the eyes. He is always respectful and does not seem to be particularly bothered or concerned by much. He is slow to respond to questions on any topic and corrects himself often when pushed for elaboration. His mother is a scientist and his father is an engineer.

4.5.1 In the classroom

Aiden was observed on five different occasions in the laptop classroom. The following vignette is a snapshot representation of his behaviour.

Aiden sits with an erect posture in his seat in the classroom. He faces towards the teacher and listens intently to everything that is said and smiles to himself. He does not readily engage with the conversation until asked by the teacher and then his answer is short with little elaboration. His desk is always neat as is the area around it. However, his desk tray located nearby is crammed full of bits of paper and dog-eared books and odd bits and pieces from the environment. This is Aiden the classroom: quick to smile; happy to listen more than interact; and, always has a secret.

Aiden loves many aspects of school. His friends take pride of place at lunch time and he likes to be involved in sport. He does not put in any particular effort in the classroom or out and seems happy to takes things as they come. Aiden generally achieves at a B and above level and is happy to coast in every aspect. When pushed to maintain his effort and approach for a specific topic or cause he is able to deliver very high outcomes.

4.5.2 Self-Description

During the interview Aiden considers every question before answering. There is no automatic response. He describes himself as happy and easy going. He lists mathematics, technology and science to be his particular areas of strength and interest. A strong theme emerging in the data is that he values the balance between school and friends. He places high values on friends and teachers. In response to a question concerning what he values most at school he replied, “Friends because they make him feel happy and teachers because they always help him learn in the best and most understanding way.” He is most engaged in school when it is something that is challenging and he likes doing as evidenced in the following response;

> I find school the most enjoyable when I have something interesting and challenging to do. When it is something that I like doing like algebra.

Aiden also described himself as having a dry sense of humour and that being able to have a joke laugh and relax to be amongst his favourite things to do. He believes that this is why he fits in with most groups in the school because he is more relaxed. When working in the classroom Aiden most liked it when he worked a group of peers who understood how he worked. Sometimes that means sitting with others but working alone

and sometimes it means working with a partner. He also readily admitted that he can become distracted and drift onto other topics when he has the opportunity to talk in subjects and this meant that sometimes he did not finish work to the highest possible standard and that he was happy with a B. This was particularly evident when asked how he felt about using computer technology to develop a project.

> I like using computer technology to develop a project because you don't just write everything and draw everything. You actually have a few different programs to help you create the project and that makes it easier and faster. I like things being quicker and I can go onto other projects. I don't like going back and checking.

Aiden wants to be successful at school and thinks that school is important. If he could share anything about school with others it would be that he thinks it is important for people to know that 'school today is good at catering to different peoples learning needs making things easier to understand.' His future ambition is to be a computer programmer as he wants to know and understand what makes a program work and how it can be improved on. Money is also a contributing factor as he wants choices in life and he sees that education is the way of achieving it.

These three students although exhibiting their own personalities possessed a number of common characteristics as show in table 4.2 Common themes of motivation, engagement, peer working and speed were strongly evident across all participants. Also self-regulation and improved results were also elucidated.

4.6 Common Themes

These profiles are essential in defining the participants, their experiences, understandings and expectations as it relates to the central research question. Table 4.2

below highlights the common themes from the participant interviews. Of note is the commonality of motivation, speed and engagement with the device.

Table 4.2

Common Themes

Themes	Motivated by challenge and interest	Self-Regulation	Engagement with Laptop	Peers at same level	Speed of work	Improved Results
Eamon	✓		✓	✓	✓	✓
Hamish	✓	✓	✓	✓	✓	✓
Aiden	✓	✓	✓	✓	✓	

4.7 Participant Based Feedback on Engagement

Both parents and students made references to the level of engagement in the classroom being important for improved outcomes. Engagement was indicated by time on task, during the science tasks was monitored and immediate feedback provided by the participants. For feedback the science task was broken down into four phases: Introduction, Research, Experiment (Computer Simulation and Video) and consolidation. (Appendix J) During each stage of the key learning area lesson students marked on their sheets (Engage-o-meter) their level of engagement at 10-15 minute intervals during the activities as prompted by the computer timer.

From each of the lessons the responses were averaged out across the areas. Students were most engaged during computer research and simulations. Figure 4.2 below provides a summary of the feedback from participants on when they were most engaged in the topic. It is easy to identify that on average the areas of research and simulation when using the laptop are the most engaging for the participants. It may be

inferred that for gifted students moving more quickly from the introduction to the task and simulation provides more engagement in the overall task.

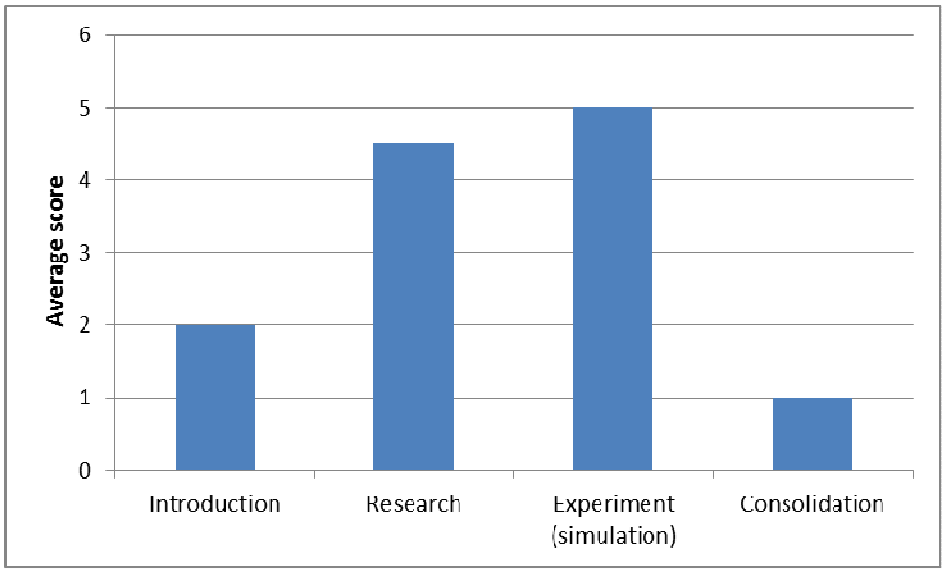

Figure 4.2 Student Engagement as Reported on Engage-O-Meter.

4.8 Video and Software Monitoring

Video recordings covered the whole classroom space during science lessons. Students were each observed and then videoed five times during the course of the study comprising of four sessions of computer use and one of discussion and working with peers. The average science lesson lasted one hour.

In total, video sessions provided 200 minutes of formal observation where critical incidents were mapped. To assist in detailing the experiences of students in a one-to-one classroom student work habits that were monitored. This time included time on task, time off task, conversation with peer, conversation with facilitator, movement from desk and interruption by another were also monitored (Appendix I). Through these observations students were actively engaged in the one-to-one environment on the

commencement of a task. When comparing the non-computer related session to the computer related session less than five minutes was spent off task compared to twelve and half minutes in the discussion where the students tended to argue minor points and roles. This was also supported by the software mapping of the student's actions and keystrokes where there were limited idle periods. The video reveals that all students were engaged when given a task using the laptop and online resource gathering. Whilst students enjoyed working collaboratively the three focus students tended to drift away from the core purpose more frequently than when using the laptop. Whilst students and community members worked within the rules and obligations the facilitator provided for the dynamic interaction students were more prone to tangential discussion. The students were monitored using control software when working on the laptop in the research phase of the lesson. Participant actions were broken down into four main categories of resource gathering comprising primarily of internet based research on the topic; (1) note taking comprising of the composition of dot points; (2) artefact creation comprising creating a template or canvas to complete their work; (3) virtual classroom access; and, (4) distraction.

During the one hour all three of the participant students when compared to their classmates had a time on task average of 90% compared to their classmates average of 75% during the research and simulation components of the key learning area lesson. Also, it was also observed that they required less teacher referral time and were subject to fewer interruptions by peers than most other students. Figure 4.3 and 4.4 below represent this finding graphically. Of note is that for all students the longer the activity went for the time on task started to even out and parallel.

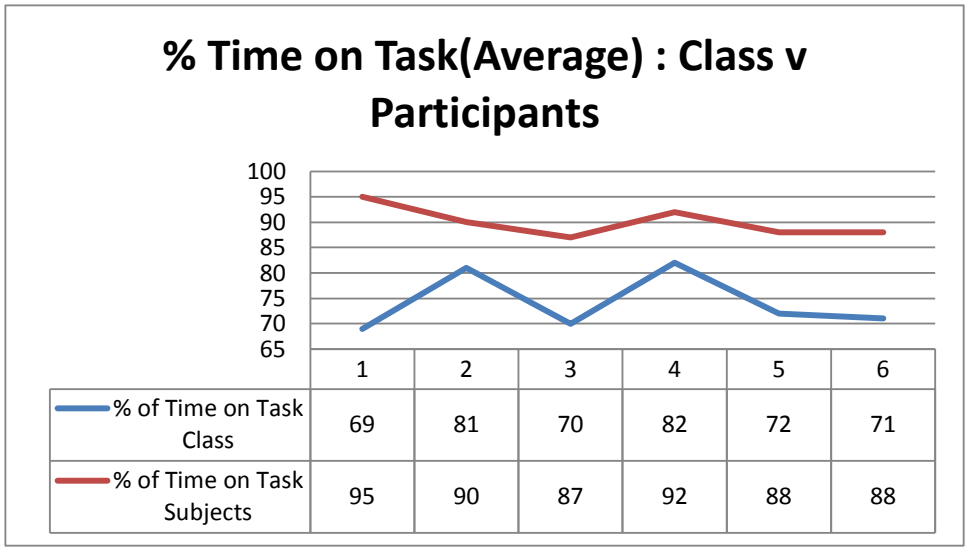

Figure 4.3. Time On Versus Time Off Task.

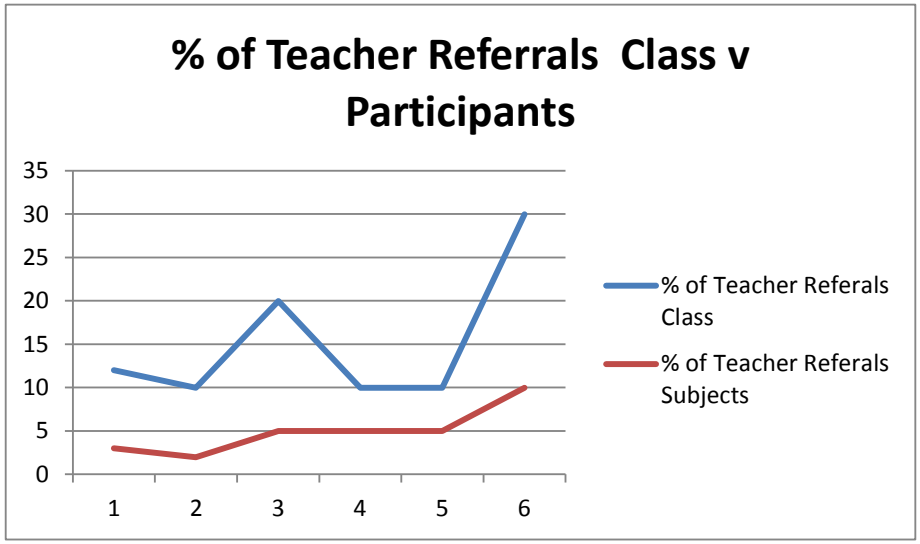

Figure 4.4. Percentage of Total Number of Teacher Referrals.

4.9 The Difference

Parents indicated in section 4.1 that compared to previous years the main and most apparent difference was the level of engagement and the opportunity for self-regulation and achievement. This was directly attributed to the use of a laptop during class time by both parents and students. All parents indicated that the device provided opportunity and avenues that were previously absent or only ad hoc at best. From the post survey all parents either agreed or strongly agreed that the following aspects were an outcome for their child in the one-to-one class:

- catered for gifted students;
- actively fostered enjoyment of learning;
- enhanced greater self-confidence and self-esteem;
- encouraged the use of computers more often for learning;
- helped develop greater ICT skills;
- increased their research skills;
- improved problem solving and critical thinking skills;
- increased access to information;
- enabled them to present information more effectively;
- encouraged more self-direction in learning;
- increased engagement in learning; and
- generated more enthusiasm.

Students also indicated a number of positive changes in terms of using the device. For students however, the highest ranked response from the survey was a sense making learning fun. From previous years students remarked that the opportunities for self-direction and the pace of learning was also the biggest change during class time. They also reported a range of other enhancements such as:

- more fun;
- increased engagement in learning;
- higher interest in learning;
- more self-directed learning (Pace);
- use computers more often for learning;
- higher focus on improving performance;
- enhanced ICT skills;
- improved research skills;
- writing more extensively with improved quality;
- presenting information more effectively; and
- enjoying learning actively.

4.10 Summary

In general, the participants and parents indicated that being involved in a one-to-one laptop classroom had positive outcomes for learning ranging from improved student achievement to shifts in the way in which participants are responsible for their own learning. The main areas of converging responses and beliefs about the use of laptops in a one-to-one class were in response to questions of engagement and self-regulation. The students in isolation pointed out that using a laptop made the classroom more fun however, this could also be incorporated into the parents' response that their child is more enthusiastic about learning. Parents did raise concerns about their children obsessing with the technology and becoming distracted by the laptop. However all parents were closely monitoring their child and had rules and routines about the use of the device.

Chapter 5: Classroom Activity Systems and Outcomes

The previous chapter provided a detailed profile of the three participating students Eamon, Hamish and Aiden. The major aim of the study was to document and analyse their experiences during a one-to-one laptop class and ultimately provide insights into their learning from their perspective. Specifically, the following question was posed:

What are the experiences of the gifted learner in a one-to-one laptop environment?

As stated in Chapter 3 (Section 3.6) two distinct phases are applied to the data in this study. The first phase in Chapter 4 provided a description of the case and an inductive approach was applied to analyse the subject interviews and surveys in the understanding that as the research progressed the research emphasis would be adapted to yield a richer understanding of the experiences of the participants. A multiple case study approach was used to provide opportunities to develop converging lines of inquiry. Chapter 4 focused on familiarisation with the data, initial code generation and identification of the common themes and assertions that were derived as summarised in Table 4.2.

Chapter 5 reports a deductive process and involves examining the data presented in Chapter 4 through the activity theory framework. As highlighted in Chapter 2 (Section 2.7), as a framework activity theory allows us to differentiate the whole

structure of the classroom and associated learning activity as interdependent activity systems and examine how different activity systems predisposed and affected each other in the wider classroom context.

In short according to activity theory, learning takes place when the subjects are engaged in constructing knowledge through a mediated process. Systems are realised and identified when participants of the system are collectively engaged with a tool for an outcome.

As stated in Chapter 2, in Engestrom's original work, activity systems include a subject, tool, object, rules, community, distribution of labour, and outcomes as shown in Figure 5.1. Subjects are participants of the activity and tools are the resources that subjects use to obtain the object or the goal. Rules can be informal or formal regulations that subjects need to follow while engaging in the activity. The community is the group that subjects belong to and the division of labour is the shared responsibilities determined by the community. Any component of an activity system can bring about tension in the subject's effort to attain the object. Finally, the outcome is the consequences that the subject faces as a result of the activity. These consequences can encourage or hinder the subject to participate in future activities.

As stated in Chapter 3, Activity Theory was chosen for this study due to three main considerations.

1. AT has well named and easily identifiable conceptual and analytical constructions within a system.
2. The perspective of the individual is paramount to everything. Activity Theory focuses on the cognitive process of an individual situated in an intertwined world of social, cultural, and historical nuances and norms.

3. Activity System diagrams provide a simple, descriptive and visual power to educational based settings.

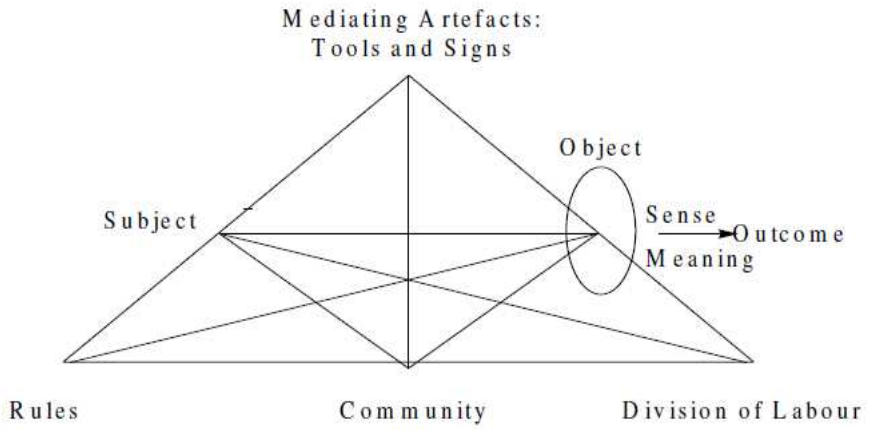

Figure 5.1. Activity Theory Overview of a System

Activity Theory makes the links clear between learning and outcome-based activity. As stated in Chapter 3, Jonassen and Rohrer-Murphy's (1999) have created an approach for analysing activity systems. This six-step approach, that is intended to match activity system components with the learning outcomes, will be adapted in this study to analyse the one-to-one classroom system. The 6 steps to be applied include:

Step 1 Analyse the purpose of the activity system;

Step 2 Analyse the activity system;

Step 3 Analyse the tools and mediators;

Step 4 Analyse the context;

Step 5 Analyse the structure of the activity system; and

Step 6 Analyse the system dynamics.

5.1. The Purpose of the Activity

The system being analysed is a one-to-one classroom in a suburban state primary school. Students in this classroom use a laptop in a one-to-one setting where every student uses and owns a device.

The focus of the lessons was science. The aim of the science coursework was for students to gain a critical understanding of science concepts and knowledge and be able to transfer these concepts to new situations whilst working in a one-to-one laptop classroom. During the course of this unit and at various junctures all students worked at their own pace and level. During these times differences between the intent of the science unit, the teacher and student intent created tension within the system that may drive change and be the catalyst for learning. Some participants in the system worked fast, some slow, some interested, some not and as such the motivation and outcome of each participant is different.

Figure 5.2 below provides the system diagram for this educational setting.

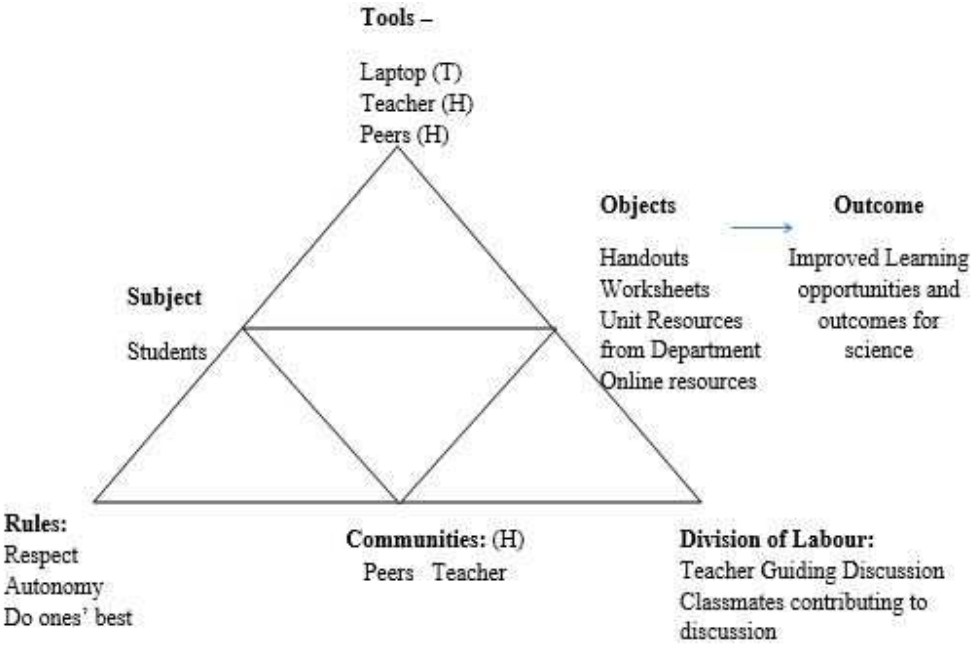

Figure 5.2. Activity System Overview of Classroom

5.2. The Activity System

A fundamental element of activity systems is that activity is driven by difference in needs such as, doing one's best or not wanting to get in trouble, which in turn spawns a difference in motivational levels. As such, in its most simplistic form the higher the need, the greater the motivation. Within this system students used a one-to-one device to support learning within the key learning area of science, specifically motion and forces. The intended outcome was for students to understand the concepts and be able to apply their knowledge to new situations. The timeframe was standard school term of 10 weeks. The sequence of core understandings to be achieved and intent were provided by pre-set unit of the state education department including assessment tasks of a written report and culminating test.

The assessments were moderated on the student's ability to show critical understandings of topics involved and then transfer this knowledge to new situations. Rules both explicit and implied governed the behaviour of participants within the system. Explicitly stated rules such as respect for others and working to the best of your capability combined with implied rules of working hard and promotes and reinforces the concept of teacher expectations. The teacher as the facilitator, mentor and authority redirected students when needed and reminded them of the rules and expectations. Such interactions provide students with the intent and expected outcomes from the lesson.

This relationship between the teacher and students also reflects the division of labour in an activity system. This relationship parallels the research reported by many researchers, and is commonly dubbed the hidden curriculum. Michael Apple and Nancy King (1977) and Henry Giroux (1983) argue that schools systems implement a hidden curriculum that is the covert pattern of socialisation that prepares students to function in

the existing workplace and in other social/political spheres. That is there are norms of practice, rules and values transmitted by the way school classroom operate.

5.3. The tools and mediators

From the literature review, central to the understanding of activity theory, is that human activity is mediated by tools and that during any activity tools are created/transformed fluidly. In essence tools provide a meditated pathway between the subject and object and cultivates consciousness of learning for participates of the system. As such it is reasonable to assert that tools inform and shape behaviour, actions and reasoning of participants in an activity.

Tools are multifaceted within this system and can be viewed from many aspects. For the purpose of this study tools will be divided into two aspects; human (H) and technical (T). Figure 5.3 outlines the structure. The human tools encompass the teacher, the peers and their associated classroom interaction. The technical tool was the one-to-one laptop device.

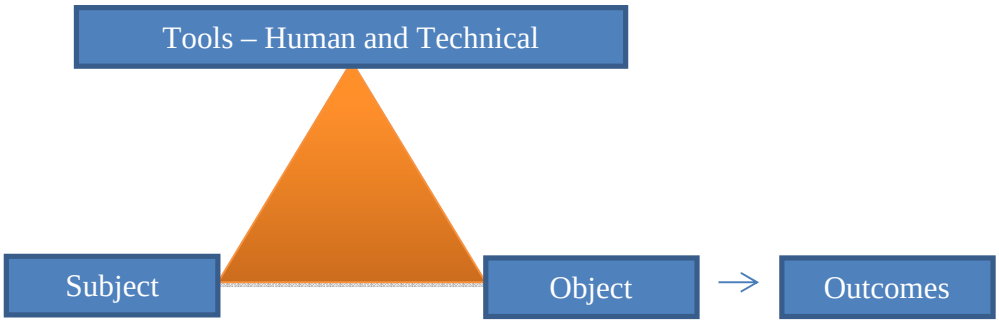

Figure 5.3. Tools of the Classroom System

The teacher as a tool within a system creates the constructs and environment for learning. Teachers set the scene, enforce the rules and understanding and help question

and direct when needed. An example of which can been see in the following teacher quotes taken directly from observation and journal notes:

> Today we will be exploring how forces affect acceleration of an object at rest. It is my expectation that you will work quietly in pairs to read through the information provided, take notes before we talk about it as a class group. You will have 10 minutes. Time starts now.
> Boys are you busy? Do you need some help or just making poor choices?
> Ok now we have that think about an experiment that you could create to test that theory? Think of design, procedure and equipment needed.
> That is good girls but can you make the diagrams more clear?

Peers help create the platform for social interaction and also provide some sense of expectation and motivation that are different for all subjects of the system. An example of which is illustrated when students broke into pairs and they compared notes from their reading. Then a group would change or enhance their notes to reflect what another group had created.

From the literature review in Chapter 2, particularly the evidence provided by Johnson, et al., (2010) and from beliefs of the participants unearthed in Chapter 4 the laptop device provides students with a way to individualise learning that best suits them. Where students need support, they can turn to their peers and teachers and for students who need an advanced pace of learning the laptop enables students to go further more quickly and in turn increase motivation and to moderate learning. Aiden's quote below best encapsulates this.

> I like using computer technology to develop a project because you don't just write everything and draw everything. You actually have a few different programs to help you create the project and that makes it easier and faster. I like things being quicker.

Figure 5.4 provides some screen shots of the focus group's research (namely Aiden, Eamon and Hamish) patterns compared to those from the rest of the class. Figure 5.5 depicts the general browsing and research habit of another student (average academic ability) in the class. Of note is the small number of tabs open (3) compared to Eamon, Hamish or Aiden (12). Of particular note is that the focus group as a whole has many more tabs open than that of others students and some of them were more tangential to the topic.

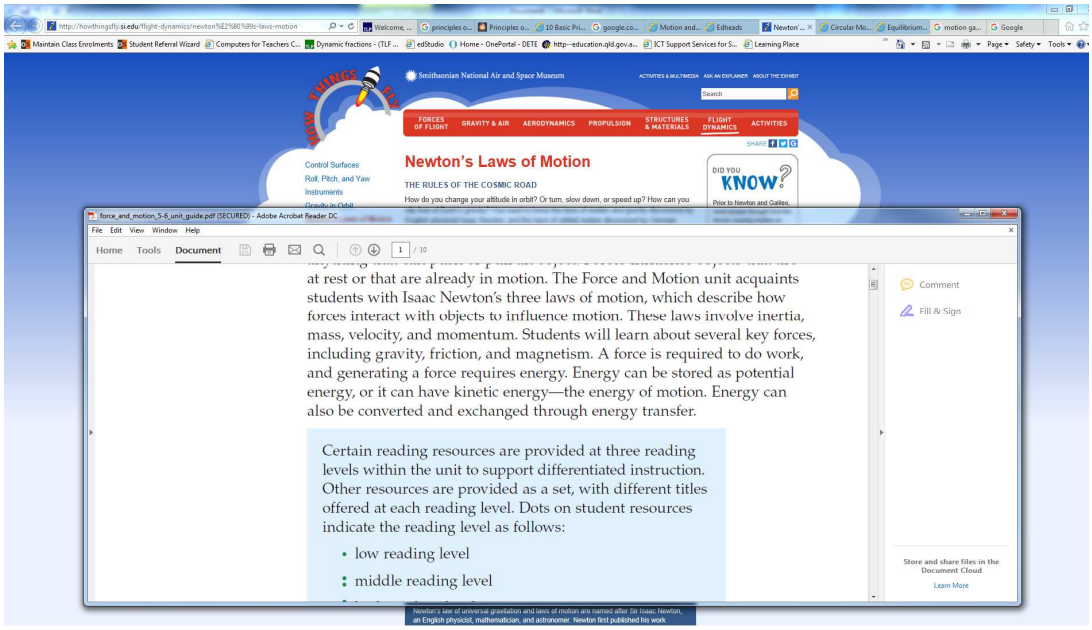

Figure 5.4. Screen Capture Focus Group – 12 Tabs Open and a PDF document

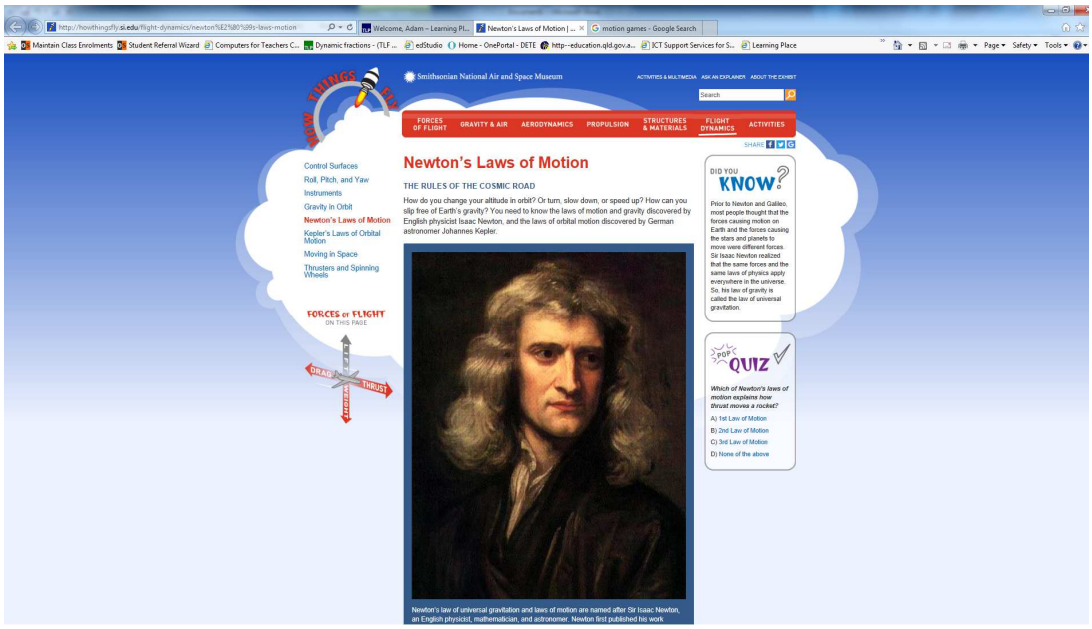

Figure 5.5. Screen Capture of Average Student – 3 Tabs Open

In respect to activity theory, Figure 5.6 summarises this relationship between the tools both human and technical, the subject and object. For instance each tool within the system provides a different pathway and relationship between the subject and object.

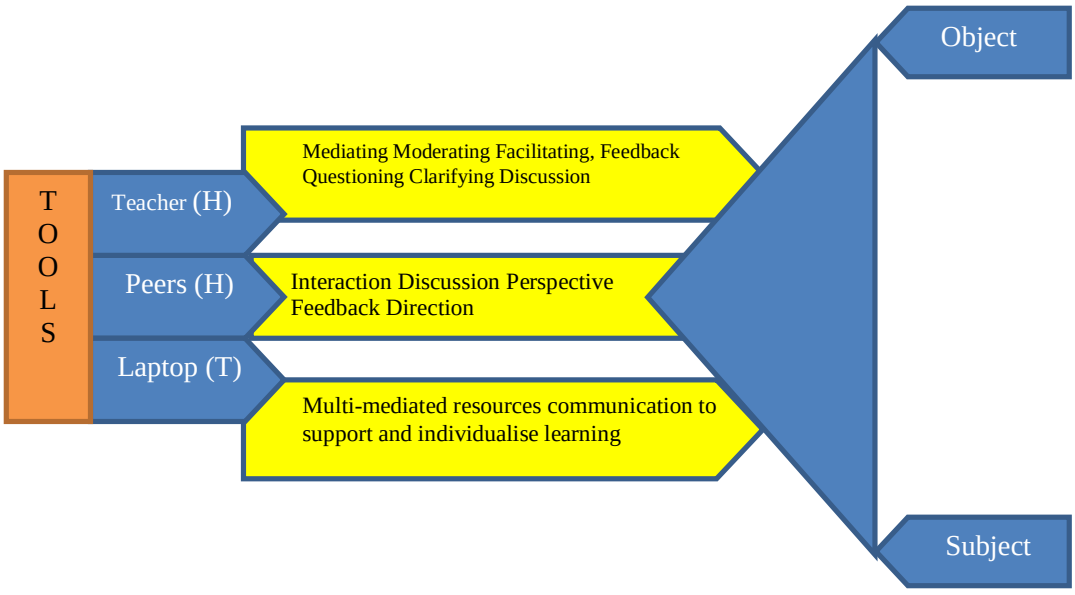

Figure 5.6. Activity Theory Summary of Interactions

5.4 The Context

When using activity theory the context of any activity may be drawn from elements or circumstances in which the activity occurs. Activity theory also acknowledges the difference between internal and external contexts and relies on an acceptance that internal contexts cannot be understood if separated from external contexts. As such activity theory provides a structure to focus on key aspects of a given context.

For this study the internal context was the intent for the students to demonstrate critical understanding of the science concepts and validate this knowledge by applying to new situations. From this perspective there will exist a difference for both the teacher and students of the importance of this outcome. This difference is nourished by the relevance and perceived importance of the intent by subjects and in turn will inform motivation and self-direction of the participant. Figure 5.7 summarises the context of the system.

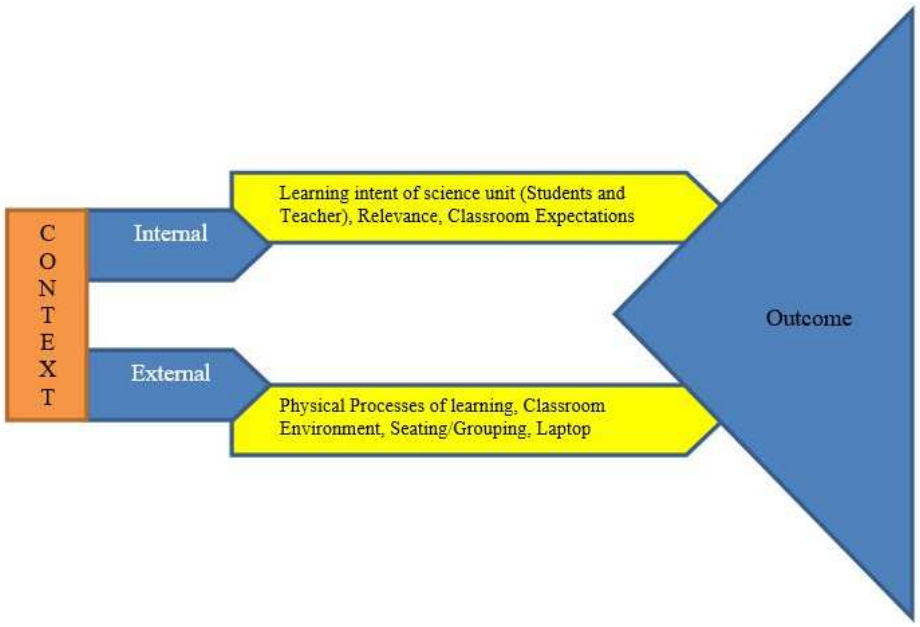

Figure 5.7. System Context

The external context envelopes the physical classroom and the social interaction between participants as well as the one-to-one device. However, the laptop is a tool that extends the external environment to include sources of information embedded in the internet. The first element of the external context is the process of learning itself. As stated in Chapter 2 the classroom in which this study is situated is a one-to-one classroom that adheres to an overarching constructivist model of learning. Under such a model subjects are actively involved in a process of meaning and knowledge construction rather than unreceptively receiving information. Ultimately it is the students who are the makers of meaning and knowledge and as such learning is a social process that involves external influences.

The second element of the external context is the physical classroom environment and its associated seating and grouping. Students sat in clusters of five in an open circle design. This allowed for students to see the teacher and also their peers and to discuss openly or within the group. Within this environment both the students and teacher act alternately as a tool to support learning through social interaction.

The final element of the external context is that of the device. Each student in this environment owns and uses a device that allows learning in a just in time context which can support and reflect both the individuals' motivation for achievement and mastery and also the groups need for knowledge and discussion. Ultimately as one impacts the other, both the internal and external contexts are relevant in achieving the system outcome. This is consistent with activity theory.

5. 5 Activity System Structure

Within activity theory, a subject's interaction with the tools mediates the learning process. Therefore, within a given structure the greater the number of tools the greater possible number of interactive subsystems. For the purposes of this study the main tools identified within this system that impact the most directly on subjects were that of the teacher, the peers and the laptop (human and technical). Each tool mediates learning and provides the subjects with a different possible outcome. These three tools subsequently create different subsystems within the classroom and subjects will switch between tools and consequent subsystems to create an outcome that reflects their needs and is underpinned by motivation.

In such a subsystem motivation can be both internal and external. Internal motivation can simply be achieving a good desired response. External motivators could include peer pressure or competition and the influence of the teacher through directed feedback and moderation. From direct observation the teacher builds extrinsic motivation by explicitly telling students exactly what she expects and outlines possible negative outcomes from not listening to advice.

> I am expecting that bookwork is neat and clear. If it is not I will extract it from your book and you will rewrite the whole page again. So I suggest that you take your time, make it neat and legible and not redo it. (Observation Notes, 27 March 2013)

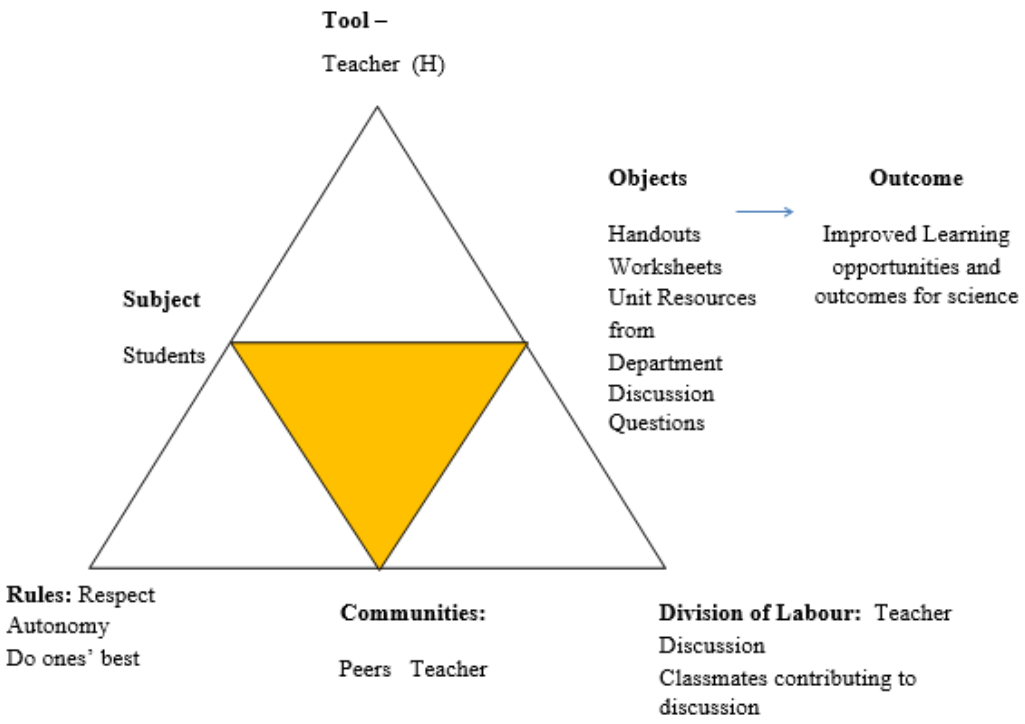

Figure 5.8. Subsystem 1 Teachers

In subsystem 1 the teacher is the dominant tool that mediates learning as represented by Figure 5.8. As stated previously the overarching classroom philosophy of learning is constructivist. Within this system the teacher provides the basis for learning through the environment construction and student co-construction. Through the use of a variety of objects such as appropriate open ended questions, meta-language and resources the teacher creates an environment and conditions that motivates students to achieve an outcome. It is also where the teacher creates a cognitive challenge to all students. During the course of observations the teacher was to ask questions similar to these examples.

> What would happen if you increase the angle of the plane but lowered the weight of the vehicle? Research and design a fair test to show the results in a table.
> How do you think the information is best represented? How effective and accurate will it be if you only do the test once?
> The vehicle moves forward on the ramp. Why do you think that happened? What would be some of the other possibilities?

The teacher also issues the appropriate level of cognitive challenge by providing tasks that are new and not easy to explain with logical reasoning alone. Students must research, must use the tools to achieve and as such the teacher is channelling appropriate engagement. Once the task is set the teacher and the students have acknowledged the understanding of the challenge the students begin work. In a pattern repeated in each lesson when these types of tasks were given some students would work with the teacher for extra scaffolding whilst others, including all three of our focus group would find a place to work and set to the task at hand.

In this subsystem the teacher can adapt and support each subject for highest gain for students and ensure that her expectations regarding the outcome are met. The division of labour tends to be more hierarchical as the teacher leads. Therefore, teachers have strong influence on the activity system through their choice of rules and division of labour within the community. They can assume a low level of regulation and allow the activity system to fluidly balance where subjects can work effectively as a community, sharing roles and agreeing to their own rules or can assume a higher level of regulation assuming total control.

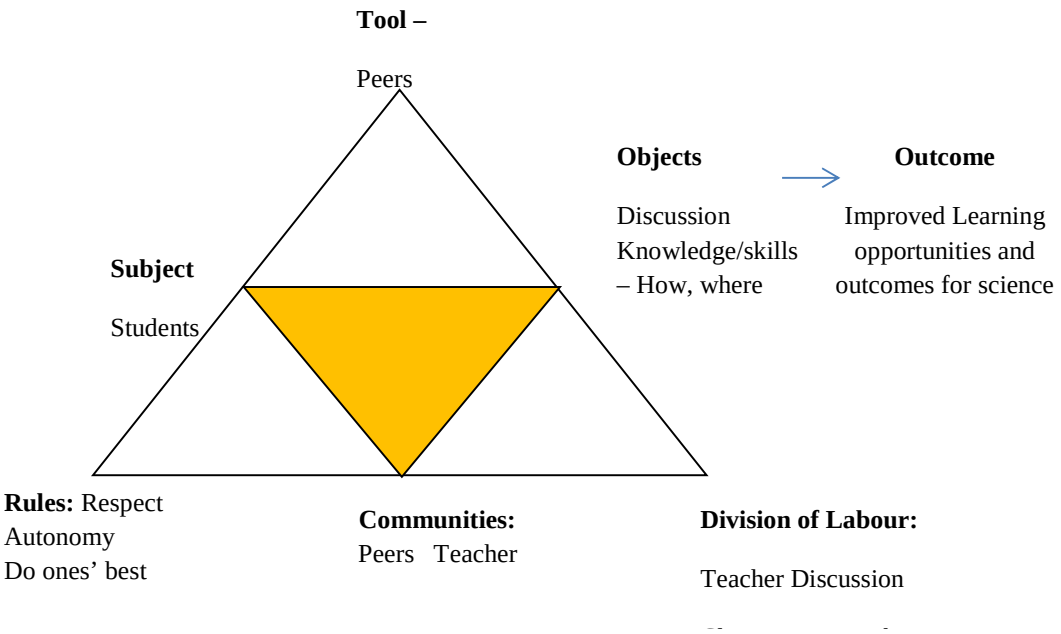

Figure 5.9. Subsystem 2 Peers

Figure 5.9 represents the peer's subsystem. From the evidence provided in Chapter 2 activity theory maintains a conceptual binding of social and material capitals that interact to enable and constrain what an activity may accomplish. The peer subsystem plays its part in moderating behaviour, reinforcing culture and also provides a possible less threatening avenue for support that approaching the teacher constantly. Feedback in this system is at a student language level and is much more direct without the tact and experience of a teacher based subsystem. Within this subsystem different subsystems arise based on core skills and success of individual subjects who in turn become the tool for another student requiring help, direction or candid feedback. Whilst the teacher is still active in this subsystem they are much less dominant.

Within this subsystem a different motivation comes to the fore; that of "keeping up with …". When initially the task is set and students are able to make their work choices some students gravitated to small groups or to the teacher for extra information.

Other students including Eamon, Hamish and Aiden can be observed and heard explaining what they are going to do and how they are going to do it; task completion. Generally within five minutes, apart from those students working with a teacher, most were settled and working. Our focus group of Eamon, Hamish and Aiden were focused on their laptops.

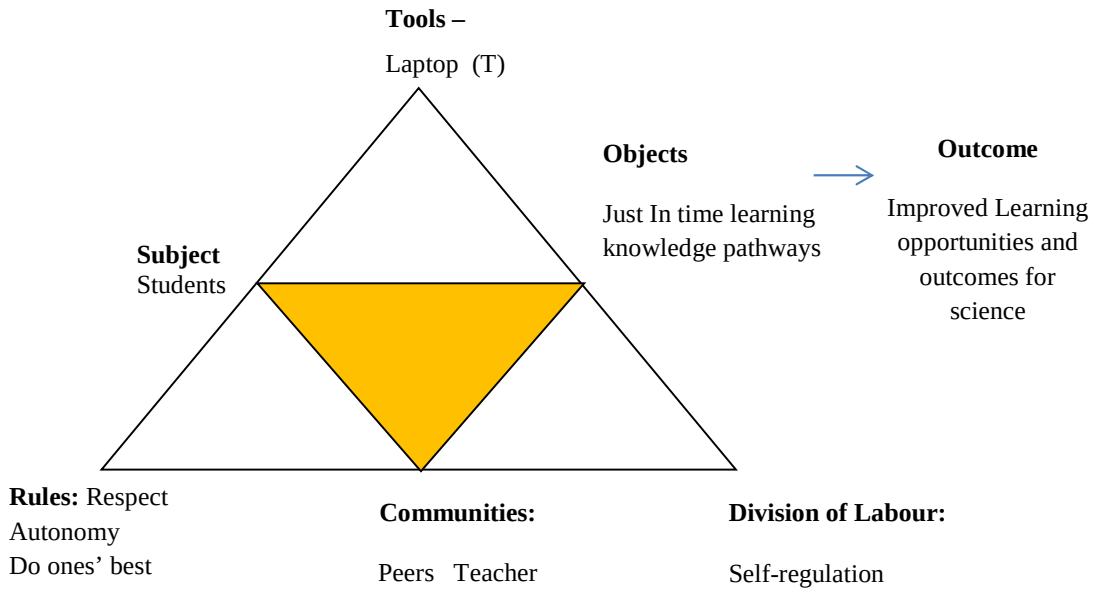

Figure 5.10. Subsystem 3 Laptops

Figure 5.10 represents the final subsystem based on the technical tool, the laptop. When engaged in this system subjects generally lessen their dependence on other human based systems. The technical tool has supplemented the teacher and peer based interaction, discussion and knowledge with a virtual library and community of its own dependent upon the skills of the subject. As such it can give rise to its own subsystem as students who work quicker or with a greater skill base may find resources or gain deeper understanding than others in the community and therefore are placed in a position to share. The laptop provides the subjects with an increased level of independence and

control due to the personal nature of the devices. It also provides control to the student over the pace and direction of their learning albeit within a broader classroom context. Within this subsystem then engagement, speed and self-regulation would be the main outcomes areas within the greater context of task completion.

5. 6. The System Dynamics

The success of any given activity system is based on the dynamic and fluid interactions between the subsystems. These interactions provide a plethora of avenues for understanding and knowledge construction and theory deconstruction. From the direct and video observations of the classrooms the percentage amount of time of the total that subjects operated within each system, the initial interactivity of the systems was apparent. Figure 5.11 provides an overview of the initial interaction of the classroom subsystems. The arrows in the figure represent the extent of interaction between the components of the system.

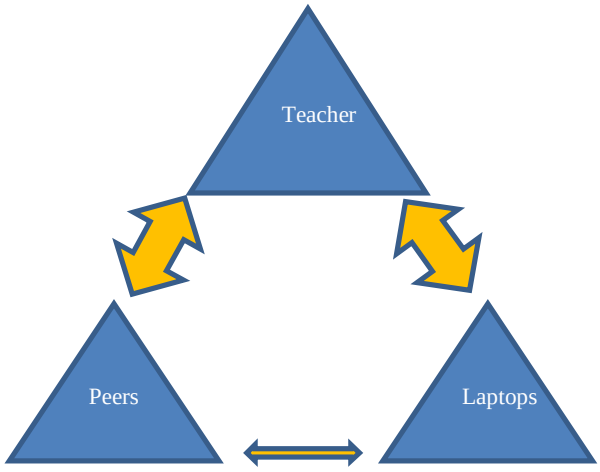

Figure 5.11. Initial Interaction Pathways Within the System

In consideration of identified subsystems and in understanding that the teacher is working in a constructivist framework, initial interaction between the systems is teacher based as the expectations, rules and working conditions are enforced. The teacher has strong relationships with both other subsystems and as a result there is little interaction between the peer and laptop subsystems. However, from observation as the teacher moderates their approach, the relationship changes as indicted by the percentage of time for each type of interaction.

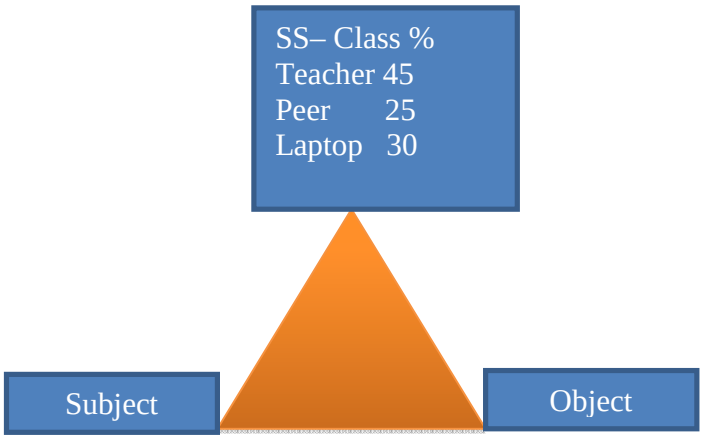

Figure 5.12 Teacher Speaking V Student Side interactions Time

Once the initial classroom routines have been established the total amount of time directed for a system as a percentage can be seen in Figure 5.12. As the time progresses the dynamics have shifted with more interaction between the laptop and peer systems and little interaction between the teacher and laptop systems as seen in Figure 5.13 below. The teacher provides less interaction with some students as they capitalise on the technical tools. This is consistent with the constructivist nature of the classroom as the subjects become the co-creators of knowledge and meaning and more engaged with the device.

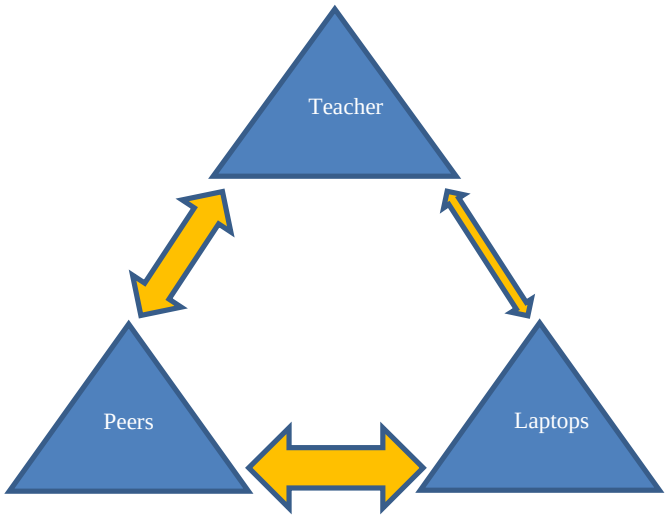

Figure 5.13. System Dynamics Shift as Time Progresses

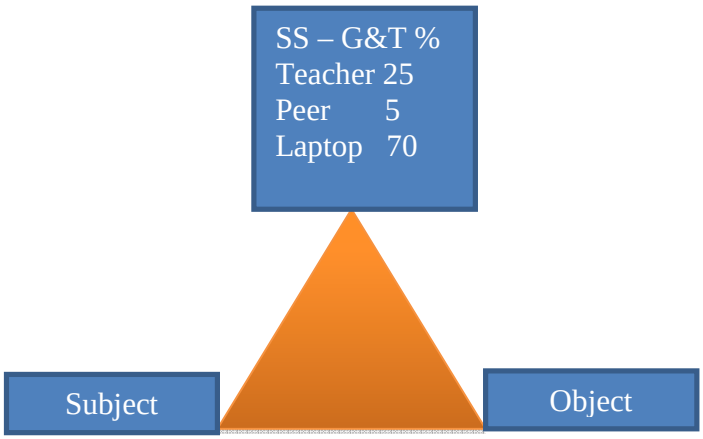

Figure 5.14. Interaction Between Class Systems

When the system dynamics are analysed for the three identified students in the subsystem interaction was different again. Figure 5.14 shows, as a percentage of time from direct observation, the amount of interaction as a between systems.

In this activity the teacher represents an entrance and exit point in the system dynamic and interaction. The device becomes of greater importance and the system dynamics evolves.

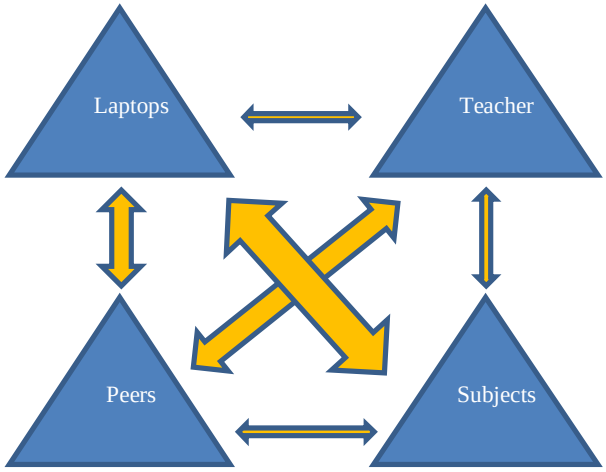

Figure 5.15. Greater Interaction Between Subjects and Laptops

When comparing the use of tools between the subjects and the rest of the class the subjects of this study were actively gathering information and plan of attack to help them decide on what action to take to support their learning. Figure 5.15 represents the subjects' greater interaction with the laptop and reduced interaction with peers and the teacher at this point.

In each sub system tools are used to moderate the learning process. However, the classroom observations revealed that students use the tools at varying amounts at different stages. The results depicted in these figures also reflect the data gathered from the Engage-o-meter sheets in Chapter 4 (Table 4.2) where most engagement for our participating students was during research and experiment simulation phase of learning.

It must be noted however, that due to the nature of primary classrooms that the teacher subsystem is an entrance and exit point. Within this system the teacher initially created the environment for learning, posed the task, set the challenge and also created the time limits that must apply. At the end of those time limits, students were called back and refocused for debriefing or summary activities.

5.7 Summary

Following the principles of activity theory, learning takes place when subjects are engaged in constructing knowledge through a mediated process where subjects use tools to peruse an outcome. A summary of the key findings is presented in Tables 5.1 and 5.1. Activity theory accentuates that there exists within a system both internal and external activities that influence outcomes and that both activities need to be considered. As such for students within this environment external activities will influence internal ones. The tools in this system were the laptop, the peers and the teacher. The subjects were the students working on their science key learning area. The rules for the system include a sense of responsibility to participate in the class and self-regulation on engagement and control of learning. It also encompasses the understanding for all individuals' right to participate in class, express opinions and contribute openly.

Table 5.1

Activity System Components Summary

Component	Description	One-to-One Classroom
Subjects	The individual or group of people involved in the activity	Students and focus participants
Object	Tangible or intangible product acted on by the subjects during the activity which could be transformed as the activity unfolds	Research Task Handouts Worksheets Unit Resources from Department Discussion Questions
Tools	Anything from a physical object to a mental map or model used in the transformation process.	Human Technical Teacher Laptop Peers Virtual Classroom
Community	The socio-cultural context in which the activity takes place.	Peers and Teacher
Rules	Implicit and explicit norms, policies or regulations of the community that constraint the activity.	Expectations Respect Autonomy
Division of labour	Horizontal and vertical roles and relationships within the community that affect task division.	Teacher Students
Outcome	The overarching goal of the activity system; the overall intention of the activity system	Demonstrated Science application of understanding to new or unknown situation. Critical user of science knowledge.

Students were actively engaged in the system when working on the science task involving motion and forces. The observations show students working initially with the teacher and then focused on their own tasks at their own pace. The peers and the teacher provide the interactive foundation needed for learning to occur.

According to activity theory the role of the teacher is important to a learning environment and enhancing learning. By using the rules of the environment and the explicit learning desires the role of the teacher within the classroom environment was to ensure the division of labour, clarify the learning intent and provide some direction on sequencing so as to scaffold the learning to reach an end goal or product.

Each of the subsystems as indicated in Table 5.2 within the activity impacts on the outcomes for students. From observation and feedback the following aspects can be ascertained from each subsystem.

Table 5.2

Subsystem Outcomes Teacher, Peer and Laptop

Teacher	Peer	Laptop
Motivation - Extrinsic Cognitive challenge	Motivation Extrinsic intrinsic Cognitive Challenge	Motivation Engagement Intrinsic Speed Self-regulation Task completion Challenge Cognitive and physical

Chapter 6: Discussions and Conclusion

6.1 Overview

The focus of the study was to examine and detail from a student perspective the experiences of the gifted learner in a ubiquitous one-to-one laptop classroom. Specifically, the research sought to answer and detail the following question:

What are the learning experiences of the gifted learner in a one-to-one laptop classroom?

The challenge of this study lies in the broad focus of the experience. Where the researcher considers not only detailing the experiences of participants and the system in which they operate but also considering the outcomes for these participants in terms of enhanced outcomes, self-efficacy and the artefacts that support it.

6.2 Discussion of Findings

To understand the experiences of the gifted learner as they worked with laptops in a regular class one must understand the context. Therefore, Chapter 4 focused on context and profiled the participants Eamon, Hamish and Aiden. The profiles included information from interviews with the parents noting it is their past experience that informs the decisions they make for and with their child. Other information was obtained through interviews with the participating students and teacher, surveys, classroom observations, and documents. The classroom was conceptualised as an "activity system". It was a social community comprising a physical space, students, teacher curriculum materials, software tools, and the technology. Activity theory is appropriate for understanding how all these aspects interact.

Aspects from outside of the system, parental views, were also used to support the findings. Chapter 5 used activity theory as a framework to explore the system in which the activity took place for the participants. This chapter specifically looked at the subsystems and the experiences of the participants as they work in those subsystems.

This chapter will present and discuss the common themes and findings in relation to the research question and relevant literature on catering for gifted students, motivation and their use of ICT's. Section 6.2.1 presents the findings in relation to the research question. In this section the key themes distilled from the data will be discussed. These include activity theory subsystems, student motivation and engagement, challenge, Speed, Task Completion and Results, Peers. Section 6.3 will briefly examine parental influences on students and their impact on students' experiences as an external context. Finally section 6.4 will look at the role of the teacher as they hold a special position within the system and primary classroom that warrants separate consideration and understanding. Across all reported sections the discussion will combine the student experiences, theoretical underpinnings and explanations and the contextual affordances.

6.2.1 Subsystems

A system will work best when there are dynamic and fluid interactions between the subsystems. As such it must be noted that the teacher still has a pivotal role in creating the environment and conditions for learning regardless of all other tools. Primarily as this is a primary classroom the role of the teacher is much more prominent than what may possibly be in a high school. This is consistent with the view of Rakow (2008) outlined in Chapter 1 that an environment rich and challenging is designed by the teacher to stimulate interest and motivation. The results further align to the research reviewed in Chapter 2 on the important role of the teacher in designing learning

experiences, and the consequences of not catering adequately for gifted students (Davidson & Davidson, 2004; Webb, Gore, Amend & DeVries, 2007; Kulik, 1993). It confirms research on the importance of teachers alternating not only the content but also the approach (Maker 1981, 1982, 1986; Tomlinson, 2003).

The analysis of the subsystem based on the human as the tool provided evidence that the teacher is both the entry and exit point for all activity within the system. Initially in the subsystem the teacher is dominant creating challenge, task outcomes and extrinsic motivation in various forms. However, as the lesson progresses the teacher's role changes and so does our students' engagement. The shift from teacher focused to student-centred activity is when the students' engagement peaks consistently over the observations. It is at this point in the lesson that the teacher who remains in control of the system through the hidden curriculum and the enforcement of rules and the division of labour uses other tools for understanding. In short, as the tools within the system changed from human to technical, participants' level of engagement also changed. From the transcript in Chapter 4 Aiden best encapsulated this by stating this in the Q and A.

> Is there anything else you think motivates you or is different in the laptop class? Do you think you have to ask the teacher as much?
> No because most of it is in the computer so if we forget part of it we can look on the computer again.
> What about when you are doing research?
> I can just go to my recently closed tabs and open it again so I am not relying on the teacher as much.
> Do you like not relying on the teacher?
> Yes, it's a lot easier.

Within the greater system, the peer subsystem maintains a special place. Here groups of students would enter and exit the subsystem for various reasons such as friendships and wanting to have a quick discussion or help based and the asking of questions. Some students would gravitate to another student for redirection or assistance but then move back to where they were once the answer or direction was provided. For the three participants, this system is imported to have others who work at the same level and pace. In Chapter 4 all parents of the participants commented on the want and need grouping/clustering of students who work at the same level to allow for discussion and reduction of isolation. Students made reference to and commented on having someone to work with. For example, Hamish stated in response to the question; Do you receive any special accommodation in the classroom based on your preferred learning style?

> Yes. The teacher uses mostly individual but sometimes as a group.
> Do you like working as a group?
> Yes.
> Why?
> Because the other people in the group can help you.
> Do you like helping other people?
> Yes people who work like me.

Eamon similarly stated to the same question,

> Well yes because I feel that with mathematics and English rotation groups I am paired up with people who have the same amount of learning experience and learning understanding as me.
> Do you like that?
> Yes I do because it gives me and others a sense of similar understanding.
> There are some people who get it and some who don't.

Often the participants in this study may have spoken briefly regarding a plan of attack and then they would separate to do their own thing only to come back at the end of a session to discuss what they had achieved. It can be concluded from this that the

peer subsystems provide elements of motivation and support. The thought of challenge may also be taken from this subsystem from individual to individual.

Finally, the technical tool subsystem provides the participants with an opportunity to complete the task in their own manner. During the periods of student-centred research and simulations the participants recorded the highest level of engagement for the observed sessions. Here students can approach the research and simulations that cater for their skills and interests. It is also where students can work at their own pace with the Eamon, Hamish and Aiden working quicker than that of other students in the class and often going on more linearly related tasks in the research mode. For Eamon, Hamish and Aiden their peers only contributed to this subsystem by providing feedback or general advice to ask/answer a question. When reflected upon these results strongly aligns to research (Moore, 2005; Van Deur, 2004) reviewed in Chapter 2 and underlines the notion of a set of constructive behaviours that affect an individual's learning, that is, Self-Regulation

As such, when comparing the outcomes of Chapter 4 to Chapter 5 many similarities can be identified. The most salient themes discussed in both chapters were those related to motivation and engagement, challenge, speed, task completion, results and peers. It will be specifically these areas and their implications that will now be discussed. The role of the teacher will also be discussed.

6.2.2 Student Motivation and Engagement

Motivation as a concept is derived from its Latin root 'movene or motivus' that translates as "to move". Therefore, if one is motivated it can be reasoned that they are moved to action. If one is motivated to learn they are moved to learn. Within motivation the simplest distinction is between intrinsic motivation, that is doing something

inherently interesting or enjoyable, and extrinsic motivation, that is doing something because it leads to a separable outcome or task completion.

According to Blumenfeld, Kempler, and Krajcik (2006, p. 476), "Motivation is iterative. That is, interest may lead to deeper engagement with the material, which results in increased skills and knowledge. This increase may encourage interest and sustain cognitive engagement". Similarly, Corbin (2008, p. 74) identifies that motivation is, "largely an emotional reaction in which the learner sees benefit and reward in attending to the learning task or activity or anticipates some positive result or sense of emotional well-being." He further contends that motivation is an extremely important aspect of learning. A motivated individual learns more quickly and more effectively. Motivation affects the length of time that learners will dedicate to a particular learning task. Motivation is highly personal and largely intrinsic, but there are things that teachers can do to establish the proper stage and state for learning. One might speculate that students like Eamon, Hamish and Aiden are seeking challenge and seeking understanding given their assessed giftedness. The tools of one-to-one laptops enabled them to pursue their interests independently and solve complex problems as they have access to information. Successful problem solving should enhance a sense of efficacy which contributes to that sense of competence and self-esteem necessary for motivation. The laptop opens up pathways to expand knowledge and optimise engagement by positioning the students into Vygotsky's ZPD.

All student participants and their parents indicated that motivation was a major factor for their child joining the one-to-one class. Parents had indicated that that they were in need of a pathway for their child to achieve and be engaged. For students motivation and engagement also seem to stem from the enjoyment and 'fun'. This would

reflect and align with Irvin, Meltzer and Dukes' (2007) beliefs that intrinsic motivation comes from within and is associated with the joy or passion that the task gives the learner rather than any reward it brings. This further aligns with the work completed by Schick and Phillipson (2009), and Moore (2005) who in Chapter 2 affirm that academic motivation is quite a separate entity to high intellectual ability and certainly self-regulation.

The findings can also be considered through the lens of Self Determination Theory (SDT). This theory delves deeper into motivation and provides a framework to clearly distinguish between different types of motivation. Recent studies in motivation have shown that it is more complex than a simple internal or external driving source that determines an individual's motivation. Ryan and Deci, (2000) contend that paramount to research in learning motivation is the portent of what invigorates and leads an individual to develop interest, enjoyment, and persistence for learning as opposed to boredom and disengagement.

Figure 6.1 (Ryan & Deci, 2007) provides a clear continuum of this differentiated understanding of motivation.

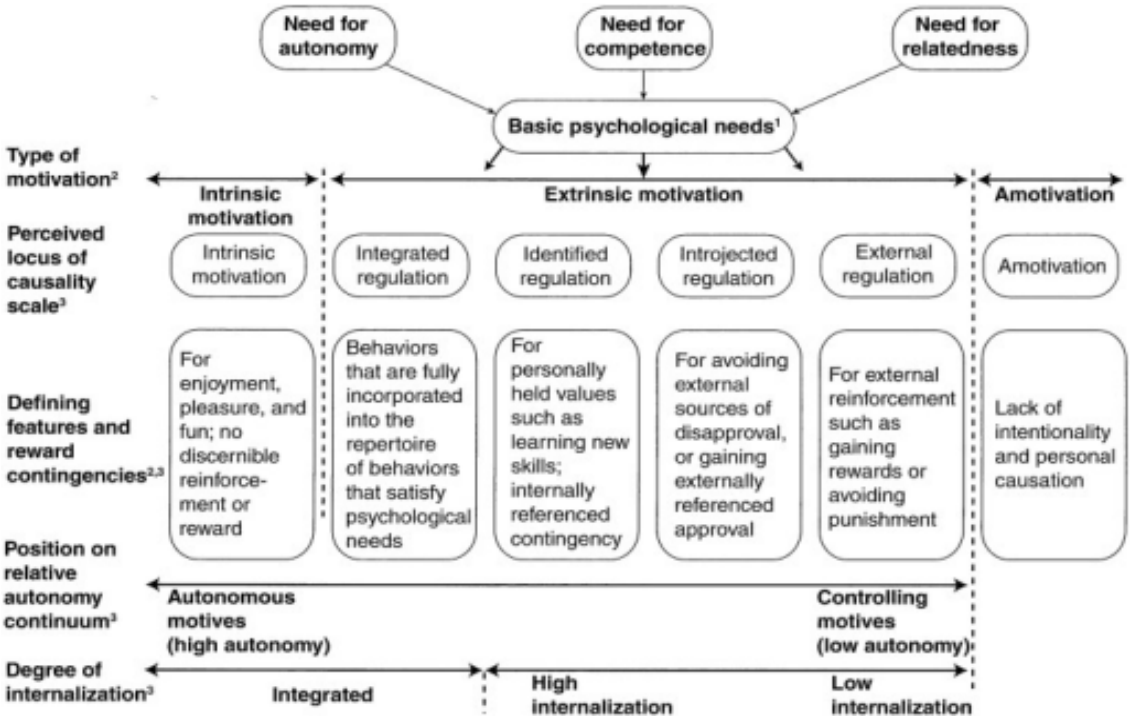

Figure 6.1. Continuum of Motivation (Ryan & Deci, 2007)

On one side we see Amotivation where it is understood that there is zero or little value, or an undesirable outcome in an action and as such there will be no intent to act. Amotivation represents the least autonomous form of extrinsic motivation. Centrally lie other forms of extrinsic motivation and they range across from external regulation and reinforcement to fully integrated regulation where the learning behaviour is self-determined even when the motivation is extrinsic in origins. The final motivation, intrinsic, represents a learning behaviour that is fully self-determined. From this continuum it is those behaviours that are intrinsic motivated or fully self-determined extrinsically motivated that are generally related to positive learning behaviours and academic outcomes. Self Determination Theory therefore posits that people achieve psychological needs through situations in which they have autonomy, are competent and

recognised as competent and have relationships that are positive. When we apply this understanding to our research we can synthetise significant and deep parallels.

In all classrooms, a majority of the learning activities are set by the teacher as an extrinsic motivation. Depending on the way these activities are pitched or the way in which the classroom runs it will impact on the level of motivation the student and our participants will have for task completion and academic outcomes. In Chapter 4 all of our participants and their parents recorded feelings of low motivation for the normal classrooms they have generally participated in. Eamon, Hamish and Aiden all presented as generally operating in the extrinsic range of the continuum of motivation (Figure 6.1) However, they have all reported significant higher motivation and as such levels of satisfaction with the one-to-one laptop classrooms. Therefore, if we look at motivation from the perspective of the tool subsystems identified with framework from activity theory in Chapter 4 we perceive a greater picture of clarity and understanding.

First, as stated previously in Chapter 3, the classroom was run in a constructivist manner. This means that in a convivial classroom, where the teacher as the human tool of the system makes students feel valued and supported they are more likely to accept externally prompted motivation and move to action as they understand and accept the necessity of the task. This reflects the understanding of a constructivist classroom outlined in the early chapters and again highlights the importance of the teacher's contribution to outcomes. It also reflects the 'environment' component of the Maker model reviewed in the literature review. Second as identified in Chapter 4 from the perspective of peers, the second human based tool in the system the students were recognised for their abilities by being in a class of like minds and relationships appear to be convivial with the teacher establishing a social learning environment. Finally, the

technology afforded autonomy. Hence, the task may be extrinsically motivated as its set by the teacher. However, the laptop as a technical tool in the system provides the medium and conduit for competence and as such increases the intrinsic motivation of the student to achieve

Engagement has also been a common theme from the parents and the students. With both reporting a higher sense of engagement with the one-to-one classrooms. Engagement as a concept is closely related to motivation and also directly impacts on students outcomes. As such much research as also was undertaken into its importance. Finding in this study confirms the findings of other researchers. For example, Fredricks et al. (2004) suggested that technology can help resolve the engagement problem by capturing student interest, giving students ownership in their own learning, and can also be used as a "possible antidote" to student alienation. Similarly, Arnone et al. (2011) in their study of technology pervasive learning environments states that one instance of curiosity, the desire for new information, then becomes a multistage learning episode that can lead to deepening levels of interest and vice versa.

Seymour Papert (2002) concurs and suggests that activities are fun when they are hard, or more precisely, fun because they are challenging, not in spite of the fact that they are hard. Challenge, however, is a very tricky thing. Too much challenge results in frustration, and too little challenge results in boredom, both of which are antithetical to intrinsic motivation (ZPD).

6.2.3 Challenge — Cognitive and Physical

The ultimate challenge for any educator is to teach to all learners and to build understanding and genuine learning opportunities that are at a higher cognitive level. Fredricks et al. (2004) believe that cognitive engagement draws on the idea of

investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills.

The importance of appropriate challenge, particularly with high-ability or gifted students, cannot be exaggerated. In a study by Otta and Tavella, (2010), that focused on 40 third- through fifth-grade students grouped by ability using computers, they found that if competence was high and the task was completed too easily, the relationship to satisfaction and continued engagement decreased. This is consistent with self-determination theory (also attributed to Deci and Ryan [3]). Satisfaction is achieved when certain psychological needs, namely relationships, competence, autonomy, are achieved. One could argue that laptops afford opportunities to achieve a sense of competence by providing access to information that students can capitalize on. Also laptops provided a sense of autonomy in terms of direction and pace as students are able to pursue interests, topics or directions somewhat independently of others and at times that suit them. When competence, and therefore the ability to autonomously complete a task, was at a high level, intrinsic engagement and motivation were high. However, when competence diminished (i.e., the student could not successfully complete the learning task), engagement and motivation were also diminished.

The participants and their parents identified the thought of rigour as an aspect lacking in in their previous experience in standard classrooms. Both believe that the one-to-one classroom has provided an avenue for increased cognitive challenge. The constructivist nature of the science task learning in a system is facilitated by a cognitive task in conjunction with tools. Participants identified that they are most engaged in a

[3] http://selfdeterminationtheory.org/

topic when they are stimulated and their interest is aroused and this is generally in the research and experiment/simulation phase of any task.

Brimijoin, Tomlinson and Narvaez (2008) propose that technology, specifically internet communication technologies (ICT's), provides unique opportunities for gifted students. Because gifted students are capable of achieving at high levels and growing at a pace that is often accelerated compared with their same-age peers, the challenges they encounter need to escalate with a rather steep trajectory to maintain continual growth. Often, this kind of intellectual rigour cannot be achieved in regular classroom settings.

The use of a laptop has shown to stimulate the interest of the participant and create a challenge within one's zone of proximal development (Vygotsky, 1978). As such it then is invaluable because success in a challenging situation increases intrinsic motivation (Dweck, 2000) and also enhances a sense of self-efficacy in that task (Bandura's theory, 1997).

It was further proposed in the review that it is important that tasks for gifted students be sufficiently challenging because without appropriate challenge in learning tasks, the need for achievement and recognition of that achievement is not satisfied (Lens & Rand, 2000; Malone & Lepper, 1987), which negatively effects motivation. It takes them where they want to go at what speed and in a choice of format that is personally meaningful to them.

6.2.4 Speed, Task Completion and Results

In Chapter 2 the researcher proposed that increasing student achievement is the most important goal for adopting one-to-one computing, and that studies focusing on student learning deserve a high priority (Zucker & Hug, 2007). Parents of the participants in Chapter 4 generally state that all students were not achieving at their full

potential. Performance scores of all students indicated that the use of devices together with the constructivist classroom was effective in providing avenues for improved outcomes. From this study, the researcher posits that the impact of the laptop on the learning outcomes can be described in three core ways. First, the laptop enhanced the interactivity of the process for students needing resources quickly. Second the laptop as a tool was the vehicle for increased motivation and self-direction for outcome completion and finally the laptop impacted the way information was processed and represented.

Caudill (2008) suggests that by carrying a personalised device, students can quickly and easily access the resources they need. Technology-pervasive environments provide ready access to information and function to support both episodic curiosity as well as deeper levels of exploration (Arnone, Reynolds, & Marshall, 2009). No longer is a question something deemed to be addressed at some future time, but rather, with ready access through laptop computers information-level learning can meaningfully scaffold deeper and more complex meaning making, thus supporting and sustaining curiosity, which can be a powerful motivator.

As indicated in Chapter 4 all students have a working memory in the high to superior range. The laptop reduces the load on working memory of students by multi tabbing of resources and as such allows the students to focus on higher order thinking and making connections. This proposition is consistent with Clark and Paivio, (1991) studies that is informed by dual coding theory. Students in their study agreed in interviews that they did not have to remember as much when working on the computer. In the one-to-one classroom students were able to access information at a higher pace satisfying their need and ability to access and process information more quickly and

readily so that acceleration and enrichment options can be made available. The Internet offers numerous other opportunities for gifted students to encounter and explore challenging and rigorous content.

6.2.5 Peers

The research reviewed in Chapter 2 suggested that when considering gifted students, the need for contact with peers who have similar interests and abilities is particularly important, not only to their sense of identity but also to motivation (Baylor, 2011; Reynolds & Caperton, 2011). It was also further suggested that grouping gifted peers together has positive benefits on engagement and achievement (Kulik, 1982; Rogers, 2007).

In this study students were able to work with peers at their own level as they gravitated towards one another within given opportunities. This opportunity stopped the frustration of working with other students who may not work at the same pace or think along the same lines as the identified student. Where this was not available students generally chose to work alone. As such it is my belief that whilst underperformance or reduced motivation may not be totally prevented it will be reduced by the impact of reduction in isolation. This supposition is supported in the data from interviews where participants Eamon and Aiden similarly reported that it was “good the teacher grouped them together”. The participant further reported that it was satisfying to work with other students at the same level or the same understanding. This is an argument for positive relationships – the third basic psychological need.

The one-to-one classroom also provided the participants with a sense of identity and acceptance. Whilst the laptop as a device may promote learning as a key to enter into the program it may also be viewed as a tool to belong and a creation of identity. The

parents of the participants stated in Chapter 4 that this was generally the case and that they would like to see this style of system rolled out more and more.

According to the Metiri Group (2002), technology has three major implications for learning; however, it is the first in their reported outcomes that sparks the most interest. First, it facilitates more engaged, relevant, meaningful, and personalized learning that can and does lead to higher academic achievement.

6.2.6 Self-Regulation

What motivated students was not the use of technology, but rather the opportunity for control and autonomy, challenge, cooperation, just-in-time knowledge (i.e., knowledge driven by curiosity and need), creativity, and recognition as products were provided for authentic audiences. Despite the fact that the same factors influence motivation regardless of the tools being used, it is also important to recognise that "today's students take for granted and expect technology which merges seamlessly into their work and play" (Arnone et al., 2011, p. 190). Some degree of autonomy, the extent to which one has choices about what to do and when to do it, has been shown to increase intrinsic motivation (Corno, 2004; Hardre & Reeve, 2003; Ryan & Deci, 2000).

In Chapter 2, it was reported that there is a range of models of learning for the gifted learner. Students who use technology can be categorised by the following attributes:

1) They visualise themselves as being successful;

2) They have better attitudes and self-concepts;

3) They are more motivated through learning tasks;

4) They use a computer more often for academic purposes;

5) They have the use of more than 4 times the resources; and

6) They encounter unique learning situations.

These attributes correlate with the major themes unearthed in Chapter 4. They further reflect the outcomes from the subsystems details in chapter 5.

Distinct subsystems such as the teacher, the laptop or the peer can be seen through the activity theory lens across the five observed lessons. In one lesson the teacher was the primary tool (Subsystem 1) and in the other four observed lessons the primary tool was the laptop (Subsystem 3). The function in the teacher based lesson was to clarify the task and provide the platform challenge, reinforce expectations of the community and the rules of working. The role was to initially focus the students on the production of the artefact and outline the resources available to them through virtual classroom. The other primary role of the teacher in the initial session was that of time keeper.

Authentic learning environments establish a sense of personal control over what and how the learner learns. When a sense of personal control is established learners should be able to pursue their own independent learning endeavours albeit guided by the supportive teacher (Watters & Ginns, 2000).

Individualised technology takes into consideration personal preferences and, to an extent, allows individual freedom in the use and care of the technology, which creates feelings of ownership (Armitage & Wilson, 2004). Warschauer (2006) witnessed this concept first hand in the laptop classroom, "Because of the vast array of content available online, teachers found it much easier to individualize instruction" (p. 88).

6.3 Parental Perceptions

As a background all parents were professionals and had university degrees. Home life for the participants was generally well structured with rules and routines with

specific activities to cater for their children. In the interviews with parents the key themes that pervaded the data included the lack of outcomes for their child and the lack of rigour and challenge in typical classrooms. They believed this also transferred into a lack of motivation by their child to achieve. Another strongly conveyed theme from parents was regarding ability and clustering for their child that would allow for peers that work at the same level. There was an underlying but unspecified thought of underperformance but with a belief that this would help their child become more engaged in the classroom and work closer to their full potential.

Much research has been completed on the effects of home life and parental education background on student motivation and equational outcomes. Ermisch and Pronzato (2010) showed that more educated parents have, on average, better educated children, not excluding other factors such as expectations, time and interest. Grolnick, Friendly, and Bellas (2009) believe that families have a significant impact on a variety of school outcomes, including setting high expectations, and the development and maintenance of positive motivation. They conclude that, “When parents believe in children’s competence and have high expectations for them, provide the resources that children need to feel connected to others, and facilitate a sense of autonomy by supporting children’s initiations and problem-solving, children’s motivation is most likely to thrive” (p. 295). They ultimately believe that parents’ expectations strongly influence children’s motivation. This understanding strongly aligns with the dimensions of motivation theorized by Deci and Ryan (2007). People are motivated out of a sense of obligation.

Speed of work was another area that parents believed their child was not being catered for. All parents stated that their child could perform tasks quickly and with great

depth when properly motivated to do so. In a standard classroom their perception was that their child was happy just to plod along but would rather do something different. Overall, the parents whilst acknowledging that catering for their child posed a challenge within the classroom and were frustrated by the lack of genuine opportunities that a standard classroom presented. They believe that the one-to-one class had provided their child with an avenue to be more engaged and more productive than previous classrooms.

6.4 Teacher

From the video and interviews the role of the teacher is central to the learning opportunities provided to students in a one-to-one classroom or any classroom for that matter. The teacher is ultimately responsible for the sequencing of learnings and the critical questioning challenges and invites the students to learn.

Driver, Asoko, Leach, Mortimer, and Scott (1994) in their study of constructivism in science classrooms maintain that the facilitator must guide learners effectively in the learning process within a constructivist paradigm. The facilitator in this study was initiatively actively guiding students in the laptop classroom. Here she was an external influence that helped students to learn and better understand the needs of the science task consistent with Vygotsky's idea of scaffolding and ZPD as outline Chapter 2. As an expert she filled in the gap in the students mind and helped them achieve greater understanding by moderating the learning experiences. After the initial teacher led session students had a number of avenues for available to them for continuation. The Horizon Report from 2010 states this simply in that, "Information is everywhere the challenge is to make use of it" (p. 13).

Although students have the opportunity for autonomy and self-plan and self-reflect. The teacher still has the paramount task of deciding on the direction of learning.

The students in this study whilst working in the system where the teacher is the facilitator reported higher self-regulation against classroom work. The parents of these students also acknowledged that their children were more on task and focused when out of the classroom construct. As such from this finding the home subsystem needs to be explored and detailed as to its input into the classroom.

6.5 The Participants

There were many similarities across all three participants. Chapter 4 highlighted that they all enjoyed going to school but there was general sense of ambivalence from the student participants regarding their involvement in the class and their outcomes. They liked the idea of achieving but demonstrated a genuine lack of engagement and motivation to achieve at their best level. This reflected the parental beliefs.

As revealed in Chapter 4 and summarised in Table 4.2, all three participants agreed that the one-to-one classroom provided them with a more challenging and interesting environment. All students expressed enjoyment in learning, new tasks new skills, but also tempered this with lack of enthusiasm when routines became mundane. One major difference that all three participants noted that a noticeable exception from the parents was the sense of enjoyment and ‘fun’ that the students gained by being in the laptop classroom and the different opportunities that this presented.

As a result of being in the laptop class all three students believed that they were more engaged and were trying harder than in previous years. Similarly they all believed that working with peers and people at their own desk was a factor of being engaged in the classroom. This finding is consistent with the assertion of Housand and Housand, (2012) who argued;

Adam Knights

> Technology affords curious gifted students with almost limitless opportunities for exploration and development of their interests. The integration of technology into the classroom needs care consideration. Designing an optimum learning environment for all students is always key for a teacher but 'fun' and enjoyment to promote engagement is paramount. (p. 712)

6.5 Conclusions

For gifted students laptops are a tool to support learning. It is not the only tool but when authentic learning experiences are planned for them laptops can provide gifted students with greater self-regulation and in turn motivation and engagement.

The activity theory lens brings some objects into sharper distinction such as the importance of sub-systems, while others diminish into vagueness. However, in relation to detailing the experiences of gifted students in a one-to-one classroom through the lens of activity theory four broad conclusions may be derived:

1. The needs of gifted students can be supported through a one-to-one laptop program;
2. That the authentic teaching environment is still paramount to the outcomes of teaching and learning;
3. That laptops provide an opportunity for gifted students to customise learning and increase engagement through self-management;
4. That laptops are tools that provide gifted students with the means for greater self-regulation through pace (multi-tabbing), and challenge.

Although in this study the number of participants was small, it highlights the unique need for highly able students to be properly challenged and further supports the idea of

optimal stimulus or challenge through a one-to-one environment being necessary to maintain motivation for learning and achievement.

Chapter 7: Reflections

7.1 General Reflections

In this study the researcher investigated the experiences of the gifted learner in a one-to-one laptop classroom. Specifically, the single focus was to: view the classroom; through the lens provided by activity theory and from a student perspective; and thus investigate the experiences of the gifted learner in a ubiquitous one-to-one laptop classroom environment. The results of this study should provide insight into planning and resourcing considerations of gifted students at the primary school level.

In Chapter 1, the researcher posited that the learning experiences of the gifted students is linked directly their emotional needs and development. Moreover, my position was that a laptop, as a tool, could provide a source of differentiation through which the gifted students would forge a stronger pathway for engagement and learning and ultimately learning outcomes.

In Chapter 2 the researcher utilised the current literature on gifted students and their accommodation within the general classroom to demonstrate the gap in current research and theoretical based need for a study into gifted student's experiences in the use of laptops. It specifically highlights that general classrooms may not cater to the needs of the gifted students and that research into student experiences, from a student perspective, are underrepresented as a whole.

In Chapter 3 the researcher outlined the methodology to be implemented. A multiple case study approach was proven to be the most appropriate to the given context if the questions of how and why are going to be answered. It is detailed that a rich opportunity exists for a multiple case study approach when the wide range of

interconnected interpretive practices are gathered and analysed. Finally, to aid in the analysis, activity theory was utilised to provide structure.

In Chapter 4 the researcher profiled each of the three participants. The chapter brings into focus the parental beliefs and experiences and compares their understandings with that of their child.

The researcher demonstrated that the common themes to both the student and the parent focused on the motivation, engagement, peers, and speed. Themes of self-regulation and improved results and outcomes were also strongly elucidated. Possibly the most interesting aspect the researcher found in this area was that one theme that was not voiced by the parents but strongly voiced by the child. The notion that using the device to learn was fun and consequently engagement and enthusiasm for the class was high.

In Chapter 5 the focus turns to the components of the activity system. A six-step process was applied from which it was identified that the subsystems of the teacher, peers and laptops are exceptionally important when looking at a complete system. These subsystems were identified as having the greatest impact on the outcomes of the participants (Eamon, Hamish and Aiden) and as such are the ones that must be considered when accommodating gifted students.

In Chapter 6 four broad conclusions were distilled from the analysis of data:

1. The needs of gifted students can be supported through a one-to-one laptop program;
2. That the holistic and genuine teaching environment, created by the teacher, is still paramount to the outcomes of teaching and learning;

3. That laptops provide an opportunity for gifted students to customise learning and increase engagement through self-management; and
4. That laptops are a tool that provide gifted students with the means for greater self-regulation

Thus, the results indicate that gifted students participating in a one-to-one program can directly benefit by way of engagement, self-regulation, enjoyment and outcomes. It also depicts that the teacher is still vitally important in the creation of the overall environment and setting the learning conditions for achievement.

7.2 Implications for Teaching

According to the Metiri Group (2002), technology has many implications for learning. However, the most powerful of these, is that "it facilitates more engaged, relevant, meaningful, and personalized learning that can and does lead to higher academic achievement" (p, 3).

Few would deny that the ultimate goal for any dedicated teacher is the success of their students. To provide an environment full of stimulation and challenge that promotes growth both socially and academically. However, there are obviously many challenges in creating such an environment. Success for a teacher is therefore dependent on many variables and a teacher must combine these into a classroom learning community.

Failure to accommodate the special advanced cognitive and social needs of gifted children can result in lack of motivation, enthusiasm and failure to achieve to their potential. This can be classified as a diminished joy in learning. That is one where tasks may be seen as externally motivated with little or no alignment to the goals of the students.

The results of this research indicate that participation in a one-to-one laptop classroom can be beneficial to a student's achievement and create rich and positive experiences. However, it is dependent on the how the program is structured by the teacher. This study has added to the sum total of knowledge on gifted programs involving ICTs and gifted students. Further research is needed into other avenues of teaching that when combined provide the very best for gifted students. Explicitly the distance travelled by gifted students in the later years of high school education and the impact that laptop and one-to-one learning opportunities and engagement at a primary level had on long terms outcomes.

7.3 Strengths and Limitations

All studies, regardless of their nature, have strengths and limitations. The findings contained in this study serve to provide a moment of poise and reflection and provide a snapshot into school and classroom lives of the three participants and the centre of study. As such the finding cannot be used to generalise to a wider population.

It might be argued that the focus of only one key learning area, that of science, could be deemed a limitation because of the limited scope of classwork and the possible alignment to individual interests of the target group. However, the researcher suggests that by limiting this initial study in one key learning area that the data captured are rich in detail representing multiple dimensions impacting the learner.

Some may suggest that the small number of students do not adequately represent wider populations. However, the small number of students allowed the researcher to build significant rapport and trust in a minimum amount of time. Moreover it was a central theme is to detail students experiences and though using a small number of

students that data and responses elicited were rich and descriptive which support the methodology.

Some could argue regarding the fact that all three participants are all male and provided limited diversity. However, for the purposes of this study this is not deemed a limitation because it was not a focus on gender but detailing the experiences of students within a class regardless of gender. The intention was not to make generalized claims but to explore the experiences of these students in a particular context.

The similar social economic and socio education background of the parents could also be viewed as a limitation to the overall study. However, the study focuses squarely on the student understandings and experiences. Because the parents have similar backgrounds and economic status is of only limited interest at this time and may provide a foundation for further comparative study in terms of resourcing.

7.4 Recommendations for Further Research

This study focused on the experiences of three identified gifted students in a ubiquitous one-to-one laptop classroom. The study aimed to make understanding and draw conclusions from their experiences and make recommendations for the provisions and teaching of gifted students. The study did not specifically focus on the role of the teacher as there already exists a plethora of information from this perspective.

One area for future research could concentrate on a comparative study of gifted students who choose not to participate in a primary school laptop program to determine their reasons and their academic outcomes. Specifically, it would need to look at the self-regulation of the gifted student and if the access of tools (laptops) significantly impacts their enjoyment, engagement and academic outcomes. This would need to incorporate consideration of whether current policies and programs for gifted and

talented children are suitable and sufficient to meet their special educational needs, including, but not limited to ICTs.

A further possibility for future research would be to ask identified gifted high school students who participated in a primary school laptop program to reflect on their experience in the primary school gifted program. The awareness of these individuals could provide unambiguous examples concerning how the primary school program has prepared the gifted students for high school.

Another possibility for further research lies in the influences of home environment on gifted student motivation using Self Determination Theory as a basis. This study would need to focus on social educational and social economic background of parents to be able to provide children with necessary tools for authentic learning and outcomes.

Finally, a continuation of this study would be to create a longitudinal study to follow the same students from primary school to high school. Such a continuation would provide data regarding the success of the primary school program to prepare students, in terms of self-regulation and motivation, for high school. The involvement of more participants of both genders across more key learning areas would also contribute to an increase of data rich continuation of this study.

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Appendices

Appendix A: Parent Pre-Project Survey questions

1. In what ways do you feel programming can be improved for gifted students in regular classrooms?

2. Do you feel using computer technology can help motivate gifted students? If so, in what ways?

3. Do you believe your child is sufficiently challenged in the previous classroom settings?

4. Can you described how your child approaches new tasks? What steps do they take in planning an activity?

5. What types of class activities has your child found most challenging or motivating previously?

6. What types off activities classes has your child found to be most frustrating in your course/class?

Appendix B: Initial Student Survey

1. Date of Birth:

2. Gender: ☐ Female ☐ Male

3. What is the highest level of education completed by either of your parents? (Check one.)

☐ Less than high school

☐ High school

☐ Bachelor's degree (four-year university)

☐ Advanced degree (Master's, PhD…)

☐ I don't know

4. Did you have a computer at home before you got your laptop at school? ☐ Yes ☐ No

5. Do you have access to the Internet at home? ☐ Yes ☐ No

6. What grades do you usually receive in school?

☐ Mostly As ☐ Mostly As and Bs ☐ Mostly Bs ☐ Mostly Bs and Cs

☐ Mostly Cs ☐ Mostly Cs and Ds ☐ Mostly Ds ☐

7. How much do you use a laptop **at school** during a typical week?

☐ Do not use a laptop

☐ 1 – 4 hours per week

☐ 5 – 10 hours per week

☐ More than 10 hours per week

8. How much do you use a laptop **at home** during a typical week?

☐ Do not use a laptop

☐ 1 – 4 hours per week

☐ 5 – 10 hours per week

☐ More than 10 hours per week

9. In which subjects do you use your laptop for class work or projects? (Check all that apply.)

☐ None ☐ Art, Music

☐ Language Other Than English ☐ English

☐ Math ☐ Science

☐ Social Studies, History ☐ Other: _____

10. In which classes is using the computer most beneficial to your learning? (Check all that

apply.)

☐None ☐ Art, Music

☐ Language Other Than English ☐ English

☐ Math ☐ Science

☐ Social Studies, History ☐ Other: _____

11. How often do you use your computer to do the following?

	Never	Less than monthly	Monthly	Weekly	Daily
Search for information					
Create presentations and projects on your own					
Work on assignments in small groups					
Organize information					
Take notes in class					
Communicate using e-mail or instant messaging					
Take a quiz, test, or assessment					
Do drills to increase skills in math, English, etc					
Complete homework					

Work on websites, digital films/media, etc.					

12. What software do you use on a weekly basis? (Check all that apply.)

☐ Word processing ☐ Internet/Web browser ☐ Email

☐ PowerPoint/Presentation ☐ Graphics/Image/Multimedia ☐ Database

☐ Simulation ☐ Website design/editing ☐ Spreadsheet

☐ Others: _____

13. How would you rate your computer skills overall? (Check one.)

☐ Beginner (I am just learning)

☐Intermediate (I am comfortable using a computer)

☐ Advanced (I can help teach others)

14. How often do you typically help another student use a computer?

☐Never ☐Less than monthly ☐Monthly ☐Weekly ☐Daily

15. How often does another student help you use your laptop?

☐Never ☐Less than monthly ☐Monthly ☐Weekly ☐Daily

16. How often do you typically help a teacher use a computer?

☐Never ☐Less than monthly ☐Monthly ☐Weekly ☐Daily

17. How often does a teacher help you use your laptop?

☐Never ☐Less than monthly ☐Monthly ☐Weekly ☐Daily

18. Would you say that the following practices occur in your classes less often about as often, or more often now than they did before the laptop program began?

	Less often	About as often	More often
Students teach other students			
Students teach the teacher			
Students select their own research areas			
Students explore a topic on their own			
Students work in groups			
Students present their work in class			
Students engage in multiple activities during class			
Students write more than one page			
Quizzes and tests			
Direct instruction by teachers			

Student interests influence lessons

20. In terms of your ability to complete class assignments and projects, how would you rate your access to each of the following?

	Inadequate	Somewhat adequate	Adequate	Excellent	Don't use
Computers					
Printers					
Projection devices					
Digital cameras, scanners					

Other technology needs:

21. Please indicate whether you agree with each of the following statements:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Laptops make schoolwork more interesting					

Laptops make schoolwork easier to do

Laptops have improved the quality of my schoolwork

Having a laptop has improved my grades.

I do more homework outside of school if I am able to use my laptop.

I am more motivated to do schoolwork when I use my laptop

What I learn in school is relevant to my life now.

What I learn in school is helping me to prepare for the future.

22. Have you ever used your laptop to communicate or work with students or teachers at another school? ☐ Yes ☐ No

23. Please briefly describe the most interesting class project you have done with your laptop:

24. Do you have any suggestions for new ways laptops could be used to improve your learning experience at school? ☐ Yes ☐ No

If **YES**, Please briefly describe:

Appendix C: Initial Parent Survey

1. Date of Birth:

2. Gender: ☐ Female ☐ Male

3. What is the highest level of education you have completed (Check one.)

☐ Less than high school

☐ High school

☐ Bachelor's degree (four-year university)

☐ Advanced degree (Master's, PhD…)

4. Why did you choose to nominate your child for the One-to-one classroom?

5. In terms of ways of interest and engagement, what did your child struggle with most in a regular classroom?

Appendix D: Student Pre-KLA interview starting questions

1. Why do you find school enjoyable?
2. How could school be more challenging or interesting?
3. What types of activities are you motivated (excited) to participate in during classtime? Why do you enjoy these activities?
4. How you feel about using computer technology to develop a project?
5. How would you rate your level of comfort using computer technology?
6. How comfortable are you in using the Internet to find information?
7. Do you currently receive any special accommodation in the classroom based style of learning? (if yes, please describe them)
8. Describe how you normally plan out a project or an assignment? For example is there a certain way you do your research, are there certain steps you take before you start, is there a certain approach you take in placing the information into your project or assignment?
9. What is different for you about being in laptop classroom?

Appendix E: Question Set 2/3 Student During-KLA interview starting questions

1. Are you enjoying working on your project?
2. Do you feel more motivated while working on this project versus the work you would normally be doing in the classroom?
3. We talked about how you plan a project before you started this research (read back student's response) would you say you are or are not using the same approach for this project? If student's response is not the same approach – ask them to explain what it is that they are doing differently.
4. Described what you are thinking while you are working on your project.
5. Describe what you like most about working on your project.
6. Describe what you like least about working on your project.

Appendix F: Question Set 4. Post KLA interview questions

1. Would you describe working on this project as a positive or negative experience for you?
2. Do you feel the project motivated you to learn more in a given subject area?
3. Do you feel the use of computer technology motivated you to learn more in a given subject area?
4. We talked about how you plan a project before you started this research (read back student's response) now that you have completed the project would you say you used or did not use the same approach for this project? If student's response is not the same approach – ask them to explain what it is that they are doing differently.
5. Do you feel that you enjoyed your regular class or courses more as a result of having worked on this project?
6. Describe the activity that had the most impact on your learning. Explain why you think that particular activity helped you the most.
7. Describe the activity that had the least impact on your learning. Explain why you think that particular activity was not helpful.
8. Can you describe any changes that you may have noticed in yourself as a result of participating in this program?
9. Would you participate in this program again?

Appendix G: Parent post-project survey questions

1. Do you feel the one-to-one program motivated the gifted student to learn more in your subject area?

2. Do you feel the use of computer-technology in particular has motivated your child to engage with Key Learning Area content?

3. Do you feel that your child enjoyed the class more or less as a result being catered for through the use of a laptop?

4. Can you describe any specific changes that resulted in your child as a result of participating in this study? Have you seen differences in behaviors, study skills?

5. Have you noticed any differences in terms of how the student approaches new tasks? Reread to them statement from initial interview – Would you say the steps have remained the same or has your child developed a new approach in your opinion?

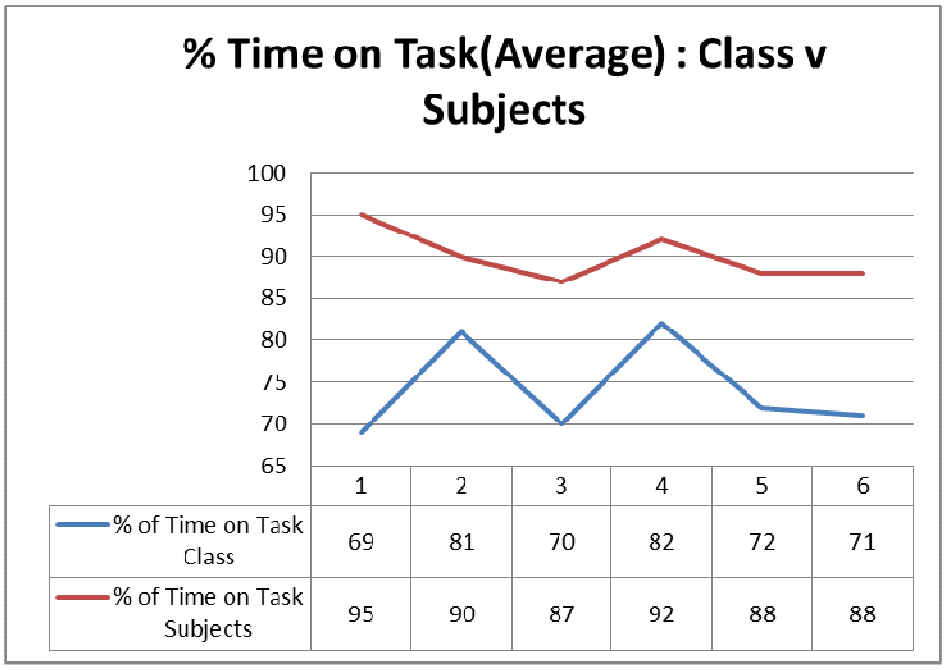
6. Was participation of your child in this program disruptive in any way to their class? If so, please explain

Appendix H: Transcript of Interview and Coding

		Transcript - Aiden
Line	Q and A	
1	Q	So do you find school enjoyable?
2	A	I find it enjoyable usually when I have something interesting to do. Where it is something that I like doing, like algebra.
3	Q	What sorts of things do you find interesting?
4	A	I find science interesting and technology and some maths.
5	Q	Is that about content of it is about the way you get to do things in science?
6	A	The way that we get to do things.
7	Q	Which is what?
8	A	We get to do the experiments and we aren't pressured to do the writing parts. I like doing the more hands on things. And also I like doing science on the computer. It makes things much more interesting.
9	Q	How could school for you be more interesting and challenging?
10	A	I don't really know.
11	Q	What would you change?
12	A	I don't know what I would change but it is not the best.
13	Q	What would you change to make it the best?
14	A	I don't know what I would change. I would make there be more tasks on gamemaker because gamemaker is good program to use because it is really helpful when you are on the computer because you learn lots of things about the computer and you find how your favourite games are made.
15	Q	What types of activities are you excited and motivated about?
16	A	I like going art with Mrs Lee, I like doing technology and experiments and I like doing maths when it's mostly algebra.
17	Q	Why do you think you enjoy those activities?
18	A	I enjoy technology because I enjoy creating things and hands on activities.
19	Q	Do you think the computer helps you create more?
20	A	Yes because it simulates things that would take a lot longer like a plant growing.
21	Q	So how do you feel about using computer technology to develop a project?
22	A	I like using computer technology to develop a project because you don't just write everything and draw everything. You actually have a few different programs to help you create the project and that makes it easier and faster. I like things being quicker.
23	Q	If you do things quicker what do you do when you are finished? Do you make something better or do you go onto other projects and do more projects?
24	A	I go onto other projects.
25	Q	So how would you rate your level of comfort in using computers?
26	A	I would rate it 7 out of 10 because I am not a computer expert but I don't need to ask about everything. But I am still learning.
27	Q	How comfortable are you at finding information on the internet?
28	A	8 out of 10 because I am actually quite comfortable doing that. I find it easy to do.
29	Q	Why is it easy?
30	A	Because I just go onto Google and search out what it is.

Appendix I: Video Observation Time Breakdown – 200 min

Area	Participant /3	Class /22
Time on Task		
Time Off Task		
Conversations with Peer		
Conversations with Facilitator		
Movement from Desk		
Interruption		



Appendix J: Engage-O-Meter Average

On a scale of 1-5 with 1 being not engaged and 5 being highly engaged rate this section of the lesson with the timer flashes.

Engage - O - Meter – Average Across Lessons			
Introduction	Research	Experiment	Consolidation
2	4.5	5	1