THE EFFECT OF TECHNOLOGY INTEGRATION ON HIGH SCHOOL STUDENTS' LITERACY ACHIEVEMENT

by **Kara Robinson**

Our Lady of Mercy Catholic College Burraneer

Cronulla, New South Wales, 2230, Australia

kara.robinson @ syd.catholic.edu.au

Abstract

This literature review presents a critical appraisal of current research on the role technology integration plays in high school students' literacy achievement. It identifies the gaps within the research through comprehensive analysis. The review develops an argument that the use of laptops in secondary English classrooms has a significant impact upon students' literacy achievement in both a positive and negative manner. The literature review begins by exploring early research and finds that there is a lack of longitudinal studies regarding laptop integration. This is a result of the trend at the time, which was to focus on the impact on student and teacher attitudes rather than the impact on literacy. Through the critical appraisal of current research it is revealed that the attitudes and beliefs of individual teachers to laptop integration is the leading cause of student literacy achievement. The literature review progresses to explore the challenges facing educators and the concerns for educators.

Keywords*:* technology; integration; laptop; literacy; high school; teaching

1. Introduction

Many secondary schools at the start of the 21st century are very traditional in their approaches to teaching literacy in English classrooms, educating for example via pen and paper methods. In the context of this review the term 'literacy' refers to the ability to read and write. Also, when using the phrase 'literacy achievement' I am referring to students' levels of proficiency in the streams of reading and writing. In many secondary English classrooms within Australia each student has access to a laptop. The review of current literature has revealed that in some cases they are rarely accessed as a tool for improving literacy, the review also exposes a correlation between this finding and individual teacher perceptions. This idea is explored in greater depth later in the literature review. To put it simply, laptops are not successfully utilised in the classroom to improve student literacy.

The question of whether laptop integration has positively or negatively impacted student learning is hotly contested in the literature thus far. Overall, literature offers conflicting answers to this question. However, many seem to agree that there are many barriers, such as funding and teacher training, which inhibit schools and teachers to

effectively utilise laptop integration in the secondary English classroom. Few deny the growing influence of technology and its use in teaching students who use digital technology daily. These results are often found within the same research and by reviewing the literature on these studies, this literature review explores some of the limitations of the research methodologies.

Currently there is a significant gap within the current bodies of research, as much of the research focuses on best practice for teachers, rather than the implications of laptop use on students' literacy. This review aims to fill this gap by looking closely at these implications. As there is paucity in the research from Australia in the interest of this literature review the case studies drawn from are primarily based in the United States. Research that emerges in the US is useful for studying Australian context as the American educational context does have some parallels to the Australian context.

2. *Why* are educators just expected to use laptops in classrooms?

It has been the experience of the author that for many educators it is an expectation that technology such as laptops and the day-to-day learning experiences be integrated into the curriculum. However, often educators are left questioning *why*, as often there is little understanding of the pedagogical implications. It is the intention of this literature review to answer this question by looking closely at those studies which explore pedagogical inferences. As Hsu (2011) puts it, often the expansion of information and communication technology infrastructure in schools is just expected to promote learning through its very presence. As a result the integration of technologies used outside the classroom such as word processors, e-mail, digital video, and the Internet must be part of the 21st century secondary English classroom.

These technologies have changed the landscape of skills and competencies needed for literacy in profound ways (Watts-Taffe, Gwinn, Johnson, & Horn, 2003). There is an increasing demand for students to be competent in their ability to access, interpret, compare and contrast, synthesize, and communicate ideas electronically through the use of laptops and additional technologies. Therefore, in the secondary English classroom the strands of literacy, technology and literacy instruction are quickly converging, and are lagging behind changes made in other aspects of students' lives. As a consequence of this teachers must be challenged to not only integrate the use of laptops with traditional aspects of pen and paper literacy instruction but they must also engage students in emerging technological literacies. Linik (2011) has found the scientists "posit that digital native students' brains are actually

developing in new ways because their gray matter is constantly engaged with digital devices. When neurons fire together, they wire together, making connections based on their interaction with technology" (p. 25). The implications of this observation is that inevitably students in secondary English classrooms are hardwired to engage with digital devices, in a way that may not be the case for many educators who are responsible for the introduction and instruction of digital technologies, such as laptops, in these classrooms. Therefore, a conclusion could be drawn that simply using laptops in the secondary English classroom does not promote learning educators are challenged to integrate laptops in a pedagogically sound way.

3. What does early research say about laptop integration?

Early research notes that specific benefits of laptop integration included increased student motivation (Gardner, Morrison, Jarman, Reilly, & Helena, 1993; Rockman, 1998) and a shift toward more student-centred classroom environments (Rockman, 1998). It is important to note and take into consideration early research exploring laptop integration because literacy education is not static and is constantly changing; therefore, it is essential to reflect on where research has come from. The use of laptops is a relatively new phenomenon beginning in the early nineties. As a result, there is little research that studies the long-term effects of laptop usage on literacy achievement in secondary schools. A report conducted by Gardner et al. (1993) found that the positive literacy outcomes attributed to laptop integration were limited to the fact that students could make use of word processors and publishing software, and that most of the curriculum learning outcomes in writing can be addressed through this software. The authors also concluded that there were notable benefits to be gained from the use of spell-checking and thesaurus facilities; however, over time this understanding has been often refuted amongst educators. This Ireland-based study was founded on tests and questionnaires that were completed by the students from the ages ten to fifteen across nine schools over one school year. The study also drew on the experiences of teachers and students, which they recorded in diaries for the purpose of the study, combined with the observations of a research team. By making no use of quantitative data, they left obvious holes in their conclusions – as teachers and students kept diaries for the purpose of the study, this may have tarnished the honesty and integrity of their responses. This lack of quantitative data also limited the aspects of student achievement that could be accurately measured. They found that the impact of laptops after one year was at best marginal on achievement in mathematics, science and writing, however, this is based only on observations and qualitative data. It is important for

the reader to note that much has changed in secondary English classrooms and this study was focused on student-centred experiences, as was the trend at the time.

Also conducting research during the nineties, Fisher and Stolarchuk (1998) in their Australian study of laptop use in middle school science classrooms found out that the classrooms that made use of laptops had the most positive impact on student learning and attitudes when skills and the process of inquiry were emphasized. Their study was designed to assess the effectiveness of laptop integration, students' attitude and achievement outcomes. Student's perceptions of the classroom environment were also utilised to determine this effectiveness. Achievement was measured using a scale from Test of Enquiry Skills among other quantitative instruments which were administered to over eight hundred students in years eight and nine, in fourteen independent schools across four Australian states in 1995. One of the limitations of this study has been that all qualitative data was collected from only two of the fourteen schools in 1996. It is unlikely that by collecting data from only two schools has given a clear and broad enough understanding of the experiences of students and educators making use of laptops in secondary classrooms. By prolonging time between the study and the collection of the qualitative data the authors of the study have inadvertently extended the chance of the data reflecting the current classroom environment rather than the environment from the previous year. It is important to note that unlike Gardner et al. (1993) the focus was also on student attitude to laptops rather than on their achievement against learning outcomes. Correspondingly, Fisher and Stolarchuk (1998) reported a more positive relationship between laptops and student attitudes than between laptops and academic achievement. Rockman (1998) reached similar conclusions to Fisher and Stolarchuk (1998) and Gardner et al. (1993); a majority of teachers in laptop schools reported an increase in cooperative learning and an improvement in project-based instruction. There is very little early research that focuses on the long-term effects of laptop integration on literacy, as laptop integration was in its early stages and laptop use was not widespread.

4. Laptop integration in the 21st century

As research moved into the 21st century, new digital literacy skills became part of the demands placed upon schools to develop 21st century competencies (Spektor-Levy & Granot-Gilat, 2012). As a result of these newly found needs federal legislation in the United States mandated that technology be integrated into school curricula because of the popular belief that learning is enhanced through the use of technology (Davis, 2001). This phenomenon is not unique to the United States; other countries, such as Australia, have also implemented

one-to-one laptop programs. Australia was once considered to be a leader in laptop integration in classrooms (Fluck, 2011). Fluck conducted six case studies of government primary schools to gather data about current initiatives in laptop integration. One of the limitations of this study is that each of the schools was observed by a single researcher on only one day in only one classroom. Many educators will agree that it is very difficult to effectively evaluate the performance of students by observing them on only one occasion. Comparative analysis in the study demonstrated that the potential of laptop-based schooling could be conflicted through concerns about curriculum direction and equity. While technology integration has been mandated in some countries including Australia, the United States and Ireland, there is little in the way of research on the effect this has on secondary school students' literacy. Whilst Linik (2012) postulates that reading and writing are fundamental skills of literacy, and when technology is integrated effectively it can be powerful tool for literacy instruction.

4.1. Challenges of successful laptop integration faced by educators

Integrating laptops into secondary English classrooms with a focus on improving student literacy has the potential to create challenges for educators. Davis (2001) recognizes that the challenge for educators is to understand how to best teach with laptops while developing the literacy expertise of their students. Rather than seeing laptops as something to fit into an already crowded agenda, Biancarosa and Griffiths (2012) argue that laptops can be conceptualized as beneficial tools that teachers can deploy in their quest to create young readers who possess the higher levels of the literacy skills demanded by today's information-based society. There is a want and need among teachers to learn how to use classroom technologies more effectively (Labbo et al., 2003). The teachers' statements provided as a part of the study conducted by Labbo et al. (2003) were drawn from a United States survey conducted as one component of a larger study. The one hundred and twenty five survey participants included teachers and technology coordinators who participated in an online interview and survey. Like previous research the study makes complete use of qualitative methods. The focus was on the advice, insights and cautions about laptop use rather than on any impacts of student achievement.

As previously mentioned Information and Communication Technologies (ICT) such as word processors, e-mail, CD-ROMs, digital video, and the Internet have changed the landscape of skills and competencies needed for literacy in profound ways (Watts-Taffe, Gwinn, Johnson, & Horn, 2003). As part of their study, Watts-Taffe et al. found that there had been little research on the ways in which pre-service teachers are taught to integrate

technology with their literacy instruction. This is another of the many challenges faced by educators when attempting to integrate laptop usage into English classrooms in order to improve student literacy achievement. Watts-Taffe et al. (2003) describe a study of the technology integration practices of three pre-service teachers in their first year of teaching. They chose the most accomplished students to participate in the study to avoid any distracting factors that could be caused by lower-achieving students. The data was collected over three months via a portfolio, emails, observations and group meetings. The results of this study showed how individual teacher knowledge; training and beliefs impact upon the way they integrate laptops into their classrooms, and this idea is investigated in further detail later in this literature review.

4.2. The positive impact of laptop integration on student literacy achievement

The intention of this literature review has been to explore the impact of laptop integration on student literacy achievement. Thus far the review has looked at where early research has come from and how moving into the 21st century, literature has focused primarily on the qualitative methodologies and student and educators' attitudes and opinions. There have been challenges for educators in the introduction of laptops into secondary English classrooms. Despite these Lai, Chang & Ye (2006) used international data to investigate computer usage in elementary school reading classes and the impacts of computer usage on students' reading performance across fifteen countries. The study compares and reveals computer use levels in reading classes, frequencies of teachers having students use computers, times and places of students' computer usage, computer activities of male and female students, and effects of computer usage on students' reading interests and achievement by country. Countries selected for data analysis were considered to be geographically representative, because the national characteristics were comparable to each other as represented through the Progress in International Reading Literacy Study database. Descriptive statistics and figures were used to analyse the tendencies of laptop use in elementary schools. Qualitative methodologies were employed; chi-square was used to compare rates of computer usage in reading classes, and the rates of male and female students' usage. *T*-tests were used to compare the differences of students' reading interests and achievement by presence/absence of computer use in reading classes. Spearman correlations were used to determine the influences of computer use across the three aspects to students' reading interests and standardised reading achievement. The investigators found that secondary school teachers incorporated computer usage in their classes infrequently and this directly impacted upon achievement.

Eteokleous revealed the same understanding in part of a study that was published in 2008 and conducted in Cyprus that revealed that laptops are not extensively used in classrooms. "When they are used in classrooms, it tends to be in a rather sporadic fashion, more as supporting tools or fancy chalkboards than as educational tools. Few teachers were found to use computers in any sort of progressive way" (p. 669). The study examined how elementary educators make use of laptops, and what factors influence laptop integration in their classroom practices by making use of qualitative research methodologies. The study employed a mixed method approach through the usage of structured questionnaires and semi-structured, open-ended interviews as the major methods of data collection. Quantitative and qualitative data were gathered from a sample of Cypriot teachers identified as high and low laptop integrators. Unlike Lai et al. (2006), this study makes use of the qualitative data to help identify why some educators are experiencing difficulties in making consistent and progressive use of laptops as a tool for instruction.

However, it is no secret that the uses of laptops do not, in and of themselves, transform classrooms or provide promising solutions for institutional or instructional problems that result in poor learning. Based on observations of a 2008 study, Warschauer claims that "while a one-to-one laptop program can make a school better, it will not fundamentally alter a school with problems" (p. 133). The case study examined literacy practices in ten United States schools with one-to-one laptop programs. Findings were that reading instruction featured more scaffolding and epistemic engagement, whereas student writing became "more iterative; more public, visible, and collaborative; more purposeful and authentic; and more diverse in genre" (p. 52). Students also gained important technology-related literacies such as those that involve analysing information or producing multimedia. However, despite these findings laptop programs were not found to improve test scores. One crucial finding of Warschauer's research is that it is "the teachers' overall approach rather than the use of technology" (p. 142) that determines the extent to which laptops contribute to the development of students' literacy skills. Similarly, Chase and Laufenberg (2011) deduce that having access to technology is not the key, instead, an inquiry-driven curriculum served by technology is critical.

Spektor-Levy & Granot-Gilat (2012) also looked closely at laptop use and their results indicate, on the practical level, the positive effect of learning with personal laptops and routinely available ICT on students' achievements and competencies. The goal of this study was to examine the impact of a one-to-one laptop program on the implementation of learning skills, information literacy, and the usage of computerized tools among students. These skills

are part of the demands placed upon schools to develop 21st-century competencies. Seventh and ninth grade students participated in this study. One group had routinely studied in one-to-one classes with personal laptops while others studied in regular classes with no ICT. Findings indicated that students from one-to-one classes performed significantly better than students from the control group.

As stated previously, current research has identified many positive outcomes as a result of the integration of technology in the classroom. In 2011 Shapley, Sheehan, Maloney, & Caranikas-Walker conducted an experimental study involving comparisons between twenty-one middle schools that received laptops for each teacher and student. Instructional and learning resources, professional development, and technical and pedagogical support were provided for each of the schools. The researchers made use of a hierarchical linear model to analyze the longitudinal survey and achievement data. Shapley et al. (2011) found that technology immersion had a positive effect on students' technology proficiency and the frequency of their technology-based class activities and small-group interactions. Here it is important to note that whilst the research has indicated some correlation between laptop integration and literacy achievement, there has been little focus on exactly what is causing this correlation.

4.3. How individual teachers impact the implications of laptop integration

Similarly to Eteokleous' (2008) research, the results from a correlation and regression analysis of laptop usage by Hsu (2011), mentioned earlier in this literature review, indicate that teachers who infrequently use basic ICT tools such as word processing rarely assign ICT activities to students. This study reports what variety of ICT activities teachers are likely to assign to students, and what type of teachers are more likely to assign these activities. Teacher ICT usage and student ICT assignments were examined using a sample of over three thousand elementary and junior secondary school teachers in Taiwan. A questionnaire was administered to educators in three hundred and thirty four schools. One of the limitations of this study was that not all educators who participated had access to laptops or the Internet in their classrooms and only about sixty per cent of educators felt that the laptops provided by their schools were satisfactory for their teaching needs. Despite these limitations it is clear that whilst there can be a positive impact on student literacy achievement from laptop integration, the research indicates that individual teachers impact upon student laptop usage and thus their literacy achievement.

Likewise, research findings by Chen (2008) indicate that "Teachers' beliefs play an important role in their deciding how they will integrate technology into the classroom" (p. 65). The author used qualitative research methods to explore the relations between teachers' pedagogical beliefs and technology integration. Participants were twelve Taiwanese secondary school teachers, and findings indicated inconsistency between the teachers' expressed beliefs and their practices. Using qualitative methods Chen (2008) collected data from multiple data sources, specifically interviews, syllabi, lesson plans, handouts, PowerPoint slides and classroom observation over two months. One of the limitations of this study is that it relied on data from only school that the author had chosen which was understood to have a reputation for technology use and was above average academic achievement. Therefore, the study did not use a representative sample.

Ottenbreit-Leftwich, Glazewski, Newby & Ertmer (2010) revealed that teachers used laptop integration to address professional and student needs, all of which related to the underlying value belief of promoting student learning. This hermeneutical phenomenology study investigated the value beliefs that underpin teachers' uses of laptops. Data were collected from eight award-winning teachers through the qualitative methodologies of an interview, observation, and electronic portfolio. Like Eteokleous (2008), Hsu (2011) and Chen (2008), this study indicates that individual teachers hold their own beliefs about laptop integration, which has a direct impact on student laptop usage and, in turn, affects student literacy achievement.

4.4. Negative impacts of laptop integration on student literacy achievement

While this literature review has focused on the positive effects of laptop integration and how individual teachers can negatively impact on this, it is also important to understand that not all the studies indicate positive results. There have been many recorded negative impacts of technology integration on high school student literacy achievement. Lai et al. (2006), as previously indicated, have used international data to investigate computer use situations in elementary school reading classes and the impacts of computer usage on students' reading performance across fifteen countries. The results reveal that the effects of computer usage in reading classes and reading teachers' computer activities on elementary students' reading interests and achievement are unclear. Students' reading achievement did not show significant improvement with computer use in classes, or teachers' and students' computer activities, and some even showed negative influences. "The results of this study using an international perspective confirm that computer usage in education is not always beneficial to students'

academic achievement" (Lai et al., 2006, p. 63). While there can be many explanations for this divergence, the failings can be attributed to "moderate awareness and low level of working knowledge, but a high degree of interest and openness" (Jost & Mosley, 2012, p. 5) among teachers. This survey based on laptop integration competencies as outlined by experts in the field collected data from two hundred and twenty-four pre-service teachers in ten different teacher education courses. In the survey teachers responded to questions about themselves, in order to measure their technology literacy in three levels: awareness, working knowledge, and transformative practice. Results indicate a moderate awareness and low level of working knowledge, but a high degree of interest and openness to laptop integration for the researchers this indicated a need to design a strong curriculum for teachers as part of the curriculum on technology and literacy (Jost & Mosley, 2012). Similarly Techlehaimanot, Mentzer & Hickman (2011) offer the view that lack of confidence in integrating technology and making use of laptops combined with a deficiency of understanding of the benefits of technology integration to student learning were identified to be contributing to this discrepancy. As previously stated, individual teachers have impact on student literacy achievement based on laptop integration. By looking closely at the research which focuses on the negative impacts of laptop integration it has become apparent that again it is individual teachers who are ultimately instigating these impacts.

4.5. Strategies for improving student literacy achievement via laptop integration

Current research has developed a need to investigate strategies to use laptop integration to improve students' literacy achievement. Therefore, there has been a significant amount of research conducted regarding strategies for improving the use of laptops in classrooms. Wendt (2013) provides suggestions for integrating literacy learning in the general curriculum at the secondary level with particular attention to content area literacy and laptop integration. "Studies have shown a slight increase in achievement through the use of e-books" (p. 44), though this minor increase requires further study and repeated trials. Likewise Warschauer, Arada & Zheng (2010) also discovered positive outcomes, however in a different area.

> We have found that the greatest impact of individual laptop use is on student writing. When students have daily access to Internet-connected laptops, they conduct more background research for their writing: they write, revise, and publish more, they get more feedback on their writing; they write in a wider variety of genres and formats; and they produce higher quality writing (p. 221).

This research has implications for the ways in which laptop use is incorporated into the daily English secondary school classroom. There is little research to support the claim that this improvement corresponds to other areas of literacy such as spelling and grammar, which should be considered integral parts of students' literacy achievement.

Moore-Hart (2008) attributes the improvement of students' writing to the inclusion of technology tools. Students improved their literacy through challenging learning experiences. This study investigates how two elementary teachers begin to use laptops in a private school that had access to technology at many levels. Using a collaborative teacher-research model, Moore-Hart (2008) specifically examined how to support teachers' practice as they integrated technology tools within their literacy curriculum. Due to a supportive context, the teachers reformed their writing instruction to include technology tools, and students improved their literacy through challenging learning experiences. Ottenbreit-Leftwich et al. (2010) offer another view, stating that "when teachers believe technology uses are valuable, they are more likely to incorporate those uses into their practices" (p. 1321). Findings indicated that teachers used laptops to address professional and student needs, all of which related to the underlying value belief of promoting student learning. This research has left a gap; there is a need for researchers to examine exactly how these strategies have directly impacted on student literacy achievement.

4.6. Concerns for researchers regarding laptop integration

Making accurate measures of literacy achievement can be quite difficult in this context. A concern for researchers is how to best measure the impact of laptop use on secondary student literacy achievement. It could be measured with pre-existing curriculum accountability frameworks. In Australia this is the National Assessment Program – Literacy and Numeracy. As Fluck (2011) observed, it was also a hotly debated issue whether laptops will lead to increased scores in the National Assessment Program – Literacy and Numeracy testing. In the main principles were wary of suggesting this should be used as a means of judging the efficacy of the laptop-based learning. This is understandable, since National Assessment Program – Literacy and Numeracy testing is largely pen and paper, and handwriting skills may noticeably diminish when laptops are more frequently used for literacy. The impact of laptop use could also be measured by other factors such as student engagement. Fluck (2011, p. 13) observed that pupils with laptops were more engaged with learning, and undertaking learning at home. An example stated in the results of this study demonstrated how two girls, who were considered to be low-achieving, used their laptops to read at home and brought

reflective reviews back to school. So whilst some studies have identified both positive and negative impacts of student literacy achievement as a direct result of laptop use one of the limitations of this research is that often the skills required for pen and paper literacy tests are not the same as the skills comprised in laptop based literacy. This may impact the results that these studies have found.

5. Conclusion

The question of whether laptop integration has positively or negatively impacted student learning is hotly contested in the literature thus far. As a result of critical analysis of current literature a conclusion could be drawn that educators are challenged to integrate laptops in a pedagogically sound way rather than simply using laptops in the secondary English classroom which does not promote learning. Close analysis of early literature has shown that much has changed in secondary English classrooms and it is important to note that these studies were focused on student-centred experiences, as was the trend at the time. Moving into the 21st Century many governments have mandated the integration of laptops into classrooms. Yet in order to make significant improvements to students' literature in secondary English classrooms, educators continue to fail to successfully integrate these technologies effectively.

Despite this, positive impact of laptop integration has been recorded in many studies. Whilst the research has indicated some correlation between laptop integration and literacy achievement, there has been little focus on exactly what is causing this correlation. However, some attribute this correlation to individual teachers who hold their own beliefs about laptop integration. These attitudes have a direct impact on student laptop usage and, in turn, affect student literacy achievement. Similarly, teacher attitudes can cause opposing results, where negative impacts of laptop integration on literacy achievement are recorded. This has led researchers to investigate strategies of using laptops to improve students' literacy achievement. Likewise these contrasting results have caused researchers to analyse the limitations of some studies because often the skills required for pen and paper literacy tests are not the same as the skills utilised in laptop based literacy.

As educators we must all challenge ourselves to think more broadly about laptop integration. As laptops were integrated into secondary English classrooms, the focus was on traditional pen and paper literacy. As Watts-Taffe et al. (2003) note, it is "…crucial that we as literacy teacher educators begin to reconceptualise our notions of literacy and embrace the emerging and new realities of technological literacy" (p. 130).

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