

## EXAMINING THE IMPACT OF THE APPLE 'IPAD' ON MALE AND FEMALE CLASSROOM ENGAGEMENT IN A PRIMARY SCHOOL IN SCOTLAND

Iain McPhee, Lisa Marks,  
and Dougie Marks  
University of the West of Scotland  
United Kingdom

### Abstract

Many studies have shown that the use of technology in the learning environments in schools may influence pupil engagement (Kearney, et al., 2011). Despite the recent surge in the popularity and use of touchscreen tablet computing technology by consumers, little research has been carried out into their use in a primary school setting. This study investigates the use of the Apple *iPad* in an upper primary school setting with regard to children's engagement. Cognitive, emotional and general engagement was increased in lessons based on use of the iPad. Of particular significance was the increased engagement in boys to levels comparable to girls. The study suggests that tablet computer technology has potential as a useful tool in the classroom setting and in aiding convergence of the gender gap.

### Introduction

The importance of education to be engaging for learners is well understood (Finn and Rock, 1997; Kirsch et al., 2002; Willms, 2003), and is associated with academic success (Bloom, 1976). Engagement correlates with several factors, including positive measures in school attendance rates (Voelkl, 1995), a sense of belonging (Goodenow, 1993), pupil confidence in achieving learning outcomes (Schunk & Zimmerman, 1994), and most importantly academic achievement (Connell, Spencer, & Aber, 1994). Conversely, antisocial behaviour is inversely associated with engagement (Jenkins, 1995). Engagement is therefore an important indicator of the success of an educational environment.

### Defining engagement.

Precise definitions vary, from those emphasizing a holistic educational experience to approaches emphasizing complex cognitive, behavioural, and emotional measures of engagement and their impact in a task based setting (Skinner & Belmont, 1993). In this model, behavioural engagement is central to the concept of participation, (social, academic or extracurricular), whereas emotional engagement refers to affective reactions (positive or negative attitudes) to those sharing the school learning environment. Cognitive engagement involves the intellectual faculties necessary to comprehend new information and skills (Fredricks et al., 2005). More recently, some studies have focused on the idea of decreasing alienation and increasing engagement in higher education (Case, 2008).

### **Measuring engagement.**

Engagement Theory (Shneiderman, 1994, 1998; Kearsley & Shneiderman, 1997) describes the measurement of engagement utilising several measures, including student questionnaires and teacher observations. Although used extensively self-reporting assessment tools are subject to subjectivity bias (Assor & Connell, 1992). In addition, asking schoolteachers to make meaningful systematic observations require the complete attention of the observer. A teacher involved in teaching a class will not be able to devote their entire attention to observing. For this reason, observational studies using neutral observers may be preferable, although further insight may be gained by teachers' observations. Drawing upon the themes in the literature, (Chapman (2003; Kearney, & Perkins, 2011) we define *engagement* as: The emotional, behavioural, and cognitive evidence of students being actively involved in the academic experience.

### **Gender differences in attainment & engagement.**

In Scotland, the Department for Education and Skills began recording a gender gap with regards to educational attainment in 1988. Since 1995 this gap has remained roughly constant at around 10% in favour of girls (Department for Education, 2003). Many factors are thought to contribute towards this discrepancy (Jackson, Moore, & Leon, 2010). It is argued that this has led to young males being at an unnecessary disadvantage (Kovalik, 2008). Of the multitude of factors that may potentially influence engagement, one factor that may encourage young males in the classroom is the use of technology in schools, which they use at home and at play.

### **Learning engagement and the use of IT in schools.**

Using technology to *promote active learning* and raise engagement levels in the classroom is not new (Arrowood & Overall, 2004; Chung & Walsh, 2006; Schmid, Miodrag, & DiFrancesco, 2008). However touch screen technology remains relatively unevaluated in education settings out with the specialist area of IT. A recent second-order meta-analysis spanning 40 years of research found that technology had a significant impact on education to the effect that the average student in a classroom where technology is used will perform 12 percentile points higher than the average student in the traditional setting that does not use technology to enhance the learning process (Tamin et al, 2011). However the perception of technology in education is that of novelty (Plumm, 2008), rather than a medium effectively embedded within the curriculum. Of particular concerns are the gap between the school environment and the way in which information is accessed at home.

## **Mobile Learning and Tablet Computers**

A distinct move from the use of desktop computers to tablet devices has fuelled the concept of *mobile learning*. Masrom and Ismali (2010) (as cited by Marks 2013 p.6), describe mobile learning as “affective forms of motivation characterized among others; control, ownership, fun and communication” (also noted by Jones et al., 2007; Sharples, 2007). Touch-screen technology computers feature applications or *apps*, programs allowing the user to perform a multiplicity of tasks that are fun and engaging. Internet browsing and

accessing a wide range of audiovisual media include social networking capabilities.

### Rationale for Current Study

This study utilised the most popular touch screen technology, specifically the Apple iPad ‘tablet’ device. This is portable, user friendly, having few limitations than the smaller devices (in terms of lack of connectivity to outside devices and lack of word processing ability). The findings of this study may well be applicable to other technologies and this is an area that requires further investigation. We were particularly interested in any gender specific differences in engagement in this setting.

### Methods

The study was conducted in a private school on the West coast of Scotland that had deployed a one iPad per child policy prior to data collection for approximately seven months before the study took place. Two classrooms were used for the observations, which were composite classes of primary 4-5, and 6-7 (aged 8-11 years old).

### Design.

The study was cross sectional in design, using systematic observations of two primary school class settings, with both teachers using identical lessons based upon the experiences and outcomes. One teacher used 1:1 iPad deployment in one setting, and the other teacher used a traditional classroom teaching style, in which no touch screen tablet computer technology was used. The same children were in both lessons for each teacher. Three researchers observed each child in each lesson for 30 minutes (60 minutes in total per child) and completed the Classroom Engagement Questionnaire (see below). Results from these observations are compared using within groups t-tests. The study was designed to examine two key units of learning in the curriculum for excellence, geometrical and linguistic studies. Four lesson sub units were observed in total: two iPad and two non-iPad based sessions. Both group conditions in both lessons were the same. This was intrinsic to the study design.

### Participants.

A total of 28 pupils were observed in the study. Table 1 outlines participant demographic data.

Table 1

#### *Participant Details*

|         | Number | Primary           | Age (M, SD) |
|---------|--------|-------------------|-------------|
| Males   | 18     | P 4/5=10, P 6/7=8 | 8.6 (0.63)  |
| Females | 10     | P 4/5=5, P 6/7=5  | 10.6 (0.65) |
| Total   | 28     | 28                | 9.5 (1.2)   |

### Procedure.

Teachers were instructed to perform lessons as they would if not being observed, half of the day using the iPad, and half using traditional teaching methods. Three observers joined the class, and observed all children for 30 minutes using the iPad, and 30 minutes being taught traditionally. Observers scored each child on each item of the Classroom Engagement Questionnaire for both sessions. Comparisons across the two conditions were made.

### Checklist development.

Engagement was measured using a 'Classroom Engagement Checklist' developed by the authors with reference to Engagement Theory (Shneiderman, 1994, 1998; Kearsley & Shneiderman, 1997). The checklist was composed of three subscales, measuring emotional, cognitive, and behavioural engagement, as well as an overall engagement score. The scale employed 17 five-point Likert scale observational statements. The scale had a good to moderate reliability, with Cronbach's  $\alpha$  values of .56 (Emotional Engagement), .82 (Cognitive Engagement), and .55 (Behavioural Engagement), for each of the subscales.

### Analysis

Mean engagement and subscale scores were compared between the experimental (with iPad) and control (without iPad) conditions. In addition, given previous research suggesting gender differences in engagement and classroom achievement, gender differences were also analysed.

### Results

Significant differences were found between iPad and control conditions, with students scoring higher on overall engagement, cognitive, and emotional engagement when using the iPad, but not behavioural engagement. These are illustrated in Table 2.

Table 2

*Engagement (T-Tests)*

| T-tests                | Without iPad (Mean) | With iPad (Mean) | t-value (df) | p-value | Effect size (Cohen's d) |
|------------------------|---------------------|------------------|--------------|---------|-------------------------|
| Behavioural Engagement | 22.7 (3.3)          | 23 (3.6)         | -.453 (27)   | .654    | 0.087                   |
| Cognitive Engagement   | 21.2 (4.9)          | 25 (3.8)         | -3.1 (27)    | .004**  | 0.87                    |
| Emotional Engagement   | 17.6 (3.1)          | 19.5 (2.4)       | -2.69 (27)   | .012*   | 0.69                    |
| Overall Engagement     | 61.5 (9.6)          | 67.5 (7.9)       | -2.62 (27)   | .014*   | 0.68                    |

\*p. < .05, \*\*p. < .01

In addition, analysis by gender revealed that the pattern of significant differences observed in the overall analysis remained in males, but there were no significant differences between the conditions for females' engagement. These are illustrated in Table 3.

Table 3

*Gender Differences in Engagement (T-Tests)*

| T-tests                       | Without iPad (Mean) | With iPad (Mean) | t-value (df) | p-value | Effect size (Cohen's d) |
|-------------------------------|---------------------|------------------|--------------|---------|-------------------------|
| Male Behavioural Engagement   | 22.2 (3.7)          | 23.3 (3.3)       | -1.34 (17)   | .199    | 0.31                    |
| Female Behavioural Engagement | 23.7 (4.1)          | 22.6 (4.1)       | .892 (9)     | .396    | 0.27                    |
| Male Cognitive Engagement     | 20.3 (5.4)          | 25.1 (2.8)       | -2.95 (17)   | .009**  | 0.9                     |
| Female Cognitive Engagement   | 22.8 (3.6)          | 24.8 (5.3)       | -1.21 (9)    | .259    | 0.44                    |
| Male Emotional Engagement     | 17.1 (3.6)          | 19.6 (2.1)       | -2.67 (17)   | .016*   | 0.85                    |
| Female Emotional Engagement   | 18.6 (1.8)          | 19.3 (5.1)       | -.782 (9)    | .454    | 0.18                    |
| Male Overall Engagement       | 59.5 (11)           | 68 (6.6)         | -2.8 (17)    | .012*   | 0.94                    |
| Female Overall Engagement     | 65.1 (5.1)          | 66.7 (10.2)      | -.508 (9)    | .624    | 0.198                   |

**Discussion**

Campbell (2008) underlines the importance of the classroom environment designed to cultivate pupil engagement in order to enhance learning. The results suggest that using the iPad in a classroom increases wide-ranging engagement and cognitive and emotional engagement achieved in part by implementing touch screen technology in schools.

**Gender Differences**

There has been much concern with declining male achievement in education in recent years (Trent & Slade, 2001). The results suggest that there are potential benefits that are specific to boys in harnessing the pleasurable aspect of the technology raising male engagement to levels comparable to that common in girls. However, it is important to note that the variation in scores ranges 2% to 4%. The girls in the study did not decrease in engagement when using the iPad, but remained steady, whilst boys' engagement improved. In addition, the large standard deviation in overall engagement for girls suggests that the engagement levels were more spread in the female sample than the male. This suggests that, for some of the girls in the sample, the iPad did increase engagement, whilst for others, its effects were minimal. It could be hypothesised that factors such as intellectual ability, previous technological experience, or confidence, may distinguish between engagement levels in girls, but not in boys.

Volman et al. (2005) found that in ICT-based activity girls favoured having an explanation given to them, whereas boys would rather explore the activity for themselves. The nature of the iPad format favours the latter, in that a wide range of applications are available, and often, there are no set guidelines to

complete a task using the application. Cooper (2006) has argued that much educational software is based upon game-like attributes of scoring points, and competition, and that this may appeal to boys more than girls, impacting positively in engagement in the teaching environment. In terms of the applications (apps) used, a wide variety was available to pupils. On the children's use of the apps one of the teachers involved in the study commented:

... a girl of 8 years old (X) carried out the following in the geometry lesson: a) Found an image on Safari. b) Put into ColorSplash to adjust image c) Put onto PS Express to further adjust image d) Put onto Brushes to add colour and detail e) Saved image onto Moxier Collage to add text. This was not taught. The pupils had experimented with each App but had free choice as to how to complete their design logo. X decided to experiment and was not restricted in which Apps she was allowed to use. It was easy for her to use and adjust, as she wanted. This allowed her to concentrate on the image she wanted and not to have her time taken up by trying to get each program to run.

Does increased engagement lead inevitably to improvements in learning? Smith et al. (2007) reported increased engagement with the use of interactive whiteboards (and boys in particular showed increased behavioural engagement); however, there was no evidence of increased attainment. This is clearly an event that which requires further investigation.

### **Limitations of the Study Design and Sampling**

This study utilized an opportunistic sample of pupils attending a private school in which the Apple iPad was used in the classroom. The sample size is smaller than would be ideal, potentially reducing the scope for creating robust conclusions. Further research is therefore required with a larger sample size. Further investigation is also warranted on the impact of socio economic factors, in order to ascertain whether income and educational level of parents, and home environment are important variables in measurements of engagement. Any underlying bias in the observers' judgements about the role of technology in engaging boys may have unconsciously influenced their scoring. It may be interesting to investigate further the gender differences in engagement levels, and to ascertain whether any increase in engagement is translated into academic achievement.

### **Implications and Conclusion**

A number of implications emerge from this study that may impact upon educational theory and practice. Our results suggest that the technology afforded by the 'iPad' can contribute to classroom engagement. In addition, it appears that boys may benefit in particular, facilitating the rise of their engagement to levels observed in girls. Given the growing concern over how well the education system caters for the needs of boys, implementing this sort of technology in schools would appear a valuable endeavour.

## References

- Arrowood, D., & Overall, T. (2004). Using technology to motivate children to write: Changing attitudes in children and pre-service teachers. In R. Ferdig et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2004* (pp. 4985–4987).
- Assor, A., & Connell, J. P. (1992). The validity of students' self-reports as measures of performance-affecting self-appraisals. In D. H. Schunk, & J. Meece (Eds.), *Student Perceptions in the Classroom* (25-46). Hillsdale, NJ: Lawrence Erlbaum.
- Atkinson, E. S. (2000). An investigation into the relationship between teacher motivation and pupil motivation. *Educational Psychology, 20* (1), 45-57.
- Bloom, B. (1976). *Human characteristics and school learning*. New York: McGraw-Hill.
- Campbell, D. E. (2008). Voice in the classroom: How an open classroom climate fosters political engagement among adolescents. *Political Behavior, 30* (4), 437-454.
- Case, J. M. (2008). Alienation and engagement: Development of an alternative theoretical framework for understanding student learning. *Higher Education, 55* (3), 321-332.
- Chapman, E. (2003). Alternative approaches to assessing student engagement rates. *Practical Assessment, Research & Evaluation, 8* (13). Retrieved from <http://PAREonline.net/getvn.asp?v=8&n=13>
- Chung, Y., & Walsh, D. J. (2006). Constructing a joint story-writing space: The dynamics of young children's collaboration at computers. *Early Education and Development, 17*(3), 337–420.
- Connell, J. P., Spencer, M. B., & Aber, J. L. (1994). Educational risk and resilience in African-American youth: Context, self, action, and outcomes in school. *Child Development, 65*, 493- 506.
- Cooper, J. (2006). The digital divide: the special case of gender. *Journal of Computer Assisted Learning, 22*, 320-334.
- Department of Education (2003). Boys achievement in secondary schools. Retrieved from <https://www.education.gov.uk/publications/standard/publicationDetail/Page1/HMI%201659>
- Finn, J., & Rock, D. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology, 82*(2), 221-234.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109.
- Fredricks, J. A., Blumenfeld, P., Friedel, J., & Paris, A. (2005). School engagement. In K. A. Moore, & L. Lippman, (Eds.), *What do children need to flourish? Conceptualizing and measuring indicators of positive development*. New York, NY: Springer Science and Business Media.
- Goodenow, C. (1993). The psychological sense of school membership among adolescents: Scale development and educational correlates. *Psychology in Schools 30*, 79–90.
- Jackson, J. F.L., Moore, J. L., & Leon, R.A. (2010). Male underachievement in education across the globe: A shift in paradigm for gender disparities regarding academic achievement. *International Encyclopaedia of Education* (3<sup>rd</sup> ed.) (pp. 838-844), Available at <http://www.sciencedirect.com/science/referenceworks/9780080448947>

- Jenkins, P. H. (1995). School delinquency and school commitment. *Sociology of Education*, 68, 221–39.
- Jones, A., Issroff, K., & Scanlon, E. (2007). Affective factors in learning with mobile devices. In M. Sharples (Ed.), *Big Issues in mobile learning* (pp. 17-22). Nottingham: LSRI University of Nottingham.
- Kearney, S. P., & Perkins, T. (2011). Improving engagement: The use of authentic self and peer assessment for learning to enhance the student learning experience. Paper presented at the Academic and Business Research Institute Conference. Las Vegas, Nevada, 6-8 October.
- Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technology- based teaching and learning. *Educational Technology*, 38 (5), 20-23.
- Kirsch, I., de Jong, J., Lafontaine, D., McQueen, J., Mendelovits, J., & Monseur, C. (2002). *Reading for change: Performance and engagement across countries*. Paris: OECD. Retrieved from <http://www.oecd.org/dataoecd/43/54/33690904.pdf>
- Kovalik, S. (2008). Gender differences and student engagement. Retrieved from <http://www.leadered.com/pdf/Student%20Engagement%20and%20Gender%20white%20paper.pdf>
- Marks, D., Laxton, T., McPhee, I., Cremin, L., Sneider, A., & Marks, L. (2013, April) Does use of touch screen computer technology improve classroom engagement in children? Online Educational Research Journal. Retrieved from <http://www.oerj.org/View?action=viewPDF&paper=81>
- Masrom, M., & Ismali, Z. (2010). Benefits and barriers to the use of mobile learning in education. In R. Guy (Ed.), *Mobile learning: Pilot projects and initiatives* (p. 9026). Santa Rosa. California: Informing Science Press.
- Plumm, K. M. (2008). Technology in the classroom: Burning the bridges to the gaps in gender biased education? *Computers & Education* 50, 1052–1068.
- Schmid, R. F., Miodrag, N., & DiFrancesco, N. (2008). A human-computer partnership: The tutor/child/computer triangle promoting the acquisition of early literacy skills. *Journal of Research on Technology in Education*, 41(1), 63–84.
- Schunk, D. H., & Zimmerman. B. J. (Eds.). (1994). *Self-regulation of learning and performance: issues and educational applications*. Hillsdale, N.J: L. Erlbaum Associates.
- Scotland's digital future: A strategy for Scotland (2011). Retrieved from Scottish Government website: <http://www.scotland.gov.uk/Resource/Doc/981/0114237.pdf>
- Sharples, M., Taylor, J., & Vavoula, G. (2007). A theory of learning for the mobile age. In R. Andrews, & C. Haythornthwaite (Eds.). *The Sage handbook of e-learning research* (p. 221-247). London: Sage.
- Shneiderman, B. (1994). Education by engagement and construction: Can distance education be better than face-to-face? Retrieved from <http://www.hitl.washington.edu/scivw/EVE/distance.html>
- Shneiderman, B. (1998). Relate-create-donate: An educational philosophy for the cybergeneration. *Computers & Education*, 31(1), 25-39.

- Skinner, E.A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, 85(4), 571- 581.
- Smith F., Hardman F., & Higgins, S. (2007). Gender inequality in the primary classroom: Will interactive whiteboards help? *Gender and Education*, 19(4), 455-469.
- Tamin, R.M., Bernard, R.M., Borokhovski, E., Abrami, P.C., & Schmid, R.F. (2011) What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research*, 81(1), 4–28.
- Trent, F., & Slade, M. (2001). *Declining rates of achievement and retention: the perceptions of adolescent males* (Report to the Department of Education, Training and Youth Affairs, Evaluations and Investigations Programme). Canberra: Higher Education Division, Commonwealth of Australia.
- Voelkl, K. E. (1995). School warmth, student participation, and achievement. *Journal of Experimental Education*, 63(2), 127–38.
- Volman, M., van Eck, E., Heemskerk, I., & Kuiper, E., (2005). New technologies, new differences: Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers and Education*, 45, 35-55.
- Willms, J. (2003). Student engagement at school: A sense of belonging and participation results from PISA 2000. Paris: OECD. Retrieved May 11 2011 from: <http://www.oecd.org/dataoecd/42/35/33689437.pdf>

**Author Details**

Iain McPhee

[Iain.mcphee@uws.ac.uk](mailto:Iain.mcphee@uws.ac.uk)

Dougie Marks

[dougie.marks@uws.ac.uk](mailto:dougie.marks@uws.ac.uk)

Leah Marks

[leah.marks@glasgow.ac.uk](mailto:leah.marks@glasgow.ac.uk)