First-year Secondary Students' Perceptions of the Impact of iPad Use on Their Learning in a BYOD Secondary International School

Martin Watts, EdTech Coordinator, International School in the Netherlands
Ioannis Andreadis, Mathematics teacher, International School of the Hague

Abstract

This study uses a statistical survey over three consecutive years to show how the first-year students of a mid-sized Bring Your Own Device (BYOD) secondary international school perceive the impact of using their own iPad on their learning. The students' perceptions show awareness of the usefulness and challenges associated with using their iPads in school life as well as at home. The students indicate several perceived benefits relating to having instant access to a variety of learning opportunities via the internet. However, they also indicate the challenges of keeping a balanced approach and avoiding overuse of their iPads inside and outside school (e.g., for gaming and social media). The original rationale for implementing the BYOD scheme did not anticipate specific benefits for students' academic outcomes (grades). However, academic performance has continued to be monitored to identify any adverse effects associated with the scheme. Students' overall academic performance has not been adversely affected since the scheme was implemented.

Keywords: iPad; tablet technology; BYOD; middle secondary schools; classroom pedagogy

Introduction

Since the introduction of the iPad, there has been relatively rapid uptake of these devices in schools (Young, 2016; Erbes et al., 2016). This uptake has coincided with advances in processing power and the ubiquitous availability of wireless networking and high-speed internet connections. The advantages of using iPads in class include reliability, functionality, and availability (Young, 2016). The main driver for using iPads or similar devices in the classroom has been the opportunity they afford for implementing 21st-century models of teaching and learning which specifically define the role of the teacher and redefine what, and how, the students learn (Smith & Santori, 2015). The iPad's relative affordability has also made it an attractive choice for institutions wishing to take advantage of the Bring Your Own Device (BYOD) trend. However, as Erbes et al. (2016) note, such programmes are most typical in affluent settings, such as private or international schools.

This study took place in a large international school in the Netherlands. The school is well resourced, and has a reliable and fast technology infrastructure. The school's Educational Technology (EdTech) team conducts an annual survey to collect data from students as part of an ongoing evaluation of the impact of technology on the student experience.

The students of each first secondary year over three school years were asked to respond to questions about their perceptions of how their iPad use contributed positively or negatively to their learning. The data was obtained with an online Google form survey questionnaire (see

questions in Appendix A). The questionnaire was completed in the classroom with a supervising teacher to assure the authenticity of the students' answers (see letter in Appendix B). The students were also asked to estimate how much time they spent using the iPads—both at school and at home—and to provide feedback on potential distractions associated with using their electronic devices. The information gathered therefore provided an opportunity to support our research statement that using iPads empowers student learning—especially in environments where the integration of technology is mature, is supported effectively, and is monitored. For these reasons the team that prepared this study felt the data gathered would be of interest to educators and researchers, as was the case in previous work by the team in terms of the implementation of a Device Free Lunch programme in secondary schools (Andreadis & Watts, 2022).

Another aim of this study is to promote the research methodology endorsed by theories of Action Research, in which the collection and analysis of data can be used to evaluate an implementation and determine the effects of change in the classroom (Feldman & Minstrell, 2022). The same authors caution that this methodology raises concerns about validity and reliability. In mitigation, Feldman and Minstrell (2019) point out that, with proper training, teachers can act as classroom researchers. The authors of this study, although currently teaching in school, have received training in research and have conducted university-based research.

For the current study, it was decided to present the results over a period of three academic years (2017–2019), to avoid the impact of the COVID-19 pandemic that affected the school community from February 2020.

A brief history of the BYOD iPad programme at the study school

The BYOD implementation at the school was informed by two models of education technology impact. Firstly, the Teacher Pedagogical Content Knowledge (TPCK) framework (Mishra & Koehler, 2006) describes how technology might assist with the communication and availability of learning content and support pedagogical approaches that enhance learner experience. Secondly, the Substitution Augmentation Modification Redefinition (SAMR) model (Puentedura, 2014) was adopted as a tool that provided the school with a vocabulary to articulate the educational impact of the use of technology on learning.

The introduction of the iPad programme in the study school began with a pilot programme in the academic year 2014–2015. Students were required to attend classes with an institution-owned iPad, which was available for each student in their first year of secondary school. Students kept these devices as they progressed through the first 3 years of their Middle Year Program (MYP). The teachers also received a device and training to help them become familiar with the tool to support learning in the classroom (Kontkanen et al., 2017; Fenton, 2017). The programme included support for teachers by an Ed. Tech. Coordinator, and six teacher representatives— drawn from different faculty areas—would provide training and subject-specific insight into using the devices in the classroom. This commitment amounted to 1.5 full-time educational (FTE) teacher positions.

The introduction of a BYOD 1:1 programme at the school was based on benefits that were discovered during the pilot phase of the project.

The digital devices would:

1. support learning inside and outside the school
2. improve communication between students and teachers
3. provide access to a wide range of applications to further support learning

4. reduce the number of physical books carried by students
5. prepare the students for an increasingly digital future.

One of the functions carried out by the EdTech team is to conduct periodic deep dives into subject departments to evaluate the visibility of these models, and their potential effects, in classroom practice. The EdTech team also ensures that software used in classrooms has measurable (or the potential for) positive effects based on these guiding models. Thus, the school in this study has structures to promote the teacher's self-efficacy in the use of the mobile device. The importance of this self-efficacy is emphasised by Tilton and Hartnett (2016).

As part of an annual review of the impact of the implementation, feedback from students has been gathered at the end of each academic year from 2015–2016. Despite some slight amendments to the survey instrument after the first year of data collection, the questionnaire items have remained consistent. The data collected from 3 years of identical questionnaires are the focus of this investigation.

Note that there was no expectation that academic results would improve as a result of introducing the devices. Figure 5 shows that students' average grade yearly performance was not adversely affected. On the contrary, there was a slight increase in performance. This was possibly due to the teachers being familiar with the devices and because the curriculum was enriched by their use.

Literature review

Research by The Economist Intelligence Unit (2018) highlights the role played by technology in equipping students with the skills and attributes that will "transform businesses and influence economies" in the future (p. 2). The research identifies characteristics necessary for effective integration of technology into school curricula. These characteristics include appropriate teaching strategies, the teacher's ability to teach 21st-century skills, and their ability to leverage the communication and interactivity facilitated by technologies. Limitations of the potential impact of technology include lack of budget resources and a generally cautious approach to adopting these new technologies. In the study school, some of these limitations were overcome by adopting a BYOD model, and by providing teachers with support and training to increase their confidence and promote the application of technology across lessons at the school.

The success or failure of introducing technology into the classroom can also depend on a variety of other factors, and the academic impact of a technology depends on how, where, and by whom it is being integrated. For example, Kolb (2019) questions the value of integrating technology when it is used merely to support traditional pedagogical methods, stating the need to "consider value-added learning over traditional resources". In some instances, the academic impact of technology can be minimal and in others it can be significant. The interplay of these determining factors can be complex and educators need to find ways to manage this complexity to identify the relative impact of the device. Varier et al. (2017) clustered these factors into three categories relating to implementation, impact on instruction and skills, and impact on engagement and motivation.

For the iPad (or any other device) to make a positive impact in the classroom, there must be a clear rationale for its introduction (Kolb, 2019). This point is evidenced by several studies on the academic impact of device use in schools (Langford et al., 2016). Sung et al. (2016) distilled research from a large number of academic papers and found that using mobile devices had a larger positive impact than using laptops. However, the findings supported the need for educators to ensure that the pedagogical approaches matched the benefits of the devices. This was more evident in inquiry-led contexts, self-directed study activities, or when supporting cooperative

learning. Results from Kontkanen et al. (2017) suggest that: (i) teachers' pedagogical approaches changed little in response to the new devices and remained largely teacher-centred, and (ii) students do not have the confidence to radically change learning styles to take advantage of the affordances of the devices. We can see that it is difficult to quantify the potential value that iPads add to teaching and learning because of the complex and often conflicting factors involved.

Nor can the effectiveness of these devices be taken for granted. Burnett and Merchant (2017) highlight the notion that the effectiveness of the device depends on external factors.

> Tablets, then, do not exist in isolation; the opportunities they present need to be seen in relation to other classroom practices and to what is, or is not, valued. (p. 240)

In studies of 1:1 classroom environments, it was reported that, when using tablet devices, "students become more self-directed, independent and collaborative" (Varier et al., 2017, p. 984). Younger students particularly favoured tablets, reporting that they preferred lightweight devices and age-appropriate games and applications. The study found that teachers in a 1:1 environment moved from a teacher-centred to a teacher-facilitating pedagogical environment. Curry et al. (2019) carried out a survey on student perceptions of a 1:1 iPad implementation in a high school. Students reported positively on the programme but noted that the integration was inconsistent among teachers.

> Teachers at once realize the power and value of technology as a tool for learning, but it also requires that new methods be adopted in order to take advantage of it; otherwise, it has little to no impact on their students' achievement. (Frazier et al., 2019, p. 19)

There is also evidence that students have responded to the use of devices in classrooms very positively. For example, Howlett and Waemusa (2019) reported that "device use increased their learning potential and satisfaction" (p. 72). Dalby and Swan (2019) report that using iPads in formative assessments contributed to effective learning and, in another study (Retalis et al., 2018), mobile technologies were identified as motivating students and improving communication and engagement. The research results indicated that participating students are more positive about the iPad specifically being an excellent tool that helped them to organise and understand their courses. Students have also reported positively about their performance and the nature of the activities (Fabian et al., 2018). However, responses from students are not universally positive and their responses are mediated by their own experience of the devices outside school. For example, a study in Italian schools (Villaniet al., 2018) showed that students who have a higher level of acceptance of the device in school will use it more for learning and communication. Yet another study carried out on Grade 7 students in Canada found small effects on student achievement but large positive effects on "equity, inclusion and diagnostic, formative, and summative assessment" (Kirkpatrick et al., 2018). The importance of the student voice can vary depending on the methods used to collect the data. Hence, the current work contributes further to the literature that is based on the collection of primary data (Hartline et al., 2022) emanating from students' voices.

Methodology

In this work we followed the method of an online trend questionnaire (Stockemer, 2019); that is, a survey in which the same questions were asked of different individuals over a period of time. The trend survey allows us to detect broad changes in the opinions of the participants over a period of 3 years. It was created with an anonymous Google form (see Appendix A) to collect data on the perceived impact of the iPads on the learning and wellbeing of the students.

The questionnaire comprised a mixture of question types including Likert-scale and multiple-choice items for quantitative data, and open-ended paragraph items for qualitative data. (See

Appendix A). The number of survey responses was as follows: 140 in 2017, 150 in 2018, and 162 in 2019. The growth in the number of responses between 2017 and 2019 reflects the increasing number of students attending the school.

The use of online questionnaires is an effective means of collecting data from younger respondents, "due to the overwhelming positive attitude of students towards these tools" (Zou & Lambert, 2017). Zou and Lambert's paper also indicated that anonymous feedback was found to be more honest and reliable. Hence, in the research shared in this paper, student voice, through their perceptions of using iPads for learning both in and outside of school, was collected anonymously via the online Google form questionnaire. Students completed the questionnaire in school. They were instructed to complete the questionnaire in silence and to not collaborate during the activity (see instructions shared with the supervised teachers in Appendix B). It was stressed that their perceptions and attitudes to the device use were the key focus of the study. Thus, we could analyse the results of this study as part of the yearly evaluation of the use of devices as a tool to empower the learning via the students' school work.

The questionnaire collected data in two main categories: the learning taking place at school, and iPad use at home.

Description of the collection of data

The data presented in this paper are largely derived from a trend study (Stockemer, 2019). The questionnaires were sent to cohorts of first-year students in the Middle Year Program (MYP) over 3 years (2017–2019). The survey was implemented in June of each academic year so, by the time the students responded to the questionnaire, they had completed almost 10 months of an academic year using the devices. The surveys were completed by all Year 7 students (11–12 years old) during teacher-supervised lesson time.

Discussion

Using the iPad to support learning

One of the most important elements of the decision to implement a 1:1 iPad programme was the belief that ubiquitous student access to technology would support their learning. To obtain some feedback from the students about their perceptions of the value of the iPad to support their learning we included several items in the survey. The question was a general one (question 2, Appendix A) in which students used the 5-point Likert scale to indicate how strongly they agreed, or disagreed, with the statement: "The iPad helps to support school work". We used the percentages of the Likert scale 1 and 2 for a negative attitude and the scale of 3, 4, and 5 for a positive attitude. The results are presented in Fig. 1.
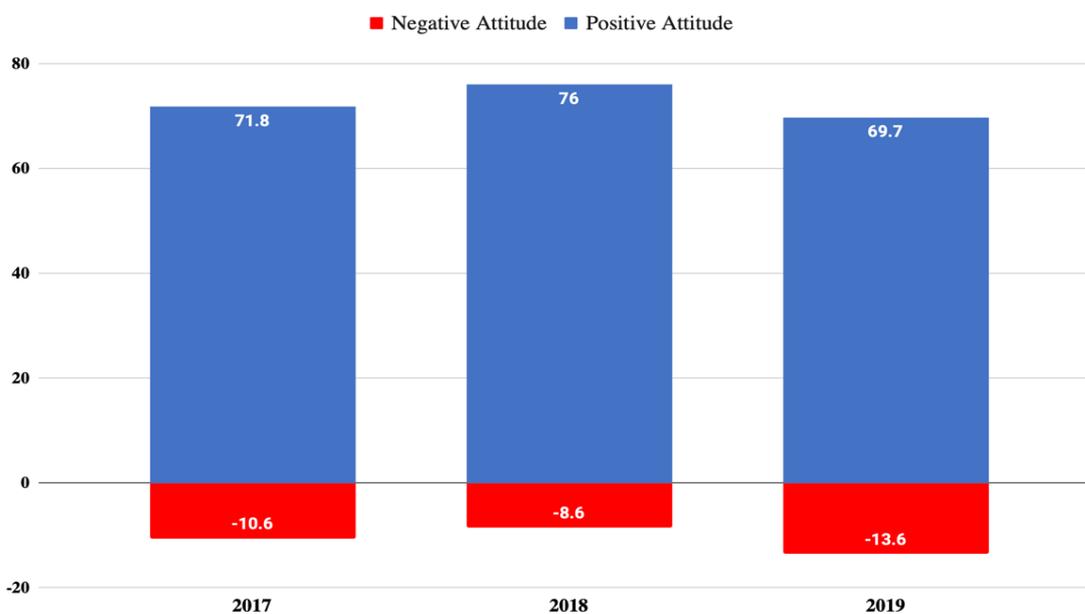
Figure 1 Student attitudes to the iPad to support learning (neutral responses not included)

The quantitative data was supported by an opportunity for students to comment on their reasons for their item selection. Most students commented on the iPad's positive contribution to school work, especially when the device could benefit specific learning challenges. They highlighted the benefits of centralising resources and not losing the material, and supporting research. Several indicated that using an iPad made a positive contribution to the environment.

> I think it is better for the environment and you won't ever lose something that's on your iPad because you care about your iPad.

> You can research what you don't understand and also you can learn your technology and apps better.

> It's a great new way of learning and you have the internet to work from. It's great for me because when I have a spelling mistake it helps me and that's great for my dyslexia.

> I think an iPad is really helpful for school work especially for EAL students like me so they can translate and search up things if they don't know something. I didn't give it a 5 because sometimes it is distracting.

A minority of student comments (8.6%) were negative about the iPad's contribution to learning in class. Most of these commented on the potential for distraction. Some students also expressed a preference for using a laptop.

> Because it is fun working with the iPad but it also distracts you from doing your work, since you will start playing games and you might get an email or a message and want to reply.

> I personally am not the biggest fan of it because a lot of people including me get distracted from their iPad and start doing different things than asked.

> Because I don't think it is that important to use an iPad during school hours and stare into it for hours because it could affect our eyes.

> Many kids use it to play games and it affects their academics and their learning because they don't focus on work nor on the tasks at hand.

The results reported in this study in terms of the impact of using the iPad on the learning digital efficacy of students further support the key finding in the literature (Howlett & Waemusa, 2019; Retalis et al., 2018; Dalby & Swan, 2019) that the iPad can support student learning.

Using the iPad to facilitate learning at school

In Fig. 2 we summarise students' perception of using iPads to facilitate communication with their teachers (question 5, Appendix A), to support their completion of homework (question 8, Appendix A), and to estimate their overall use in their lessons at school (question 10, Appendix A).
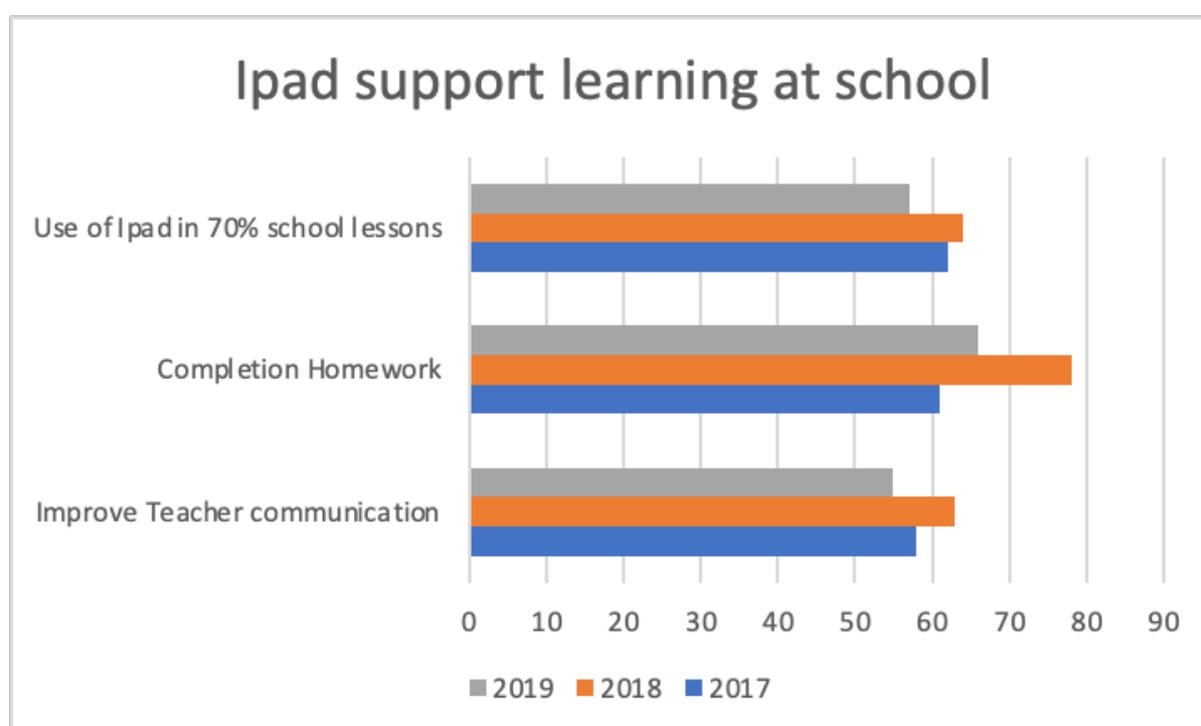

Figure 2 Use of the iPad at school and at home to support learning: Agree or Strongly agree

To evaluate how often the devices were used in lessons, the students were asked to indicate the extent to which iPads were required during a school day. They were asked to estimate their daily use by indicating the proportion of lessons that required them to use the iPad. For example, in a 10-lesson schedule, 7 lessons where a device is used would be considered to be 70% or more of their daily lessons. The table in Fig. 2 shows that most students selected the 70% option in each year of the survey. A small number (7.4%) used the iPad in less than 50% of their lessons. Classroom observations supported the finding that most lessons required using technology as part of the learning process, including (for example) accessing resources. There have been no significant differences between student responses each year.

Overall, the data indicated a positive view of the value the iPad brought to supporting homework activities, with positive perceptions consistently above 60%. Students were also invited to add a written comment if they found that the iPad did not support their homework. Their negative responses could be characterised in four types: procedural, technical, behavioural, and

pedagogical. Procedural problems included issues such as teachers insisting that students complete homework on paper, as indicated in the answer of one student below.

Because most teachers want it on paper anyway

But procedural issues also included issues relating to teachers' lack of confidence in the devices.

Technical problems reported by students related to apps not saving properly, accidental deletion of work, lack of familiarity with an application, and problems uploading work.

Well, sometimes the iPad can randomly [delete] things meaning you have to do it again, and it can also run out of battery.

Thus, the results presented in this study further support those obtained by Fabian et al. (2018), where students responded positively to the statement that using iPads for school work supports their school work.

Use of the iPad for non-school-related activities at home

In this section we explore some of the unforeseen issues that have emerged from the BYOD programme; for example, overuse of devices for non-school-related activities. In Fig. 3 (a 3-D stacked bar chart), respondents reported their perceived average non-school-related use of the devices each day. This question was included in the survey to ascertain the degree to which students could manage their non-educational use of the device. The results showed that around 50% used their device for 2 hours or less at home per day. They are also consistent across consecutive years of the study. Figure 3 also shows that over the 3 years, around 25% of students self-reported that they sometimes struggle with too much screen time. Almost half of the students also reported that their device use resulted in anger from their parents.
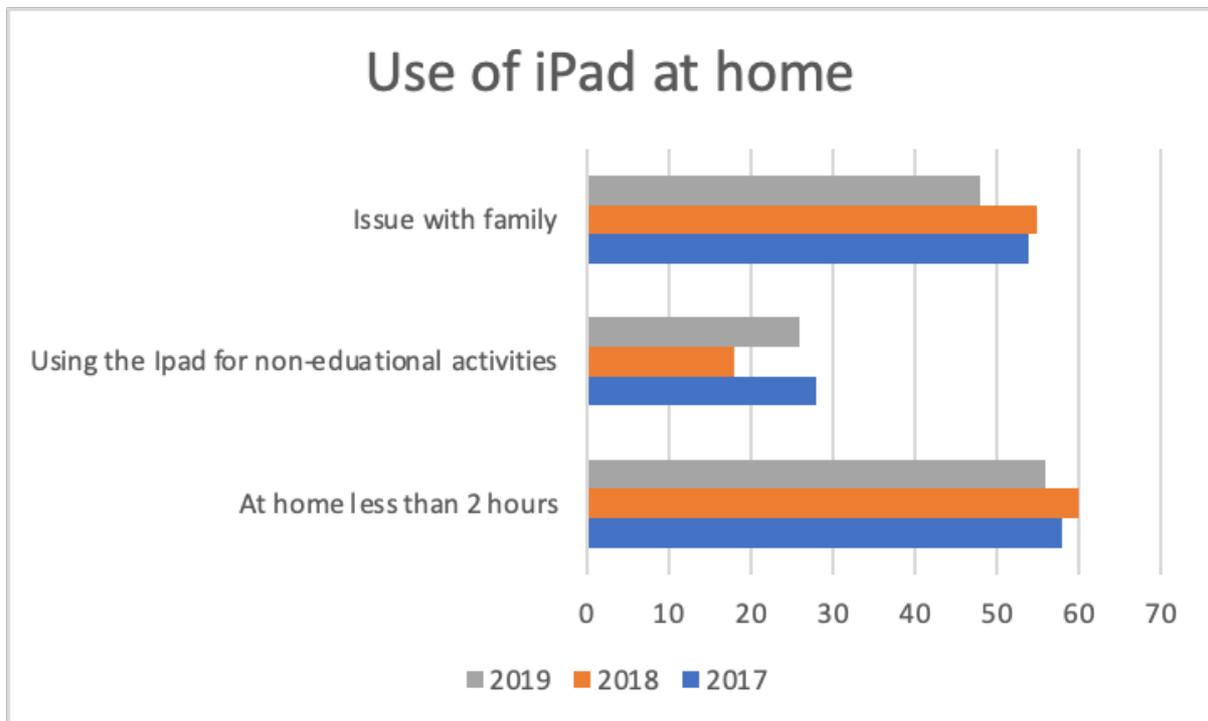

Figure 3 Use of the iPad at home

98

Unanticipated outcomes of using the iPad inside and outside of school

Non-educational use of student devices is explored further in Fig. 4, where students were asked to rate the occurrence of activities supported by the devices that distract students from school work. In the school in this study, the students own their devices, so the school did not restrict personal applications loaded onto the device. The following uses of the iPad were considered to be the main non-educational uses of the devices by students in all years of the study. Social networking was identified by approximately 30%, watching videos by around 10%, and playing games by around 40% of students.
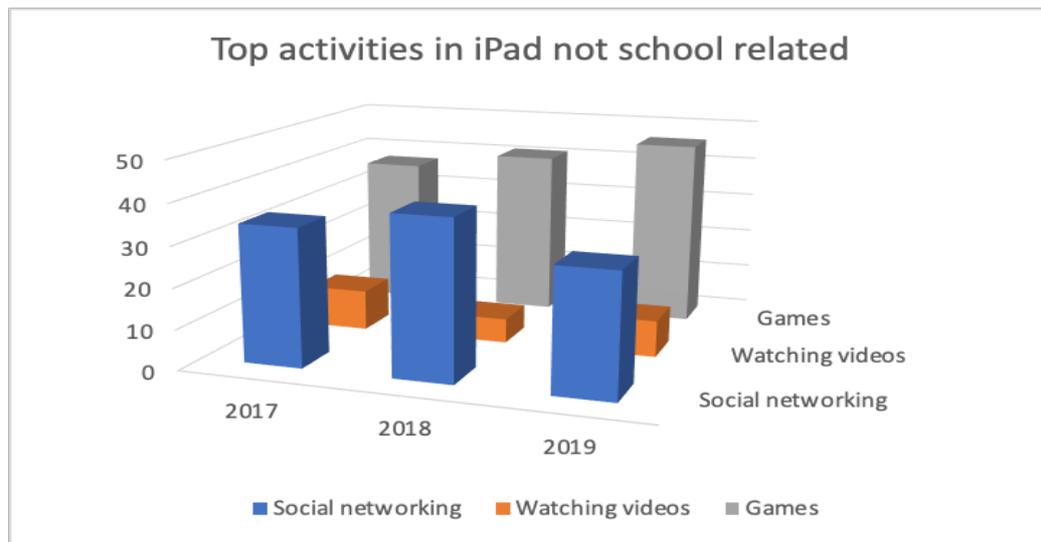

Figure 4 Top activities that distract from school work

As reported in other research into the use of iPads in schools (McCoy 2013; 2016), using the device for gaming, social networking, and watching videos for recreation were identified by the students as actual or potential distractions.

The impact of the iPad on academic results

We were interested to consider whether students' positive learning perceptions were consistent with their actual learning outcomes as measured by their yearly average grade performance, and also in Mathematics, English, Humanities, and Digital Design. The Middle Year Program uses a grade scale from 1 to 7, with 7 being the highest grade. To provide a benchmark, we also included the yearly performance from the 2 years before the full implementation of the BYOD, from the school years 2014/15 to 2018/19. The results are presented in Fig. 5.
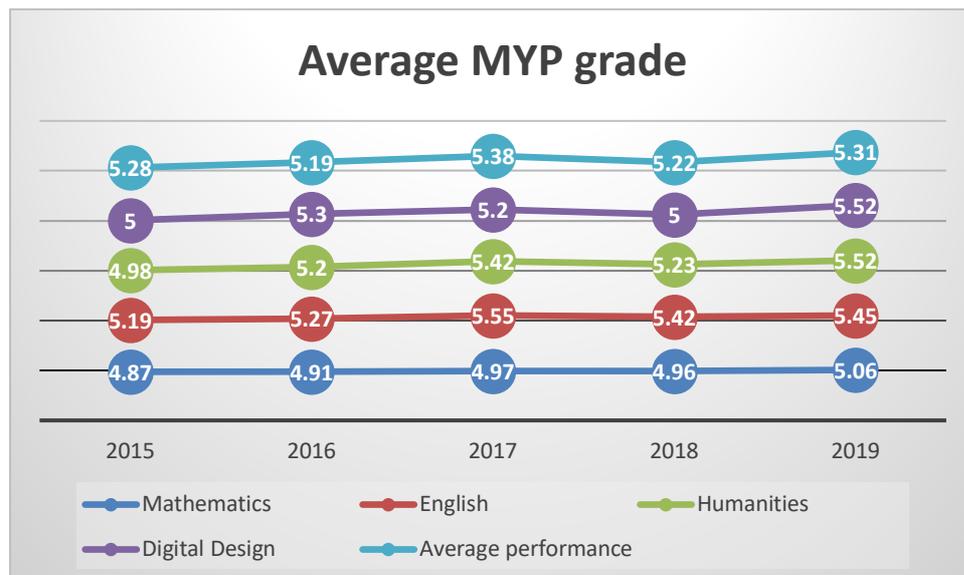
Figure 5 Average MYP grade (scale 1 to 7) from 2015 to 2019

There was no specific anticipation that academic outcomes, as measured by grades, would be significantly improved. The vision for introducing the devices focused mainly on the qualitative benefits that the devices might bring to support learning and communication, and to prepare students for a technology-rich future. However, any large-scale, planned change in a school should not negatively affect outcomes. Figure 5 shows a summary of MYP grades over the study period. The data indicate no significant changes to academic outcomes.

Student perceptions across three cohorts of first-year students indicate that learning inside and outside of school is indeed positively affected by the devices, as was communication between students and teachers. Students estimated that approximately 70% of in-school lessons involved iPads. Data from the period of the study showed no negative impact on student grades since the introduction of the BYOD scheme.

Conclusions

Even at this initial stage of exploring the pedagogy associated with iPad technology, our findings suggest that a structured professional learning programme could help teachers to move from enhancement to transformation. Although best practice is not yet ubiquitously evident, and further research is needed in this emerging field, there are promising signs that iPad use will bring about a pedagogical shift that will further support enhanced student learning.

The feedback from students also revealed that they were generally positive about the effect of an iPad on their learning. Students reported that they used the devices in approximately 70% of their lessons each week and that the iPad helped them to communicate with their teachers and to complete homework. Most students self-reported up to 2 hours per day of non-school-related use. About half of the respondents admitted that overuse of the device for non-school-related activity led to tensions at home. Students did express a degree of concern about distraction. They identified social networking, games, and watching video content on the devices as the main causes of distraction from their school work.

This study also considers the impact of the iPad on the academic results of students during the period covered before the implementation and during this study. Overall, the implementation of the BYOD iPad programme had no negative effect on academic results.

Acknowledgements

References

Andreadis, I., & Watts, M. (2022). A device free lunch break program: An experiment to promote a balanced use of electronic devices in middle secondary international schools. *European Journal of Open, Distance and E-Learning, 24*(1), 1–10. https://doi.org/10.2478/eurodl-2022-0001

Burnett, C., & Merchant, G. (2017). Opening the case of the iPad: What matters, and where next? *The Reading Teacher, 71*(2), 239–242. https://doi.org/10.1002/trtr.1606

Curry, J., Jackson, S., & Benchic, M. (2019). Four more years? A longitudinal study of one high school's 1:1 iPad implementation. *TechTrends, 63*(1), 53–61. https://doi.org/10.1007/s11528-018-0351-0

Dalby, D., & Swan, M. (2019). Using digital technology to enhance formative assessment in mathematics classrooms. *British Journal of Educational Technology, 50*(2), 832–845. https://doi.org/10.1111/bjet.12606

Erbes, S., Lesky, S., & Myers, J. (2016). Teachers exploring mobile device integration: A case study of secondary teachers' responses to iPads in the classroom. *Journal of Information Technology Education: Research, 15*, 19–27. https://doi.org/10.28945/3574

Fabian, K., Topping, K., & Barron, I. (2018). Using mobile technologies for mathematics: Effects on student attitudes and achievement. *Educational Technology Research and Development, 66*(5), 1119–1139. https://doi.org/10.1007/s11423-018-9580-3

Feldman, A., & Minstrell, J. (2000). *Action research as a research methodology for the study of the teaching and learning of science.* http://people.umass.edu/afeldman/ActionResearchPapers/FeldmanMinstrell2000.PDF

Fenton, D. (2017). Recommendations for professional development necessary for iPad integration. *Educational Media International, 54*(3), 165–184. https://doi.org/10.1080/09523987.2017.1384150

Frazier, D., Trekles, A., & Spores, J. (2019). The second year with iPads. What have we learned? *Computers in the Schools, 36*(1), 19–37. https://doi.org/10.1080/07380569.2019.1565042

Hartline, A., Conklin, S., & Garret Dikkers, A. (2022). Through their eyes: Student perspectives. *Journal of Open, Flexible and Distance Learning, 26*(1), 5–19. https://www.jofdl.nz/index.php/JOFDL/article/view/495/335

Howlett, G., & Waemusa, Z. (2019). 21st century learning skills and autonomy: Students' perceptions of mobile devices in the Thai EFL context. *Teaching English with Technology, 19*(1), 72–85. https://files.eric.ed.gov/fulltext/EJ1204626.pdf

Kirkpatrick, L., Brown, M. H., Searle, M., Smyth, E. R., Ready, A. E., & Kennedy, K. (2018). Impact of a one-to-one iPad initiative on Grade 7 students' achievement in language arts, mathematics, and learning skills. *Computers in the Schools, 35*(3), 171–185. https://doi.org/10.1080/07380569.2018.1491771

Kontkanen, S., Dillon, P., Valtonen, T., Eronen, L., Koskela, H., & Väisänen P. (2017). Students' experiences of learning with iPads in upper secondary school: A base for Proto-TPACK. *Education and Information Technologies, 22,* 1299–1326. https://doi.org/10.1007/s10639-016-9496-7

Kolb, L. (2019). Smart classroom-tech integration. *Educational Leadership, 76*(5), 20–26. https://www.ascd.org/el/articles/smart-classroom-tech-integration

Langford, S., Narayan, A., & Von Glahn, N. (2016). Revisiting the technology and student learning debates: Critical issues and multiple perspectives. *Transformative Dialogues: Teaching and Learning Journal, 9,* 1–15. https://td.journals.psu.edu/td/article/view/1051

Mishra, P., & Koehler, J. M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054.

McCoy, B. R. (2013). Digital distractions in the classroom: Student classroom use of digital devices for non-class related purposes. *Journal of Media Education, 4(*4), 5–14. https://en.calameo.com/journal-of-media-education/read/000091789af53ca4e647f

McCoy, B. R. (2016). Digital distractions in the classroom phase II: Student classroom use of digital devices for non-class related purposes. *Journal of Media Education, 7*(1), 5–32.

Puentedura, R. (2014). *Building transformation: An introduction to the SAMR model.* http://www.hippasus.com/rrpweblog/archives/2014/08/22/BuildingTransformation_AnIntroductionToSAMR.pdf

Retalis, S., Paraskeva, F., Alexiou, A., Litou, Z., Sbrini, T., & Limperaki, Y. (2018). Leveraging the 1:1 iPad approach for enhanced learning in the classroom. *Educational Media International, 55,* 213–230. https://doi.org/10.1080/09523987.2018.1512463

Smith, C. A., & Santori, D. (2015). An exploration of iPad-based teaching and learning: How middle-grades teachers and students are realizing the potential. *Journal of Research on Technology in Education, 47*(3), 173–185. https://doi.org/10.1080/15391523.2015.1047700

Stockemer D. (2019). *Quantitative methods for the social sciences. A practical introduction with examples in SPSS and Stata.* Springer International. https://doi.org/10.1007/978-3-319-99118-4

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effect of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers and Education, 94,* 252–275. https://doi.org/10.1016/j.compedu.2015.11.008

The Economist. (2018). *Fostering exploration and excellence in 21st century schools.* The Economist Intelligence Unit. https://services.google.com/fh/files/misc/eiu_briefingpaper_jan2018.pdf

Tilton, J., & Hartnett, M. (2016). What are the influences on teacher mobile technology self-efficacy within secondary school classrooms? *Journal of Open, Flexible and Distance Learning, 20*(2), 79–93.

Varier, D., Dumke, E. K., Abrams, L. M., Conklin, S. B., Barnes, J. S., & Hoover, N. R. (2017). Potential of one-to-one technologies in the classroom: Teachers and students weigh in. *Education Technology Research and Development, 65,* 967–992. http://dx.doi.org/10.1007/s11423-017-9509-2

Villani, D., Morganti, L., Carissoli, C., Gatti, E., Bonanomi, A., Cacciamani, S., Confalonieri, E., & Riva, G. (2018). Students' acceptance of tablet PCs in Italian high schools: Profiles and differences. *British Journal of Educational Technology, 49*(3) 533–544.

Young, K. (2016). Teacher's attitudes to using iPads or tablet computers: Implications for developing new skills, pedagogies and school-provided support. *Tech Trends*, 60, 183–189. https://doi.org/10.1007/s11528-016-0024-9

Zou, D., & Lambert J. (2017). Feedback methods for student voice in the digital age. *British Journal of Educational Technology, 48*(5) 1081–1091. https://doi.org/10.1111/bjet.12522

Biographical notes

Dr Martin Watts
m.watts@ishthehague.nl

Dr. Martin Watts currently coordinates EdTech at the International School in The Netherlands. He has 30 years' experience as an educator, teaching mostly about, and with, technology in secondary schools or higher education. His doctoral focus was educational management, but as a teacher educator, he has published research in online mediation of reflective practice among beginning teachers.

Dr Ioannis Andreadis
i.andreadis@ishthehague.nl

Dr. Ioannis Andreadis is a mathematics teacher at the International School of the Hague in The Netherlands. He completed a doctorate in infinite dimensional symplectic geometry and published papers in the areas of noisy dynamical systems, Mandelbrot set, and geometry. While working as a secondary teacher, he has expanded his research activities in the recurrence plots analysis and of the educational impact of electronic devices in secondary schools.

Appendix A: The questionnaire used to collect the data (anonymised by the authors)

ISH iPad use survey: Students
To help the school provide the best lessons for you, please answer the following questions about how you are using your iPad. Your responses are anonymous.

The survey will take 5–10 minutes. Think carefully about each of your responses. Be as accurate and truthful as you can. Do not discuss your responses with other students.

Q1. Please indicate your gender.

> a) Male
> b) Female
> c) Other

Q2. How do you feel about having an iPad to use for your school work?

> Likert scale: from 1 (unhappy) to 5 (happy)

Q3. If you wish, explain your answer.

Q4. Please indicate your preference below.

> a) I learn best without technology
> b) I learn best with an iPad
> c) I learn best with a laptop
> d) Other

Q5. How much does your iPad help you to communicate with your teachers?

> Likert scale from 1 (does not help) to 5 (helps a lot)

Q6. How much do you agree with this statement?
Having the iPad means that I carry fewer items in my school bag.

> Likert scale from 1 (disagree) to 5 (agree)

Q7. Which app helps you learn best?

> a) Socrative
> b) Kahoot
> c) Padlet
> d) Other

Q8. To what extent does the iPad make completing your homework easier or more difficult?

> Likert scale from 1 (makes it difficult) to 5 (makes it easier))

Q9. If it is not easy please write why.

Q10. On average, in how many of your lessons do you use your iPad on a school day?

> Likert scale from 1 (0%) to 10 (100%)

Q11. On an average school day, how many hours do you spend on your iPad NOT doing school work?

104

Likert scale from 1 (less than 1 hour) to 6 (6 hours or more)

Q12. On average, how many hours do you spend on your iPad at home each day?

Likert scale from 1 (less than 1 hour) to 6 (6 hours or more)

Q13. Do you sometimes feel you spend too much time on non-educational activities on the iPad?

a) I find it difficult to manage my non-educational iPad time
b) I feel I can manage my non-educational iPad time well

Q14. Have your parents ever got angry with you for using the iPad too much?

a) Yes
b) No

Q15. What sort of online activities distract you most from school work?

a) None, I only use my iPad for school work
b) Online social networking
c) Playing games
d) Other

Q16. Do you have any concerns or suggestions regarding the use of technology here at school? We value your feedback.

Appendix B: Instructions shared via email with the supervisors during the completion of the online questionnaire

Dearest Colleagues,

Please forward this link to your Year 7 DDes students. The link allows them to access the iPad Survey for [year].

Please complete the [year] <u>iPad survey questionnaire</u> [link to the Google form]

- The survey should take 7–8 minutes to complete, depending on how the students choose to respond (there are some questions that provide the option to explain their ideas and thoughts on the use of technology in the classroom).
- Students should not discuss their responses with other students.
- The success of the survey relies upon the views and feedback of each student.

Thanks very much for supporting this Y7 iPad survey.