ONE-TO-ONE LAPTOP USE AMONG STUDENTS and TEACHERS In a SELECTED SECONDARY SCHOOL IN TRINIDAD AND TOBAGO

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Abstract

This study examines the extent to which one-to-one laptops are being used by both teachers and students and the perceived barriers that may hinder laptop integration at the fourth form level. In 2010, the government of Trinidad and Tobago launched a massive laptop initiative to deliver over 100,000 laptops to students in all secondary schools. While much is touted about the transformative power of one-to-one laptops on student learning, it has been observed that laptop use in minimal in the nation's schools. A case study approach is used to investigate student and teacher use in a selected government secondary school in order to provide a better understanding of how teachers and students are using these laptops. A mixed sequential data collection approach was employed with student questionnaires to fourth form students followed by (3) teacher interviews of those students. Data analysis of instruments includes thematic analysis and coding to reveal patterns of use and issues. Findings at the school indicate fourth form students use laptops for preparing PowerPoint presentations, playing games and doing research but this is at home not at school. Teachers appear to discourage students from bringing laptops to school and several barriers to laptop integration are revealed including maintenance issues, pedagogical challenges and lack of administrative and technical support. Further research across school levels, schools and districts can give a clearer picture of widespread usage and the development of more robust structures and policies to ensure effective use in schools.

Keywords: one-to-one laptops, technology barriers, digital divide

Background to this study

In our increasingly technology-rich world, stakeholders, including policy makers and educators, recognise that focus on skill development of its young people is necessary to advance society. The World Bank (2013) points out that with globalization, nations must correspond with high urgency to building the capacity of efficiently employing ICT

in education in response to the information revolution, and increasing demands for highly skilled labour. According to UNESCO (2002), Information and Communication Technology is defined as the combination of informatics technology (technological applications of informatics in society) with other related technologies, specifically communication technology. Therefore, the use of computer, laptops, Internet, emailing, chatting, websites online programmes and educational software falls under ICT. Hence, countries, including developing nations, have made ubiquitous technology a national priority and embarked on small and large scale initiatives such as provision of wireless networks and laptop initiatives as instructional tools. Laptop integration in basic day to day activities includes banking, social networking, entertainment, communication and increasingly, in education.

One-to-one laptop initiatives are rapidly increasing globally with large-scale programmes such as Microsoft's Anytime Anywhere learning and the now famous One Laptop Per Child (OLPC) program. In 2013, Government of Ontario launched its first National OLPC program by providing 3600 laptops to Aboriginal youth, ages 6-12 years through supportive learning environments. In Australia, the Digital Education Revolution (DER) policy launched in 2007 focussed on the provision of laptops for secondary students in Years 9 – 12 with high speed broadband connections to Australian schools. In the USA, Maine launched the Maine Learning Technology Initiative (MLTI) in 2001 to equip each student with a laptop and expanded in 2006 where Apple provided 360,000 laptops.

Access to laptops, the Internet, and the capacity to make use of ICT are related to factors such as socioeconomic status, ethnic background, gender, age, educational background and geographical location. It is important that education policies acknowledge the gap and promote ICT in ways that will not widen the gap further. Globally, there are many challenges in the service output, placement of laptops and Internet access of ICT for governments and education administrators. One, is a high cost associated with laptop initiatives which may lead to a momentous obstacle to the effectiveness of these programmes. In education, Australia for example, spent approximately $AU800M in 1:1 laptop initiative by 2007 (Hayes, 2007), Barbados spent $US213M for EduTech (Gaible, 2009), whereas the provision and management of 20,300 laptops for Trinidad's programme in 2010 cost TT83M according to Minister Gopeesingh (Express, 2010). This was part of a very large education budget by the government which has a focus on ICT by students and communities.

Advocates for increased access to technology can bring about changes to teachers' instructional roles in the classroom lecturer (Gahala, 2001) plus increased student motivation and independece in learning (Inan and Lowther, 2010; Penuel, 2006). The equal distribution of laptops across schools, provides equal access to digital literacy and mastery of skills closing reducing the disparities between affluent and disadvantaged schools. There is a need to transform education in a way that will advance the social and economic development goals of a country, thus, prevent digital divide (Tsikalas & Huerta, 2006) if students lack technology-related competencies.

Problem statement

        Laptops were introduced into secondary schools to first form students by the Government of Trinidad and Tobago in 2010 and every year thereafter to present. To date, all secondary students from first to fifth form have received a personal laptop which they take home. Schools were supplied with an ICT technician to support technological devices and schools are expected to facilitate the implementation of this national initiative. It has been observed, in secondary schools, that students rarely bring these laptops to school and if they do, use it to engage in non-academic activities mostly. Further, in the researcher's secondary school, it has been perceived that teachers themselves discourage students from bringing their laptops to school.

        At fourth form level, students prepare for the Caribbean Examinations Council (CXC), the results of which generally determines mobility and future success of graduates at sixteen plus. Students are expected to have developed technological competence sufficiently to function effectively at jobs thereafter or in higher education. Teachers are expected to increase the use of technology in the classroom to transform the teaching and learning experience in schools. Fourth form teachers have all been exposed to varying levels of training in computer literacy over time but it has been observed that most of them at my school still opt to using traditional pedagogies such as lecture-style, which do not involve the use of laptops.

        There is a need to investigate laptop use at this school and to seek information from both students and teachers. It is important to examine investments into technology for data-driven decision-making and to determine what barriers exist that can impact success.

Purpose of the study

        This study examines the extent to which the 1: 1 laptop initiative is being used by both teachers and students and to investigate the perceived barriers that may hinder the effective adoption of laptops in curriculum delivery at the Form Four level.

Research Objectives:

Overarching research question: To investigate the extent to which Government funded one-to-one laptops are being integrated in the classroom?

1. What is the extent to which the 1:1 laptop initiative is being used by both teachers and students at the fourth form level?

2. What are the perceived barriers of teachers and students of the use of 1:1laptops at the fourth form level?

Review of Related Literature

Role of laptops in education

        There is a strong movement by various stakeholders in education that purport that laptops are essential for advancing education. Research on laptops in schools point to

gains in student learning due to its ability to facilitate multiple uses such as a tool for management, classroom preparation and delivery. As laptops offer students frequent access to the Internet and educational software, there is extensive access to resources to support student learning, thus students can communicate with their peers, teachers and the wider community. Penuel (2006) says that this increased availability results in increased computer skills, which potentially can transform the learning environment and improve student-learning outcomes. In addition, Fitzpatrick (2007) illustrates that technology provides flexibility in learning through an interactive and continuous learning culture. The process of using e-learning enables the opportunity for increased learning and growth by students.

According to Swan, Kratcoski, Mazzerand and Schenker (2005), teachers believe that laptops enable greater students' motivation and engagement leading to better quality of work. It also facilitates a project-based, collaborative and authentic learning environment. Further, Inan and Lowther (2010) state that laptop initiatives when incorporated into teachers' current teaching practices, can impact positively on student achievement and learning.

Furthermore, student- centred classrooms foster personalized learning whereby students learn at their own pace. When students have 24/7 access to laptops and choice in how they demonstrate their understanding, learning becomes personalized for all learners. Demski (2012) advocates that personalization allows for students' learning experience to be self-paced where learning can adapt to a student's characteristics such as background and learning style.

Mouza, Cavalier and Nadolny (2008) highlight that using laptops can cater to the needs of students with learning disabilities to express themselves in multiple formats, showcasing unique abilities that generally are not revealed in traditional school assignments. "Access to laptop computers can change the general culture of the classroom, providing students with more autonomy and ownership in relationship to technology and learning, which can facilitate the development of academic motivation" (p. 414).

Findings from Youssef and Mounir (2008) suggest that laptop use for educational purposes in the homes by students have enhanced exam scores. When students actively and frequently use their laptops and internet at home for learning, their achievement at school likewise increase (Tsikalas & Lee, 2007). The power of the 1:1 laptop initiative is in the convenience of this learning tool for students both at school and at home (Cisco, 2006). Furthermore, students' grasp of concepts and their capacity to integrate information across subject areas can be heightened using laptops as a result of project work which fosters higher order skills such as critical thinking and problem solving (Warschauer, 2005).

However, some studies suggest negative effects of laptops on student learning (Awan, 2012) primarily because it acts as a distracter (Young, 2006). Weston and Bain (2010) argue that several large-scale laptop initiatives have not yielded results to match

political expectations of the program. Cuban (2001, 2006) a well-respected voice on technology integration and one-to-one computing, admonishes about unsubstantiated claims of the impact of technology and advocates for changes in teacher pedagogical practices using technology for successful laptop integration.

Student laptop use

Access to laptops provides students with multiple sources for the same topic, thus resulting in project-based work that enables them to search for deeper understanding (Warschauer, 2005). There are opportunities for differentiated instruction and engaging learning but according to Owen, Farsail, Knezek and Christensen (2005), only if we think differently about our learning environments. Further, Fullan (2011) states that without change in pedagogy with use of laptops for every student, technology is the driving force towards increased distraction in the classroom.

Research shows that students use laptops for research (Grimes & Warschuer, 2008), which can enhance their information literacy skills by discovering, selecting, evaluating and synthesising information. Laptops can facilitate students' interest by exploring topics of interest to them through projects. Clark (2002) points out that the effectiveness of online learning has to do with the interactive activity. It provides students with opportunities to increase cooperative and collaborative skills through the use of interactive discussion threads, wikis, Google Docs, and multimedia. The use of laptops and online learning removes students from the confinement of walls and introduces the new idea of shared knowledge on the web. The doors of communication are opened, and students' education goes beyond the classroom (O'Hanlon, 2007). Penuel (2006) adds that journaling and the use of long-term projects increase with the use of laptop programs. These activities, such as blogs, allow for reflection and hands on learning that causes students to increase the possibility of understanding and retention.

Teacher Laptop Use

Providing laptop computers as a resource for teachers is a huge step in bridging the digital divide. However, according to Mouza (2008), the biggest challenge is in teachers' competence in using technology in the classroom. Brown (2009) suggests that teachers and students can both benefit from having laptops in the classroom because it gives flexibility and opportunities to improve their technical skills. Laptops can allow a range of software to be easily accessible by students during and after class.

Simulations can permit teachers to show students experiments impractical to conduct in the school environment at that particular time. Thus, this allows students to concentrate on interpretation and analysis of data as the psychomotor aspects of practical work are reduced (McFarlane and Sakellariou, 2002). They further suggested aspect that using ICT either as a tool or as a substitute for the laboratory-based elements of an investigation can aid theoretical conceptual understanding in some topics in the science curriculum (McFarlane & Sakellariou, 2002). Thus, teachers have the opportunity to act as facilitators, in the process of guiding inquiries, promoting discussion, despite the major

barrier to laptop use whereby the science curriculum being demanding, especially of teacher (Osborne and Hennessy, 2003).

Teachers are most important and actively influence student learning as they determine to a large extent what happens in the classroom, therefore, their cooperation and willingness to employ use of laptops in the classroom plays a critical role in the success of 1:1 initiative (Fuller, 2000). Success of a laptop initiative comes down to the quality of professional and curriculum development (Wambach, 2006).

Factors affecting laptop Integration
Laptop integration, sometimes cited as technology integration, is considered to be of any type of laptop use that supports classroom instruction (Inan & Lowther, 2010). These authors suggest the significance of factors affecting their integration into classroom use as availability of resources and technical support, teacher professional development, teacher readiness to integrate technology, and/or teacher beliefs and attitudes (Murphy, King & Brown, 2007; Penuel, 2006). These seem to align to the extrinsic (school and climatic factors) and intrinsic (teacher beliefs and attitudes) factors affecting technology integration established by Ertmer (2005).

Overall support for school technology coming from key stakeholders, including teachers, staff, administrators, students, parents, and the community, has often been considered to be a critical component of a successful laptop integration effort. O'Dwyer, Russell, and Bebel (2004) indicated that administrative encouragement to use technology was one of the strongest predictors of teachers' computer use. Another study revealed that the principal's role was particularly important (Dawson & Rakes, 2003) while Cooley (2001) identified peer support as critical to success.

Dexter, Anderson, and Ronnkvist (2002) found that the availability and quality of technical support significantly predicted the frequency of teacher laptop use in classroom activities. Inadequate computer maintenance can result in low reliability in laptops. Also, aging equipment and limited resources contribute to the costliness of technology initiatives, a significant deterrent to its effectiveness. Gaible (2009), in a World bank report on ICT in developing countries, reports that even if when initial costs are covered, the operating expenses, including the costs associated with maintenance and additional materials, are not well anticipated and may have been excluded from the budgeting (Gaible, 2009). Technical capacity in the MOEs in the Caribbean is low as there are not enough IT resource personnel to be allocated (Gaible, 2009). Furthermore, the tendency for laptop computers to be unreliable and prone to technical problems often causes teachers to resist using them unless on-site support is available (Sandholtz & Reilly, 2004; Zucker & Hug, 2008).

On the contrary, the inaccessibility of ICT resources may not be due to the limited ICT resources within the school but may be due to poor organisation of resources, poor quality hardware, inappropriate software, or lack of personal access for teachers (Becta, 2004). A European study by Empirica (2006) found lack of access to computers and software among various barriers to laptop use conveyed by teachers.

Becta (2003) states that lack of on-going workshops and lack of time to prepare ICT infused lessons plans can hinder pedagogical change. This is supported by Cuban (2001), as evidenced from interviews with staff and students suggest limited is also a factor. Insufficient professional development of teachers has been an escalating concern for all technology integration initiatives and projects (Lawless & Pellegrino, 2007). Presently, K-12 schools have invested heavily to acquire computer-based technologies. However, potential educational benefits of these investments cannot take place unless teachers are prepared to use these laptop computers effectively in their instruction (Dawson & Rakes, 2008; Rutledge et al., 2007). For example, Sivin-Kachala and Bialo (2000) examined over 300 studies of computer use and found that teacher training was the most significant factor influencing the effective use of classroom computers.

Teacher concerns about laptop initiatives are well-documented and Donovan, Hartley and Strudler (2007) reported teachers' concerns about not having a voice in large scle laptop initiatives. They cited teachers' personal and management concerns as pointed to tecahers' lack of comfort with laptops. Teacher readiness to integrate laptops into instruction is one of the key components of successful laptop initiatives (Inan & Lowther, 2010; Kanaya, Light, & Culp, 2005; Penuel, 2006). In order to achieve effective use of laptops, teachers should be prepared to have knowledge, skill, and confidence to effectively design and implement lessons that support student learning and achievement of standards-based objectives (Dawson & Rakes, 2008; Donovan, et al., 2007). Teachers who reported feeling well prepared to use technology were more likely to use laptop computers in their teaching practices as compared to teachers who felt unprepared (Inan & Lowther, 2010; Murphy et al., 2007).

Research commonly suggests teacher beliefs to be one of the critical factors of successful laptop integration (Lei & Zhao, 2008; Penuel, 2006; Wozney, Venkatesh, & Abrami, 2006). Negative teachers' attitudes towards change may act as a barrier (Gaible, 2009b) and several researchers indicated that teacher beliefs appeared to influence the amount of computer use in the classroom (Ertmer, 2005; Sclater et al., 2006; Windschitl & Sahl, 2002). For example, Wozney et al. (2006) found that the perceived value of technology use was the most important factor in understanding computer use among teachers. Similarly, Inan and Lowther (2010) found that teachers' perception of technology's influence on student learning and classroom activities was a critical factor impacting technology integration. Teachers need to feel confident in their ability to facilitate student-learning with technology and integrate technology in their classrooms (Ward & Parr, 2010).

Research Design

To carry out this investigation a case study approach was selected. Case studies are investigative methodologies described as ethnographic, naturalistic, anthropological, field or participant observer research. The study is bounded in place (school) and time (Christmas term) and case study is justified as it can facilitate the discovery of new meaning and even confirm what is already known (Yin, 2014). It is hoped therefore that this case study would provide a better understanding of how the teachers and students use

one-to-one laptops.

Area of study and sampling

Trinidad and Tobago is a twin-island republic in the southern Caribbean. The education system follows that of the traditional British after colonialism. There are schools at the pre-primary, primary and secondary level across seven educational districts. Students write the Caribbean Examinations Council examination at sixteen plus for access to post-secondary education and jobs. Government secondary schools account for the majority of public education and the secondary school selected consists of approximately 620 students and forty-five teachers. The school is located in the St. Patrick district, which is a mix of agricultural and oil-based economies. The researcher worked with a teacher at the school with her fourth form students. A sample of twenty-four students was taken from the fourth form in the initial stage of this investigation.

Instrumentation and Data Collection

A Sequential data collection approach allowed student questionnaires to fourth form students (sample approximately 10% of school population) followed by teacher interviews of those students. This mixed approach allowed the researcher to explore more deeply issues raised by students in laptop use (Creswell & Plano-Clark, 2011). A 17-item semi-structured questionnaire was administered with 7 open-ended items, which can provide greater depth in responses. The teacher interview questions were developed after analyzing the students' questionnaire responses and conducted with 3 purposively selected teachers of these students.

Data analysis of instruments included descriptive statistics, thematic analysis and coding to reveal patterns of use and barriers.

Limitations

The results of this study are limited to this particular school and are not intended for generalizability of laptop use. Student and teacher consent was obtained prior to the study and transcripts of interviews were verified. This enables trustworthiness and credibility of the data.

Findings

Findings are presented which look at the extent to which one-to-one laptops are being used by students and teachers at the school. Barriers to laptop use by teachers are briefly explained.

Results show that fourth form students at the school used laptops for preparing PowerPoint presentations (64%), playing games (50%) and doing research (48%) but this is at home not at school. Over the Christmas term, 76% of did not bring their laptops to school at all. When they did bring laptops to school, 44% of students reported that they never use laptops in class while 33% indicate that they did use laptops in one period (out of 8) per day. At home, students generally spend around 4 hours on their laptops with 24% of them reporting parental supervision of their use. Students reported using their

laptops for completing school assignments such as School Based-Assignments (SBA's) and for watching videos of laboratory experiments. 76% of students felt that they could benefit from using laptops in their classrooms for enhancing practical work, share resources with peers and bring extra information about a topic that is not in the textbook or notes. They cite improve motivation and confidence to do work and improved time management of assignments.

Incidences of knowledgeable misuse of laptops have emerged with incidences of hacking, cyber-bullying and posting of inappropriate pictures. Laptops were also reported being damaged deliberately. Students spend much time gaming or on Facebook.

Students suggest the following reasons for not using laptops in schools
1. teachers do not use them in class
2. teachers ask them to leave them at home
3. poorly working or not working
4. too heavy for backpacks especially for those who walk to school or use public transport
5. no Internet access at school

Teachers' remarks corroborate the low levels of use in the classroom citing the following reasons.
1. lack of Internet access in school
2. lack of software
3. did not have laptops to use themselves
4. lack of administrative support
5. poorly functioning laptops.

Discussion

There is evidence that one-to-one laptops can enhance the student learning experience. Students largest use of their laptops in making PowerPoint presentations is supported in the literature and allows students to share their work with their peers and receive feedback which reinforces learning and can build self-confidence (Murphy, King & Brown, 2007). Completing assignments are doing research are also substantiated in the literature (Muir, Manchester & Moulton, 2005; Mistler-Jackson & Songer, 2000). Students' use of laptops to improve work in laboratory experiments is noteworthy and indicates application in Science-based subjects and in visualization and in simulations (McFarlane and Sakellariou, 2002), even though students did not express the latter specifically.

Of particular significance of the laptop initiative is parental involvement in students' use and learning at home. Parental guidance play a crucial role at home ensuring proper use of the computers by their children in the learning process towards greatly increasing conceptual understanding. Rosenzweig (2001) suggests that parenting practices account for as much as 25% of the academic differences between higher and lower performing students. Of further note, Tsikalas and Lee (2007) support frequent and active laptop use for students at home and at school to improve their learning.

Teachers all reported personal, administrative, technical and pedagogical challenges to laptop integration into their classrooms, which are aligned to issues raised by Donovan et al.

Personal
The issue of time has been raised by teachers and is discussed in the literature (Cuban, 2001; Becta, 2003).

> *"Yes using the laptops in the classroom can be time consuming as you have to check the work done by students or groups individually and this takes time.. also a lot of time and effort is required in preparing lesson plans to incorporate ICT."*

Zucker and Hug (2007) explain that with laptop programmes, teachers need to change their pedagogy in the by relying less on textbooks and using extra time in individualizing their content for students to cater for students diverse needs.

Teachers revealed that they are competent in using the laptops, however, they complained that they did not receive any training in using the laptops in the subject areas as only the teachers assigned to the Form one class in 2010 got any sort of formal training. There was a suggestion for ongoing training in integrating laptops specific to their discipline in classes. Silvernail and Lane (2004) reported that teachers' laptop use is higher for teachers who have participated in more professional development activities.

"Teachers, parents and students need to be trained to use the laptops on an ongoing basis because some parents are unaware and also lack computer literacy skills…only teachers of the Form One classes in 2010 received training… teachers can learn ways to incorporate use of laptops in their classes instead of basic research, assignments, SBAs and PowerPoint presentations."

Pedagogical

Concerns about the lack of Internet access seemed to be the major reason for not using laptops.
"Because if we don't have a reliable internet it doesn't make sense because there is no way for any effective research and students do not have the research skills that could be taught if there were internet in the classes"

Also lack of software was a barrier.
"They would use it for presentations that is and research prior to class especially like using a strategy like jigsaw"
"…and we need educational software.."
"…they lack software for individual subjects to help them with their assignments and concepts."

The issue of lack of relevant software can hinder classroom use (Becta, 2004; Empirica, 2006) however it is possible that a lack of resources may be due to poor organisation of resources or inappropriate software by teachers. A possible strategy is to provide

Blackboard or WebCT, Survey Monkey software, which provide virtual online learning (Brown, 2009).

Administrative
Administrative barriers seem to be aligned to the lack of on-site support for technology in schools and student care of laptops.

Teachers claim difficulty in accessing laptops and other supporting media from administration for their use in the classroom. While students were given laptops, teachers did not receive same.
"No it is very difficult to get a laptop to use ..there are a lot of red tapes to get a laptop.. to borrow one so because of the level of frustration no."
"With respect to the use of the AV Room, library and Computer lab... those are the only areas in the school that has internet and because of the hassle to use the AV room, I don't use the laptops".
"There is only one multimedia projector for a staff of about 50..."

Teachers claim that laptops are not working or well maintained.
> *"Umm, when students are asked to bring their laptops... most laptops are either not working or with the IT technician and it is very difficult to plan lessons so when students are asked to bring laptops .. it would be that they already did the research at home or where ever they get internet access and to do group work activities.*

Technical
Teachers also commented that students were not taking care of their laptops, an issue not highlighted sufficiently in he literature.
> *"The students should go to workshops and maintenance checks should be done frequently and students should properly take care of their laptops as they should know that the laptops are still the property of the school and the Ministry."*

Gaible (2009b) purport computer maintenance and technical support/expertise is lacking in the education system in developing countries. Also work done by (Sandholtz & Reilly, 2004; Zucker & Hug, 2008) stated that teachers may resist using laptops unless there is an on-site support available as there is a tendency for laptop computers to be unreliable and prone to technical problems. It appears that even though there is an onsite ICT technician, these services are insufficient or inefficient.

Conclusion and Recommendations
Students seem to favour working with laptops and use them largely at home for personal use and for school assignments. They usually do not bring laptops to school and teachers so not seem to advocate their use in classrooms. There seems to be some benefit to having laptops at home where there is a bit of parental supervision and involvement in student use. The impact of this initiative can be considered to be the narrowing of the digital divide since students across all locations, ethnicities, type of school and societal structure have equal access to laptops.

Implementation issues seem to pose the greatest threat to the successful implementation of these in schools and principals need to work with teachers to resolve concerns about lack of resources, training and access. Administration also need to work with parents in increasing supervision of laptop use and care for these devices, which are obtained through taxpayer's dollars. To facilitate successful integration of laptops in school, there is a need for sufficient resources, infrastructure development, teacher training, technical support, pedagogical change and content development as suggested by Kozma (2008). Even when the importance for ICT integration is recognised, if these factors are not addressed, they become obstacles.

The laptop programme was a top-down approach, initiated by the Ministry of Education of Trinidad and Tobago. Initiatives with technology cannot be successful without a change in pedagogical practices. While adequate support, funding and resources are facilitated by the top down approaches, these approaches risk involving the teacher in a superficial or even an oppositional capacity. Furthermore, "Whereas some teachers may think of technology as just another tool they can use to facilitate student learning, others may think of it as one more thing to do" (Ertmer, 2005).

This study contributes to existing literature on issues related to laptop integration in schools by providing valuable information from both students and teachers perspectives. However the sample size is very small for any of these results to be generalized to other school levels, schools or the country. It is recommended that research across school levels, schools and districts can give a clearer picture of widespread usage and the development of more robust structures and policies to ensure effective use in schools. It is expected that the results of this study can provide inputs into the design of a large-scale evaluation of the government one-to-one laptop initiative that was undertaken five years ago.

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