

Student Impressions of Laptops for Information Technology Students

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ABSTRACT

The Information Technology Programme at Auckland Institute of Studies transitioned to a laptop-based teaching mode 2014-2015. While the roll-out was a success from an administrative perspective, it had not been established with any rigor how satisfied students were with the approach. To address this gap, and to improve the students' learning experience, we carried out two surveys. Every student in the IT Programme was surveyed on the students' experiences and satisfaction with using laptops. We found that most students were satisfied with the laptops, that laptops improved the students' learning experience, and that students found laptops helpful in doing course assessments. It also showed that a large proportion of students did not backup their data. This shows that laptops are an effective tool for teaching IT. It also shows that further technical work must be done to improve the security of students' data.

Keywords: international students, student computing, student laptops, student survey

1. INTRODUCTION

The context of this research is the Information Technology Programme (ITP) at the Auckland Institute of Studies (AIS). ITP currently offers two qualifications, the Bachelor of Information Technology and the Graduate Diploma in Information Technology. These are both level-7 qualifications. Three specialisations (majors) are currently taught in each qualification: Software Development, Computer Networks, and Information Systems.

Whereas IT was originally taught using desktop machines in computer labs, between September 2014 and August 2015 we transitioned to a laptop-based teaching model. In this model, every IT student is issued with a laptop on arrival at AIS, which is used in every course. Our experiences with this transition are described in Watts et al (2016). While this approach has numerous advantages for the institution and the students, before this paper no evaluation had been carried out as to what the students themselves think about laptops.

Specifically, the questions we are investigating in this paper are:

- 1) Are the students satisfied with their laptops?
- 2) Do the students feel that laptops negatively or positively affect their in-class learning?
- 3) Do the students feel that laptops positively or negatively affect their ability to carry out assessments?
- 4) Are there technical matters we could be doing better?

The existing literature is somewhat mixed as to the effectiveness of laptops in classrooms. Research with high school students (Keengwe, Schnellert and Mills, 2011) found that laptops contributed positively to student engagement, while the academic performance of middle school students was

shown to significantly improve after being issued with individual laptops (Lowther, Ross and Morrison, 2003; Gulek and Demirtas, 2005; Del and Theresa 2001). In higher education, research has found that note-taking and other learning activities were made more efficient by the use of laptops (Efaw et al, 2003), and that the usefulness of laptops outweighs the challenges of using them (Wurst, Smarkola and Gaffney, 2008; Kay and Lauricella, 2011).

Conversely, laptops can also be distracting for the students using them, which negatively affects student's learning (Fried, 2008; Patterson and Patterson, 2017; Carter, Greenberg and Walker, 2017). This distraction, however, tends to be caused by using the laptops for non-class related activities (Gaudreau, Miranda and Gaureau, 2014). Web browsing in-class has been identified as a factor in laptops contributing to lower student grades (Grace-Martin and Gay, 2001), along with email and instant messaging (Kraushaar and Novak, 2010). Such distraction has even been shown to extend to those students who are not directly engaged in the non-class activities (Sana, Weston and Cepeda, 2013).

However, most of the literature cited above dealt with non-IT students, and all concerned classes in North America. While the makeup of the student bodies studied in the cited work were not specified, the work reported here involves international IT students in New Zealand.

2. METHOD

The first survey was carried out in November 2016, and the second in April 2017.

We investigated student satisfaction with the laptops themselves by asking the following questions:

- *How satisfied were you with the hardware specification of your laptop?*
- *How satisfied were you with the software that was pre-installed on your laptop?*

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We investigated student impressions of the impact of laptops on their in-class learning by asking the following questions:

- *Does having a laptop in class make taking notes more or less difficult?*
- *Do you find having a laptop in class makes following the class more or less difficult?*
- *How distracting do you find having a laptop in class?*

The impact of laptops on students' ability to carry out assessments were assessed using the following questions:

- *How much easier does having a laptop make working on IT assignments, while off-campus?*
- *Did you experience any problems with using your laptop in practical tests or exams?*
 - *If yes, what problems did you experience?*

The students' impressions of technical matters were assessed with these questions:

- *Did you experience any problems with printing from your laptop?*
 - *If yes, what problems did you experience?*
- *Approximately how often do you backup work from your laptop?*
- *Did you install any software on you laptop yourself?*
 - *If Yes, did you experience any problems installing software?*
 - *If Yes, what problems did you experience?*

After processing the results of the first survey, an additional question was added to the second survey:

Have you ever lost work or data from your laptop?

Questions on satisfaction, ease and difficulties experienced were assessed on a four-point Likert scale. Questions with binary answers were assessed as *Yes / No* responses. The demographics of the respondents were captured using multiple-choice responses, and looked at the gender of the student, the qualification they were enrolled in, their specialisation, and how long they had been an IT student.

The survey received ethical approval from the AIS Research Committee before being administered to students. The surveys were administered in class, and the classes were selected so that the overlap in students between classes was minimised, while maximising the number of IT students who could participate. Students were verbally instructed to not complete the survey if they had already done so in another class. Surveys were administered on paper and the results manually tabulated. While an online survey would have made processing the survey easier, we felt that a paper-based survey was more likely to get responses from students.

3. RESULTS

There were 100 respondents to the first survey, and 75 to the second. In this section we present the results of these surveys. We divide this section into four subsections, corresponding to the four research questions posed above.

3.1 Satisfaction with Laptops

Student satisfaction with their laptops is in two aspects: hardware and software. In this subsection, we present the reported level of this satisfaction.

In Table 1 we present the satisfaction with the laptop hardware. It is apparent that the student satisfaction with the hardware has improved between the two surveys. This might be because later intakes of students received higher specification laptops than earlier intakes. Also, there were some on-going problems with the quality of the first batch of laptops that were not present in the later batches issued to students.

Table 1: Student satisfaction with laptop hardware

Satisfaction	Proportion 2016 (%)	Proportion 2017 (%)
Very unsatisfied	11	0
Unsatisfied	17	10
Satisfied	63	72
Very Satisfied	9	18

Student satisfaction with the standard laptop software – that is, the software that was pre-installed on the laptop when the student received it – is presented in Table 2. The overall level of satisfaction increased between the two surveys, but the degree of dissatisfaction decreased. That is, more students were unhappy with the software, but they were not as unhappy as they had been in the previous survey.

Table 2: Student satisfaction with standard laptop software

Satisfaction	Proportion 2016 (%)	Proportion 2017 (%)
Very unsatisfied	8	0
Unsatisfied	5	18
Satisfied	72	59
Very Satisfied	15	23

These results show that student satisfaction with the laptops as they received them, improved between the two surveys.

3.2 Impact on In-class Learning

From the point of view of educators, the most important effects laptops could have on students are on students' learning. In this subsection we present the results of the survey questions that investigated the students' impressions of the effects of laptops on their learning.

In Table 3 we present the results of the survey question that dealt with student note-taking in-class. This shows an increase in the proportion of students who found it more difficult to take notes using laptops, but they are still in a small minority.

Table 3: Does having a laptop in class make taking notes more or less difficult?

Ease	Proportion 2016 (%)	Proportion 2017 (%)
Much more difficult	1	3
More difficult	4	10
Less difficult	62	57
Much less difficult	33	30

In Table 4 we present the results of the question gauging the impact of laptops on following classes. While the second survey shows a decrease in the proportion of students who reported that laptops made class easier to follow, in both surveys the largest majority of students found that it was much easier.

Table 4: Do you find having a laptop in class makes following the class more or less difficult?

Ease	Proportion 2016 (%)	Proportion 2017 (%)
Much more difficult	1	1
More difficult	4	11
Less difficult	52	59
Much less difficult	43	29

As discussed in the Introduction, previous research has found that laptops pose a distraction for students. The results presented in Table 5 show that the level of distraction, or the proportion of students who reported laptops to be distracting, was small overall, and decreased between the two surveys.

Table 5: How distracting do you find having a laptop in class?

Ease	Proportion 2016 (%)	Proportion 2017 (%)
Very distracting	3	0
Distracting	17	8
Slightly distracting	38	45
Not at all distracting	42	47

3.3 Impact on Student Assessment

Behind following classes, the next most important impact of laptops, from an educational point of view, is the impact on students performing assessments. In this subsection, we present the results of the surveys questions concerning students' experiences with completing assessments using laptops.

Table 6 presents the results of the question dealing with how much easier or harder laptops made working on IT assignments while the students were off-campus. There was little substantial change between the surveys, with the large majority finding that having a laptop helped with assignments. While some services, such as the database servers, are not accessible off-campus, the software licensing agreements we have mean that students can install the appropriate software on their laptops. The lack of access to servers is not, therefore, a substantial impediment to students working on their assignments.

Table 6: How much easier does having a laptop make working on IT assignments, while off-campus?

Ease	Proportion 2016 (%)	Proportion 2017 (%)
Much harder	3	1
Slightly harder	4	6
Slightly easier	20	21
Much easier	73	72

The proportion of students who experienced problems with their laptops during practical assessments is presented in Table 7. While the majority of students did not experience any problems at all, the proportion of students who did increased slightly between surveys, from 21 % to 29 %. In the 2016 survey, the most commonly-experienced problems (Table 8) were those caused by automatic updates, although this was less common in the 2017 survey (13 % in 2017 compared to 33 %). This might be because lecturers reminded students well before the exams to make sure that the automatic updates had been applied before the students went into the exam. The next most frequently reported problem was unspecified "crashes". Other problems reported were application software crashes, and some hardware failures. These "other" problems increased from 13 % in 2016 to 29 % in 2017.

Table 7: Proportion of students who experienced problems using laptops in practical assessments

Experienced Problems	Proportion 2016 (%)	Proportion 2017 (%)
Yes	21	29
No	79	71

Table 8: Distribution of problems experienced by students in practical tests and exams

Problem	Proportion 2016 (%)	Proportion 2017 (%)
Laptop crashed	29	29
Network access	13	4
Downloading / uploading exam files	8	8
Automatic updates	33	13
Laptop did not meet requirements	4	17
Other	13	29

3.4 Technical Matters

In this subsection we present the results of the questions on the technical matters assessed by the survey: printing; backing up data; and installing software. As IT students, the technical matters are expected to have a greater impact on the students than would otherwise be the case.

3.4.1 Printing

While the IT programme does not require hard-copy submission of assignments, and all teaching material is distributed online via Moodle, some students still like to print out lecture notes before class, or print out assignments for proof-reading. Table 9 displays the proportions of students who experienced problems with printing from their laptops. There is little change between the two surveys, and while the majority experienced no problems at all, a substantial minority did. The most commonly reported problem (Table 10) was communication between the laptop and the printer server, that is, network issues: either communications could not be established, or the laptop was not recognised by the printer server. Software issues with the printer driver also arose, and other problems reported included page layout problems and (what the student thought was) poor quality printing.

Table 9: Proportion of students who experienced problems printing from their laptops

Experienced Problems	Proportion 2016 (%)	Proportion 2017 (%)
Yes	36	35
No	64	65

Table 10: Distribution of problems students experienced with printing from laptops

Problem	Proportion 2016 (%)	Proportion 2017 (%)
Communication with the printer	28	29
Laptop not recognised by server	48	37
Printer driver	24	17
Other	0	17

3.4.2 Backups

While modern computer equipment is quite reliable, hardware or software failures do happen. Other problems, such as loss or theft of laptops have also occurred. Backing-up data is therefore an important task for any student. Each student at AIS has access to one terabyte of cloud storage space for backup purposes. The question we investigated in the survey, and which results are presented in Table 11, is what proportion of students are making use of that backup space?

We can see in this table that a sizeable minority (35-36 %) never backup their data, and that this proportion did not change substantially between surveys. Only 8 %, in each survey, backed-up their data daily.

Table 11: Frequency at which students backup laptop data

Backup Frequency	Proportion 2016 (%)	Proportion 2017 (%)
Never	36	35
Monthly to Fortnightly	31	35
Fortnightly to Weekly	14	10
Weekly to Daily	11	12
Daily or more	8	8

The observation after the first survey, that a large proportion of students either never or seldom backup their data, motivated us to include a new question in the second survey. This question asked students if they had ever lost data from their laptops, and the results of this question are presented in Table 12. As only 8 % report ever losing data from their laptops, the low rate at which students backup data is not of great concern, but it is still something that must be addressed in the future.

Table 12: Proportion of students who have lost data from their laptops (2017)

Lost Data	Proportion (%)
Yes	8
No	92

3.4.3 Students Installing Software

As IT is a diverse field of study, it is not feasible to pre-install every software package a student might require during their studies. It is therefore important that IT students are able to install software on their laptops themselves. Table 13 shows the proportion of students who installed software in both surveys.

Table 13: Proportion of students who installed software on their laptops

Installed Software	Proportion 2016 (%)	Proportion 2017 (%)
Yes	76	65
No	24	35

The proportion of students in 2017 who reported installing software themselves decreased slightly from 2016. This might be due to changes in the standard image that was pre-installed on the laptops. As we have moved on with the laptop programme, the standard image has evolved, to include more of the commonly-used software.

The proportion of students who encountered problems installing software is shown in Table 14. This shows that despite the decrease in the proportion of students installing software, the proportion of students who encountered problems doing so slightly increased.

Table 14: Proportion of students who encountered problems installing software

Experienced Problems	Proportion 2016 (%)	Proportion 2017 (%)
Yes	19	23
No	81	77

The types of problems encountered by students when installing software are shown in Table 15. The most commonly reported problem was compatibility of the software with the operating system, with lack of disc space the second most commonly encountered issue. Software required for class work is tested by the lecturer before use, so it is unlikely that essential software was not able to be installed because of OS compatibility. Also, the hard drives on the student laptops have more than 400 GB of space, which makes it an open question as to how the students could have run out. Students installing corrupted or malicious software was an issue, and this has caused some problems for our technical support staff.

Table 15: Distribution of problems experienced by students installing software on laptops

Problem Experienced	Proportion 2016 (%)	Proportion 2017 (%)
OS compatibility	24	21
Corrupted or malicious software	14	17
Anti-virus blocked installation	14	8
Lack of user privilege	11	12
Lack of disc space	17	17
Unclean temporary directory	10	4
Files locked	10	0
Other	0	21

4. DISCUSSION

The results above allow us to give some preliminary answers to the four questions posed in the Introduction.

1) *Are the students satisfied with their laptops?*

Students are satisfied overall with the laptops issued to them and that satisfaction is increasing, from 54 % satisfied in 2016 to 90 % satisfied in 2017. We have observed that the number of complaints received from students that the laptops are too slow has dropped and this is reflected in the level of satisfaction. Students are mostly satisfied with the standard software installed on the laptop, although the proportion of satisfaction dropped slightly from 2016 (87 %) to 2017 (82 %).

2) *Do the students feel that laptops negatively or positively affect their in-class learning?*

The large majority of students felt that laptops positively impacted in-class note-taking, with an average of 92 % reporting that it made note-taking either *Less Difficult* or *Much Less Difficult*. Note-taking has been observed to primarily be in the form of annotations to the lecture material (usually Power Point presentations), which are always available for every class via the Moodle learning management system. Future versions of this survey will query students as to how they use their laptops to take notes in class.

While several publications have previously found (Fried, 2008; Patterson and Patterson, 2017; Carter, Greenberg and Walker, 2017) that laptops in class are distracting to students, on average only 14 % found laptops to be either *Distracting* or *Very Distracting*. An average of 91 % of students found having laptops made following the class either *Less Difficult* or *Much less difficult*.

Overall, students reported that they found that laptops were a positive factor in their learning.

3) *Do the students feel that laptops positively or negatively affect their ability to carry out assessments?*

An average of 93 % of students found that laptops made it easier to work on their IT assignments while off-campus. A majority (75 %) of students reported that they did not experience problems with their laptops during practical tests or exams. Of those 25 % who did experience problems, an average of 38 % had problems caused by automatic updates. Although course lecturers remind students to ensure that their laptops have been re-started before practical tests, students often do not do so. This leads to updates being automatically installed during the test. A further 33 % reported an unspecified crash of their laptops. The remaining problems reported were issues with the Wi-Fi (average 14 %) and with accessing servers (average 10 %). A move to using the online learning management system Moodle for the submission of practical test and exam work has already eliminated the issues with server access, while most issues with Wi-Fi access have been resolved by simply turning the laptop Wi-Fi off and on again. These however were all technical issues, and we are investigating the creation of a standard "Exam instruction list" that will assist students with either avoiding or resolving these problems.

Overall, laptops certainly help with assignments, while technical issues can sometimes interfere with practical tests and exams.

4) *Are there technical matters we could be doing better?*

Notwithstanding the problems encountered by students during practical tests and exams, as described above, students also encountered technical issues in their day-to-day usage of the laptops. A substantial minority (average of 35 %) experienced problems with printing. Although these issues were always resolved, these problems do not contribute to a positive experience for the students.

A more troubling finding was that 35 % of students never backup work from their laptops. This might be because only 8 % report ever losing data. That is, until they lose data, they do not see backups as important. This is somewhat supported by a further analysis of the data. Of those who reported losing data, 50 % backup weekly or daily, while among those who had not lost data, only 16 % backup that frequently. Other factors, such as duration of study or qualification being pursued, were not found to contribute to frequency of backups. While every student has access to one terabyte of cloud storage, backups must be performed manually. It seems that an automated backup system would be useful for our students.

The work reported in this paper only concerns student impressions of the laptop programme. We have not yet examined the impact on the students' final course grades. Such an investigation is, however, quite fraught, as there are numerous complicating factors. For example, there has been changes in the teaching staff since the laptop programme commenced, which could also contribute to any positive or negative changes to student grades.

5. CONCLUSIONS

The laptop programme has been a success. Students report a high level of satisfaction with the laptops themselves, and with the positive impact they have had on their studies. Future improvements will include an automated backup system to protect against accidental loss of data and continuing improvement in our documentation, especially as it relates to practical assessments. In the future, this survey will be repeated annually, so that monitoring of the laptop programme can be continued. Deeper analysis of the data will also be carried out, so that any correlations between factors can be uncovered.

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