

Researching Student Perceptions of and Experiences with Alternative Learning Technologies

Replacing Traditional Tutorials with i>clicker Tutorials and Online Tutorials

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Keywords: Alternative Learning Technologies, Student Response Systems, Traditional Tutorials, i>clicker Tutorials, Online Tutorials, Online Learning, Online Surveys, Learning Outcomes, Blended Learning, Hybrid Learning.

Abstract: The researchers invited university students enrolled in two different offerings of a large introductory course which had recently transitioned from traditional tutorials to student response system (i>clicker) tutorials, four different offerings of two courses which had recently transitioned from traditional tutorials to online tutorials, plus two different upper division courses which continued to employ traditional tutorials to participate in an online survey regarding their experiences with traditional tutorials, fully online tutorials, and tutorials that employed student response systems. The purpose of this study was to evaluate student perceptions of and experiences with alternative learning technologies, and to determine whether these alternative technologies improved learning outcomes when compared to more traditional teaching methods. This paper reports on the design and implementation of the i>clicker and online tutorials, the design and administration of the online survey, and strategies employed to enhance student participation in the survey. While there was no measurable difference in terms of learning outcomes, the survey results indicate that students prefer online tutorials over i>clicker and traditional tutorials, and that there is generally a high level of student satisfaction when it comes to alternative learning technologies. The researchers were able to identify which facets of traditional, i>clicker and online tutorials the students found most appealing (and/or useful), and which facets they did not find appealing and/or useful.

1 INTRODUCTION

This paper reports on the results of a research study into student perceptions of and experiences with tutorials involving student response systems, online tutorials, and traditional (in-person) tutorials. It further describes the design and implementation of the online tutorials and the tutorials involving student response systems, the design and administration of the online survey used to collect the data, and the strategies employed to encourage student participation in the survey. The research findings identify which facets of the three tutorial formats the students found most appealing and/or useful, and which facets they did not find appealing and/or useful. It was also possible to confirm the degree to which student experiences with and perceptions of emerging alternative technologies actually correlated with learning outcomes.

2 BACKGROUND

At Simon Fraser University (SFU), three credit courses require three hours of classroom instruction. In the past, delivery of first and second year Criminology courses invariably consisted of weekly two hour lectures by the course instructor (in a large lecture theatre, with all of the students present), plus weekly 50 minute tutorials, led by a teaching assistant (in a small classroom, with 15-17 students, at a time other than that of the lecture).

In 2009, the School replaced traditional tutorials in Introduction to Criminology (CRIM 101) with tutorials involving student response systems, referred to variously as digital voting systems, or audience response systems (Comer and Lenaghan, 2012; Mathiasen, 2015). The School chose i>clicker technology, known for its relative simplicity, comparatively low cost, and compatibility with

Power Point, Excel and Word (cf. Barber and Njus, 2007; Heaslip, Donovan and Cullen, 2014). Unlike traditional tutorials, conducted by teaching assistants in small classrooms with small groups of students, these 50 minute CRIM 101 i>clicker tutorials are conducted in a large lecture theatre immediately following the weekly two hour lecture, with the entire class in attendance.

Encouraged by the apparent success of the i>clicker tutorials, the School decided in 2011 to replace traditional tutorials in CRIM 104 and CRIM 131 with online tutorials. These 50 minute online tutorials can be taken at any time and from any computer with an Internet connection, during the one-week period they are open.

This shift in tutorial format was occasioned by increasing student enrolment in Criminology courses, and by budgetary issues caused by reduced government funding (cf. Heaslip et al., 2014). Among the appeals of these new learning technologies are that they decrease costs and accommodate growing student demand, while maintaining the impression that universities are on the cutting edge of technological and educational innovation (Kirkwood and Price, 2014; Larreamendy-Joerns and Leinhardt, 2006).

CRIM 101, 104 and 131 are high enrolment courses, compulsory for intending Criminology majors and minors, of which there are sometimes more than two thousand. These are also popular 'general interest' or 'breadth' courses for undergraduate students from other departments. Thus, these three courses have lengthy waiting lists, with many intending Criminology majors and minors complaining about the courses acting as a bottleneck.

To appreciate the logistics, for a single course such as CRIM 101, using traditional tutorials would require 22 different tutorial times, sufficient classroom space (over a period of several days), and six graduate students/teaching assistants.

Following the transition, CRIM 101 came to involve a series of ten i>clicker tutorials (SFU has a thirteen week semester, with no tutorial in the first week, no tutorial during the mid-term exam week, and no tutorial in the last week). The clicker tutorials were structured around a customized course reader designed in conjunction with the tutorials, with each of the tutorials focusing on a selection from the reader. The tutorials began with an i>clicker quiz to assess student familiarity with the assigned reading, followed by further instruction regarding the reading, introduction of supplementary course content, and interactive class activities and

discussion (facilitated by clickers). Attendance, participation and quiz performance for clicker tutorials accounted for between 12 and 20 percent of the overall grade for the course, depending upon the course instructor.

CRIM 104 and 131 have enrolments ranging from 110 to 180 students. In their new configurations, both involve a weekly, two hour face-to-face lecture, supplemented by a series of ten online tutorials, again premised upon a thirteen week teaching semester. This combination of face-to-face lectures and online tutorials could be described as a 'hybrid' or 'blended' approach to education (Alammary, Sheard and Carbone, 2014; Means, Toyama, Murphy, Bakia and Jones, 2010; Nguyen, 2016).

Each online tutorial for CRIM 104 consists of a 20-30 minute audio-visual presentation, an interactive preliminary assessment exercise (an educational video game), 10 interactive flash cards that flip from term to definition, and a timed, 10 minute (5 question) quiz at the end (cf. MacKenzie and Ballard, 2015). Students can earn one point per tutorial for attendance and participation, by spending a minimum of 30 minutes going through all four of the required elements, and up to one point for their performance on a five question quiz at the end. The CRIM 104 tutorials are worth two percent each, or 20 percent of the overall grade for the course.

CRIM 131 is broken down at the beginning of the semester into groups (or tutorials) consisting of 19 students. Each online tutorial for CRIM 131 consists of two to three online readings plus a 20 minute (10 question) quiz at the end. Over the course of the semester, each CRIM 131 student is required to provide an online presentation on the assigned reading to their group, along with discussion questions. Twice per semester, assigned discussants from the group respond to these questions, with the presenter facilitating discussion (monitored by the teaching assistants and instructor) (cf. Alammary et al., 2014). The CRIM 131 tutorials are worth 25 percent of the overall grade for the course—the quizzes, 10 percent, the presentation, 10 percent, and discussion, 5 percent.

The implementation of i>clicker tutorials in CRIM 101 and online tutorials in CRIM 104 and 131 was influenced as much by pedagogical considerations as by lengthy waiting lists and budgetary constraints. While there remains a degree of suspicion amongst some faculty with respect to these new learning technologies (cf. Comer and Lenaghan, 2012; Kirkwood and Price, 2014), there is ample evidence to suggest that they have

justifiably earned their place in higher education. The jury may still be out regarding the capacity of student response systems to improve learning outcomes and/or final grades, but there seems to be little question that such systems are useful for stimulating discussion and increasing attendance and participation in first and second year lecture-style courses with large enrolments (FitzPatrick, Finn and Campisi, 2011; Steer and Gray, 2012; Ulbig, 2016).

Research indicates that asynchronous discussion groups like those used in CRIM 131 foster more meaningful interaction, and thus promote ‘reflective learning,’ because students have more time to think about (reflect upon) what they want to say than in face-to-face classroom discussions (Comer and Lenaghan, 2012; Turney, Robinson, Lee and Soutar, 2009). The type of interactive preliminary assessment exercises (educational video games) employed in CRIM 104 have been shown to have a positive effect on test results, and also, have proven to be useful to students when it comes time to re-visit course content in preparation for mid-term and final examinations (Grimley, Green, Nilsen, Thompson and Tomes, 2011; Hood, 2013; Means et al., 2010). It could be said that i>clicker technology, online discussion groups and interactive video games are consistent with the ‘active learning’ paradigm—the notion that students learn better when they assume a greater degree of responsibility for their own education, through participation and engagement in problem-solving, self-assessment, and interaction (online or otherwise) with other students (Handelsman, Miller and Pfund, 2007; Heaslip et al., 2014).

3 METHODOLOGY

A decision was made to employ an online survey, rather than an in-class survey. There are distinct advantages to online surveys, including efficiency, cost savings and the ease with which data can be collected and analyzed (Anderson and Kanuka, 2003; Evans et al., 2009). A primary consideration was the time required to complete a paper questionnaire during class, especially when students might have to sift through numerous questions that did not directly pertain to them (e.g., questions about tutorial formats with which they had no firsthand experience, or questions about their proficiency in English when English was their first language). Moreover, to increase the breadth of the sample population, it was deemed necessary to survey courses that had been offered in the previous

semester. Given that classes were already finished when the survey was conducted, students who took one or more of the courses previously would have been unable to complete an in-class survey. There are, however, a number of reported problems with online surveys, including low response rates and survey abandonment (Adams and Umbach, 2012; Webber, Lynch, and Oluku, 2013). Measures taken to encourage participation and maximize completion rates included six modest cash prizes (drawn randomly) for students who completed the survey, plus a series of three carefully timed reminders, including one ‘personalized’ reminder from the course instructor’s own email account (Best and Krueger, 2004; Joinson and Reips, 2007).

Participation in the online survey was voluntary and anonymous. The research was categorized as “minimal risk” and was approved by SFU’s Research Ethics Board in April 2013.

3.1 Population

The researchers invited students enrolled in their Fall 2012 and Spring 2013 offerings of CRIM 101 (i>clicker tutorials), Fall 2012 and Spring 2013 offerings of CRIM 104 and CRIM 131 (online tutorials) and the Spring 2013 offerings of CRIM 300 and CRIM 321 (traditional tutorials) to participate in this online survey regarding their experiences with traditional tutorials, i>clicker tutorials and online tutorials. Students enrolled in the Spring 2013 offerings of CRIM 300 and CRIM 321 were asked to participate because they by definition had firsthand experience with traditional tutorials in these two classes, and many had personal experience with i>clicker tutorials or online tutorials, or both.

3.2 Response Rates

The response rate was 50 percent, with a completion rate of 94 percent (N = 629), considered high for online surveys of university classes (cf. Sax, Gilmartin, and Bryant, 2003; Sue and Ritter, 2007). The cash prizes likely had some effect on the comparatively high response rates. However, most participants completed the survey once started, and many took the time to type in additional comments, indicating a degree of personal commitment to the outcome and integrity of the survey. In addition, most prospective participants were personally invited to take the survey by the course instructors during lecture, which may have influenced the high response and completion rates (Pan, Woodside and Meng, 2013).

3.3 Survey Design

The online survey consisted of 22 questions regarding student experiences with and perceptions of traditional tutorials, student response system (i>clicker) tutorials, and online tutorials. There were also 21 'demographic' questions pertaining to age, gender, citizenship, fluency in the English language, credit hours accumulated and grade point average. These 'quantitative' questions were designed in a manner that facilitated direct data transfer to *SPSS*. There were also three areas in the survey where students were invited to offer as much 'qualitative' commentary as they liked on the three different types of tutorials.

The survey employed software from *fluidsurveys.com*, which hosts online surveys, stores survey data, and offers a number of pre-designed survey templates (Evans, Burnett, Kendrick, MacRina, Snyder, Roy and Stephens, 2009). The software permits researchers to send personal email invitations to prospective participants, keep track of overall response rates, and send out reminders. As importantly, *fluidsurveys.com* software offers 'skip logic,' whereby required questions are answered by all participants, while topic-specific questions are presented only to participants who trigger them through their previous responses (Evans et al., 2009; Rademacher and Lippke, 2007). To illustrate, students who indicated that they had never taken a traditional tutorial would not be required to answer questions on this subject, and instead, would automatically be redirected to the next set of questions regarding i>clicker tutorials (assuming that they had previously indicated experience with i>clicker tutorials). This 'skip logic' kept participants from answering questions that were not intended for them, thereby resulting in an average survey completion time of 11 minutes and 22 seconds. Simplifying the format and reducing length are crucial factors in minimizing "survey fatigue" and enhancing completion rates for online surveys (Anderson and Kanuka, 2003; Kaplowitz, Lupi, Couper, and Thorp, 2012; Maloshonok and Terentev, 2016).

4 RESEARCH FINDINGS

Of the 1500 students eligible to participate, 663 started the online survey, and 629 completed it. Of the 663 who started the online survey, 135 (20.4%) were declared Criminology majors or minors, while another 276 (41.6%) were intending Criminology

majors or minors. That said, 252 of the respondents came from a wide range of disciplines, such as business administration, psychology, health sciences, economics, linguistics, communications, kinesiology, biology, chemistry, and mathematics. As expected when surveying students in first, second and third year university courses, ages ranged from 18 to 46, with the average age being 21 (mode = 19, median = 20). Of the 630 who answered the question on gender, 385 (58.1%) were females, 244 (36.8%) were males, while one identified as transgendered. The seeming overrepresentation of females is consistent with known enrolment patterns in the courses being surveyed. Moreover, other researchers have reported that females are more likely than males to respond to online surveys (Laguilles, Williams, and Saunders, 2011; Sax et al., 2003).

4.1 Student Perceptions of and Experiences with Traditional Tutorials

Traditional tutorials are the predominant way in which the requisite third hour of weekly instruction is delivered to first and second year students at SFU. As noted above, these tutorials are conducted by teaching assistants in small classrooms, with 15-17 students in attendance. Tutorial activities typically consist of student presentations, discussion of the weekly readings and lecture content, and/or supplementary instruction by the teaching assistant.

Student perceptions of and experiences with traditional tutorials were generally positive (see Figure 1 below). Of the 172 students who reported firsthand experience with these tutorials, 64.5% said that they enjoyed the opportunity to meet and interact with other students, 62% felt that they acquired a better understanding of the course content, and 56.4% that they received a better quality of instruction (multiple responses were permitted).

On the other hand, 51.4% said that they disliked doing student presentations, 51.4% that there was a disparity in the quality of instruction between the different teaching assistants, and 44.7% that they did not enjoy having to speak in class. By far the most common complaint—by 59.2% of those with firsthand experience with traditional tutorials—was that tutorial times conflicted with other courses they wanted to take, or conflicted with their work schedules (cf. Bolliger and Erichsen, 2013).

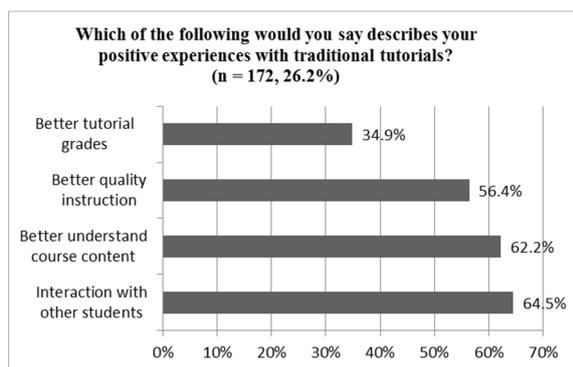


Figure 1: Positive Experiences with Traditional Tutorials.

4.2 Student Perceptions of and Experiences with i>clicker Tutorials

The student response system (i>clicker) tutorials for CRIM 101 are conducted in a large lecture theatre immediately following the weekly two hour lecture, with the entire class in attendance. These tutorials begin with an i>clicker quiz on the assigned reading, followed by further instruction or clarification regarding the reading, supplementary course content, and interactive class activities and discussion. Although a marked departure from the traditional tutorial format, i>clicker tutorials seem to have generally been well received by students (see Figure 2 below). Of the 319 students who reported firsthand experience with clicker tutorials, 70.5% said that they appreciated the opportunity to practice exam-type questions during the quizzes and interactive activities (cf. Hwang, Wong, Lam and Lam, 2015; Ulbig, 2016), 51.5% that clicker technology allowed them to participate actively in class without having to speak (cf. Heaslip et al., 2014), 53.1% that they liked being able to gauge knowledge of the course content through the clicker quizzes, and 48.1% that they liked having the tutorial scheduled for the one hour period immediately following the lecture.

More than half the students (52.7%) said they found the three hour session (a two hour lecture followed by a 50 minute tutorial) too long. This could not be resolved without returning to the traditional tutorial format or turning to the online tutorial format. The second most common complaint (47.0%) was the \$40 cost of the i>clicker (cf. Ulbig, 2016). This second problem is resolving itself over time, because more and more courses are employing i>clicker technology at SFU, there are growing numbers of previously used clickers for sale at cheap prices, and clickers are being shared between friends or family members who are not registered in the same course.

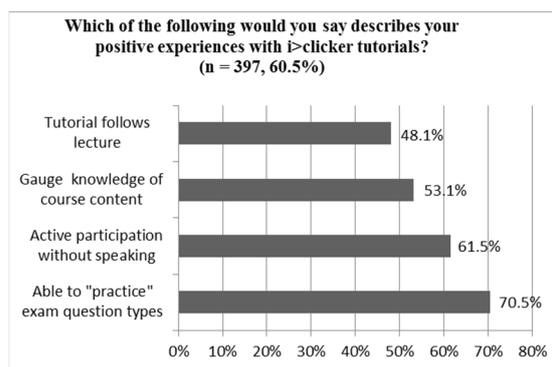


Figure 2: Positive Experiences with Clicker Tutorials.

4.3 Student Perceptions of and Experiences with Online Tutorials

The online tutorials for CRIM 104 and 131 can be taken at any time and from any computer with Internet connectivity, during the one week that they are open. The tutorials for these two courses are quite different from each other. The CRIM 104 tutorials consist of an audio-visual presentation, an interactive preliminary assessment exercise/video game, interactive flash cards and a 10 minute (5 question) quiz. Online tutorials for CRIM 131 consist of weekly online readings and a 20 minute (10 question) quiz at the end, plus online presentations and discussions.

Of the 303 students who reported firsthand experience with online tutorials, 63.5% appreciated that the tutorial structure allowed them to participate without having to speak in class, 60.7% said they liked being able to gauge their knowledge of the course content through the weekly quizzes, and 57.8% that they liked the opportunity to practice exam-type questions during quizzes and interactive activities (see Figure 3 below). In contrast to i>clicker tutorials, where only 36.5% felt they developed a better understanding of the course content and the assigned readings, 53.8% reported a better understanding of course content and readings with online tutorials. What students overwhelmingly appreciated about online tutorials (82.5%) was that they could attend them at a time of their own choosing (cf. Cole, Shelley and Schwartz, 2014).

The most comment complaint (72.6%) was the \$40 cost of accessing the online tutorials. This problem likely cannot be resolved, as the tutorials for both courses were designed in conjunction with publishing companies, and involved copyright issues, proprietary templates, royalties, and professional design teams external to the university (cf. MacKenzie and Ballard, 2015).

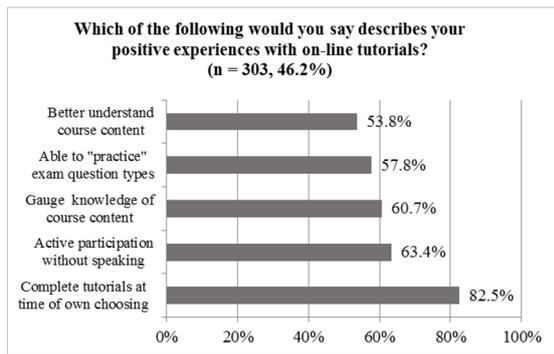


Figure 3: Positive Experiences with Online Tutorials.

4.4 Student Ratings of Tutorial Formats

When students were asked to rate the three different tutorial formats, by assigning the type of letter grade that they would themselves receive for their own coursework (with A being the highest grade, and F the lowest), the online tutorials proved to be the most well received of the three formats (41.3% As, 41% Bs, and 11% Cs), followed by i>clicker tutorials (28.5% As, 51.5% Bs and 14.7% Cs), and then traditional tutorials (11.2% As, 63% Bs and 21.3% Cs) (see Figure 4). However, when asked in a follow-up question what type of tutorial format they

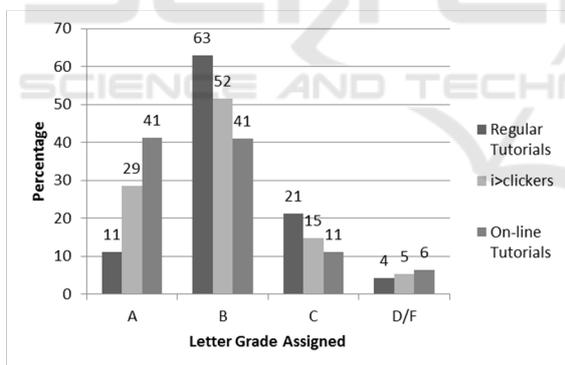


Figure 4: Student Ratings for the Three Tutorial Formats.

would prefer if given a choice, the order between traditional tutorials and i>clicker tutorials was reversed, with 20.2 percent stating a preference for online tutorials, 15.7 percent saying they would prefer traditional tutorials, and 14.3 percent saying they would prefer clicker tutorials. Student support also existed for a combination of traditional and i>clicker tutorials (10.6%), or traditional and online tutorials (8.4%), or clicker and online tutorials (5.7%), suggesting that students appreciate 'blended' course delivery methods (Bolliger and Erichsen, 2013; Cole et al., 2014; Hood, 2013).

5 DISCUSSION

The researchers were concerned that students might have rated i>clicker and online tutorials more favorably because they appealed to a large segment of the SFU student body that speaks English as an additional language. Of the 626 students who completed the survey, 467 (74.6%) spoke a language other than English. Of those, 356 (76.2%) learned to speak another language before they learned to speak English. Approximately 35% spoke a Chinese dialect (e.g., Mandarin, Cantonese), 9.6% spoke Punjabi, 7.7% spoke Korean, with the remainder speaking a wide variety of languages.

A series of chi-square tests were performed, coming at the subject from a number of different angles, including student-reported difficulty in reading, writing or speaking English, and even residency status in Canada. Most showed negligible results. Moreover, directional measures including lambda and Goodman and Kruskal tau refuted any predictive relationship or association between language proficiency and overall ratings of the i>clicker and/or online tutorials.

There was also a concern that i>clicker and/or online tutorials might be rated more favorably because they were perceived as being less scholastically challenging than traditional tutorials. However, there were no statistically significant findings to report when it came to the relationship (or lack thereof) between scholastic achievement (as measured by student-reported GPA) and overall student ratings of the i>clicker and/or online tutorials.

Finally, there was a concern that between-instructor teaching methods might have influenced how the students rated the three tutorial delivery methods. Again, however, there were no statistically significant findings to report.

For all introductory classes, tutorial grades were subjected to an independent samples *t*-test. The mean of the traditional tutorial is 78.41 ($s=10.75$) and the mean of the non-traditional tutorial is 82.58 ($s=11.09$). As shown in Table 1, there is a statistically significant mean difference of 4.17 percent ($t=13.68$, $df=3769$, $p<0.001$) between the traditional and non-traditional formats. The tutorial grades for each separate class displayed the same result of a significant mean difference between traditional and non-traditional tutorial grades with the exception of CRIM 131. Despite the mean differences between grades for traditional and non-traditional tutorials for CRIM 101 and 104, there

were no substantive differences in the overall final grades for the different versions of the courses.

Table 1: Independent Samples t-test of Differences in Tutorial Grades.

	All courses (mean)	Crim 101 (mean)	Crim 104 (mean)	Crim 131 (mean)
Traditional	78.41 (10.75)	77.79 (10.23)	79.91 (12.57)	78.61 (13.57)
Non-Traditional	82.58 (11.09)	84.25 (10.20)	87.11 (11.03)	78.15 (11.45)
Mean Difference	4.17 (0.30)	4.66 (0.35)	7.20 (0.69)	0.46 (1.25)
t-value	13.68***	13.45***	10.46***	0.37

***p<0.0001

6 CONCLUSIONS

The fact that students liked the online tutorials more than traditional tutorials, and/or that they rated clicker tutorials on roughly the same plane as traditional tutorials, does not necessarily imply that online tutorials and i>clicker tutorials should be regarded as superior to—or the equivalent of—traditional tutorials. Indeed, the findings of this present research study run contrary to the findings of a number of other studies (cf. MacKenzie and Ballard, 2015; Nguyen, 2015), which suggest that greater use of online content and student response systems in large classroom environments may lead to improved learning outcomes. The data analysis from the present study suggests that implementation of these alternative learning technologies had a minimal effect on learning outcomes, as measured by final grades and grades on midterm and final examinations (cf. Ulbig, 2016). There also remains the salient issue of whether or not educators should be catering to student preferences for “anonymity” and not having to speak in front of a class (Bolliger and Erichsen, 2013; Heaslip et al., 2014; Mathiasen, 2015).

Nevertheless, if students are open to these emerging learning technologies, feel more engaged in the learning process as a consequence, and feel that they learn—and perform—better on examinations, then the argument can be made that these learning technologies deserve consideration for wider deployment in higher education (cf. Cole et al, 2014). In fact, since this research study was conducted, one version of CRIM 101 has shifted to the use of online tutorials similar to those already in use in CRIM 104 (the other version of CRIM 101 is still using i>clicker tutorials). Moreover, a new special topics course on cybercrime, CRIM 218, has been designed using i>clicker tutorials similar to those still used in one of the versions of CRIM 101.

While these newly-designed courses were not included in this present study, students at SFU are asked to complete formal written evaluations for every course that they take, rating the presentation of course materials and the performance of the instructor. Course evaluations completed by students at the end of each term continue to indicate that these alternative learning technologies have been well received by students enrolled in the two new courses.

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