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‘Point and Click’ versus BYOD: Student Engagement Technologies as an Ethical Imperative for Teaching Law

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ABSTRACT

What conscientious law professor of first year, large format classes in torts, contracts, or criminal law has not pondered how to better engage students while easing their reluctance to speak out in class? While many students entering law schools are quite adept with student engagement technologies (SETs) from their undergraduate studies, some law faculty seem tied to the passive environment of lectures and PowerPoint presentations and hence reject SET methodologies as so much techno-wizardry. With the entry of web-based programs into the expanding field of SETs, and increasing empirical evidence that interactive learning improves grades, closes gender gaps, and helps the economically disadvantaged student, the ethical question arises, are we not obliged as law teachers to employ them? This paper examines in three steps that gap between pronouncing from the podium and actively learning by remote or online devices. Part I reviews and updates the growing empirical literature on the features of active learning tools. Part II examines two models of SET technology for their comparative attributes and drawbacks, with a particular focus on law teaching. Part III details the author’s experiences with the clicker system teaching introductory law and criminology courses and compares its attributes to newer web-based systems. The paper concludes with a look forward to teaching and learning in the emerging culture of the Internet of Things.

Keywords: clickers, student engagement technologies, interactive learning, web-based learning, the Internet of Things, law teaching

Introduction

Lectures and the Socratic method have provided the mainstay of western legal education for centuries. Instructor-centered learning has come under mounting criticism, however, with the wired (and wireless) enthusiasm of

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1 Barrister & Solicitor, called to the Ontario Bar, PhD candidate, Osgoode Hall Law School, Toronto. The author expresses appreciation to Dr Kim Varma, Criminology Chair, Ryerson University, graduate assistants Ryan Baird and Deanna Ida, and Canadian law faculty who offered commentary at the Annual Conference of the Canadian Association of Law Teachers (CALT) in Winnipeg, Canada June 7-8, 2014.
digital natives who now comprise the majority of law school entrants.\(^2\) The ensuing debate over the most effective methodology is still being met at some reputable schools with institutional policies to ban laptops in the classroom and to create wifi-free zones.\(^3\) Harvard University’s Jonathan Zittrain, law professor and co-founder of the Berkman Center for Internet and Society, admits to banning the laptop in some of his classes, but also speaks approvingly of the ‘innovators’ who experiment widely with technology and integrate it into their law teaching.\(^4\) Some of those innovators have proven that active learning methods such as student engagement technologies (SETs) can render students 1.5 times more likely to pass than students in traditional lecture courses.\(^5\) Those results raise the issue of whether professors have an ethical obligation to employ student engagement methods.

This paper examines SETs as their use continues to stoke the active learning debate. I examine empirical and anecdotal literature highlighting the

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benefits and pitfalls of two student engagement technologies, the clicker (individual handheld wireless transmitters similar to remote controls)\(^6\) and web-based systems with student-owned devices (including laptops, smartphones, cellphones, and tablets).\(^7\) Part I examines literature dealing with the validity of general principles often enunciated in support of active learning. Part II describes the key features of two active learning technologies, the clicker,\(^8\) chosen because of its use in the Ryerson study, and the more independent web-based SET system Top Hat.\(^9\) Part III details the students’ and author’s successes and apprehensions regarding the iClicker system and its potential for invigorating the traditional podium-centric pedagogy. It also compares the clicker technology with the Top Hat SET as representative of a telephone- or web-based response system. The paper concludes by placing those SETs within the growing interoperability of learning and teaching devices and poses the question of whether educators hold an ethical obligation to employ active learning technologies within the law classroom, given the impending culture of the Internet of Things (IoT).

Part I

General Principles of Active Learning

Active learning can be thought of as learning by doing; it employs many student-centric methods to encourage critical thinking, synthesis, and analysis so the learner builds her own understanding of particular concepts.\(^10\) Active learning can include any learning activity or behaviour that does not restrict participation to solitary reading and listening. Technologies that encourage

\(^6\) The iClicker technology has now been expanded to include a web-based program, web>clicker, that allows students to vote or answer questions using laptops and smartphones.

\(^7\) This paper discusses, but does not promote over their market competitors, the iClicker and Top Hat (Monocle) technologies.


\(^9\) Although Top Hat is referenced throughout as a ‘web-based’ technology, its system can also be assessed by telephone.

active, or interactive, learning include peer teaching, web applications such as blog creation and editing, wikis, and SETs such as web-based student response systems and clickers.

Law professors, traditionally, have employed podium-focused lectures and Socratic methods to generate the same results. While some learners feel a certain comfort in the passive podium method, there are drawbacks. One that is often cited is the inability of lectures, some for two or three hours, to overcome the human attention span. The preferred technology of lecturers is the PowerPoint system\(^{11}\) that, while an effective organizing tool, requires a certain level of classroom darkness, a feature that often ‘signals sleep’.\(^{12}\) Although there seems no widely-accepted empirical proof of the view that student attention spans are pre-set at 10 to 15 minutes,\(^{13}\) some proponents of SETs perpetuate that urban legend when comparing active and passive learning methodologies.\(^{14}\) What seems more accurate is that abilities for uninterrupted attention are idiosyncratic and personally depend on many variables.

In an effort to test the perceived wisdom on attention spans, a 2010 study by Bunce \textit{et al.} asked students of three introductory chemistry classes to use clickers to indicate their attention lapses as well as their in-class response to posted questions.\(^{15}\) The study was unusual in that it measured both the frequency of the lapses and their duration. The students would press their clickers when they became aware of their own inattention. The Bunce study

\[^{11}\text{© Microsoft Corp.}\]
made three observations: first, the most frequently reported length of attention lapse was 1 minute or less (suggesting that very short breaks in attention are more common than longer breaks); second, across the three courses that were studied, the researchers observed a pattern in which the first spike in reported attention lapses occurred at approximately 30 seconds into a lecture with the next spike in attention lapses occurring 4.5 to 5.5 minutes into the lecture, followed by a third spike at 7 to 9 minutes, and then another at 9 to 10 minutes into the lecture. The length of each lapse follows a ‘waxing-and-waning’ pattern throughout the lecture, but with attention lapses occurring more frequently as the lecture progresses. By the end of the lecture, lapses occurred about every two minutes. Those results indicate that students’ patterns of attentiveness are even more interrupted than generally thought.16

The Bunce study found that student attention is higher during non-lecture pedagogies. This was verified by the significantly lower number of self-reported attention lapses during either a demonstration or clicker exercise. Equally important are the data that show that students report significantly lower attention lapses during lecture segments immediately following a demonstration or clicker question than they did in comparable length lecture segments without the use of those pedagogies.17 That finding is important to show that lectures that are interspersed with active learning, such as clicker activity, will produce more attentive students as the lecture resumes. Also recommended by Bunce et al. is the re-examination by instructors of their expectations of student attention when planning their lessons, They should begin classes with more engaging methods and use methods that forestall brief but frequent lapses in student attention throughout the class.18

Another common belief is that students’ cognitive and other learning abilities have diminished since the introduction of digital devices. A 2012 Pew

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16 Ibid., p. 1439.
17 Ibid., p. 1440.
study into how teens do research in the digital world does not bear out those perceptions. The study asked teachers to evaluate today’s students compared to prior generations in terms of learning habits such as attention span and distraction, cognition, multi-tasking, media literacy, and overall literacy. The results were mixed: when asked if today’s students have different cognitive skills, a significant 88% agreed.

When given the statement ‘today’s students are really no different than previous generations, they just have different tools through which to express themselves’, 47% of teachers surveyed agreed with the statement while 52% disagreed. The study concludes that, while key habits might take different forms, or be expressed in different ways, the basic teaching challenges have not altered since the pre-digital era. We can best conclude from the Pew data that people learn in different ways, another feature promoted by supporters of active learning.

Given that active learning involves such activities as talking, watching videos, reading, reflecting, and evaluating information received from other students, Paul Caron of University School of Law argues that it produces more lasting value to students than lectures, leaving them better equipped to process new information and solve new problems. Talking forces us to clarify our observations and experiences, reading helps us clarify others’ ideas and

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20 Id. 88% agreed with that statement, with only slight variations given students’ different socioeconomic status.

21 N=2,462 middle and upper high school teachers; methodology included focus groups.

22 Id.


connect sources of information, and even reflection can bring the integration and appropriation of new knowledge.²⁶

Interactive learning also triples students’ gains in knowledge, according to Harvard physics professor Eric Mazur.²⁷ The real gain is in practical application of principles. Mazur found that, over seven years of podium-centric teaching, his classroom lecture approach revealed that very few students could apply formulae and science principles to real world situations. When he engaged peer-instruction (brief conferences between students), practical applications were quickly discovered. Mazur suggests that such a discrepancy can be explained by the nature of peer interaction:

[T]his is the crux of the method. You’re a student and you’ve only recently learned this, so you still know where you got hung up, because it’s not that long ago that you were hung up on that very same thing. Whereas [a professor] got hung up on this point when he was 17, and he no longer remembers how difficult it was back then. He has lost the ability to understand what a beginning learner faces.”²⁸

At the heart of those observations is the belief that education is not limited to information exchange and that universities, unlike in Renaissance days, are not the gatekeepers of higher education. If they were, Mazur comments, professors could just fulfill their teaching obligations by taping their lectures and posting them online.²⁹ Today’s education, while involving periods of solitary reading and reflection, is a social experience, with a multitude of socially enhancing communication methodologies to engender that process.

Freeman et al. claim to have provided the first quantitative analysis of how podium-focused lectures impact student exam performance compared to more active learning in undergraduate science, technology, engineering, and

²⁶ Id.
²⁸ Id.
²⁹ As is done by the Khan Academy, the California-based, nonprofit, online educational organization founded by Salman Khan, M.B.A. ’03.
mathematics programs (STEM). Through an analysis of 225 studies of active learning in STEM classrooms, the authors determined that average failure rates were 21.8% for active learners but an alarming 33.8% under traditional lecturing. As failing students are more likely to withdraw from a program before completion, as noted by the study, those numbers in all probability understate the problem.

Political Science professor Maureen Feeley of the University of California at San Diego addresses similar research gaps but within social science disciplines regarding the connection between interactive engagement technologies and learning outcomes. She combined peer instruction and clicker use in an upper level political science course and found a 1.69% overall increase in final grades for the clicker users compared to a 0.449% increase for non-users. That differential was judged to be a significant indicator of the learning advantage of clicker-enhanced classrooms. Some students praised clicker use for increasing their engagement in pre-class assignments and in-class discussions; others commented that clickers motivated them to come to class, made class more ‘interesting’, helped reinforce key points from readings and lectures, and promoted discussion and participation despite the large class size.

Such study results, particularly the grade differentials, pose the question of whether professors should continue use of traditional lecturing as a routine pedagogy on professional ethics grounds. Two related studies of STEM learning add further evidence that the ethics question needs addressing on a systemic-wide basis. The Haak study indicates active learning confers disproportionate

30 Freeman op cit., fn 5 at p. 1.
31 Id.
32 Ibid., p. 3.
33 Feeley, M. 2012. ‘The Impact of Peer Instruction Pedagogy and Clicker Technology On Student Learning and Attitudes Toward Learning in a Large Upper-Division Political Science Course’, APSA 2012 Teaching & Learning Conference Paper, 15-17 February 2012, Washington DC, as accessed 3 June 2014 at <http://dx.doi.org/10.2139/ssrn.19997648>. Feeley would post a clicker question, allow a few minutes for students to confer, then click their answer.
34 Politics of Human Rights, University of California, San Diego (N=254).
36 Id. (p>.05 or .10 for midterm compared to p<.05 for final).
37 Ibid, p. 18.
benefits for students from disadvantaged backgrounds\textsuperscript{38} and the Lorenzo Harvard study argues it helps to eliminate the gender gap for female students in male-dominated fields.\textsuperscript{39}

Regarding the first, a study of STEM programs from 2003 to 2008 involving students from disadvantaged and non-disadvantaged educational and socioeconomic backgrounds showed disproportionate benefits for disadvantaged students when lecture-intensive methods were replaced with highly structured active learning exercises such as daily multiple-choice “clicker questions” implemented in a peer instruction format. The program also included a weekly practice exam comprising five short-answer questions that were peer-graded, pre-class reading quizzes, and extensive informal group work in class. Students were required to prepare for class sessions, use clickers or random-call responses to participate in class sessions that were focused entirely on active-learning exercises, and complete a weekly low-risk assessment in the form of a practice exam.\textsuperscript{40}

Mazur agrees that interactive learning addresses the gender gap, as seen in his physics classes: “If you teach a traditional course, the gap just translates up: men gain, women gain, but the gap remains the same.”\textsuperscript{41} If you teach interactively, however, both gain but the women gain disproportionately more and close the gap. Mazur suggests that the verbal and collaborative nature of peer interactions might be significant factors that enhance the learning environment for women students.

The Lorenzo Harvard study of the gender gap in conceptual understanding addresses that question.\textsuperscript{42} It was conducted over a five-year period in an introductory Physics course that had a history of traditional lecture format. The study found the gender gap could be reduced through the use of


\textsuperscript{40} Id.

\textsuperscript{41} Lambert, \textit{op cit.}, fn 26.

\textsuperscript{42} Lorenzo, \textit{op cit.}, fn 38, pp 118-122.
teaching methods that promoted in-class interaction, non-competition, collaboration, and conceptual understanding. Overall, the results showed that teaching with interactive methods yielded significantly increased understanding for both males and females, and also reduced the gender gap. Most notably, in the most interactively taught courses the pre-course gender gap was found to have disappeared by the end of the semester. The study is valuable for showing that both genders benefit from interactive learning, with females improving their performance the most and overcoming a significant initial gender disparity.

The inability of the clicker system to accommodate individual questions to the professor in class, coupled with recognition of the futility of banning mobile phones in the classroom, inspired a University of Toronto team of professors to conduct a study of text messaging by engineering students. The methodology was inexpensive and employed a first year student design team and a low technology threshold: a moderator (teaching assistant or staff member), armed with a cell phone, was present on stage with the instructor. Students were encouraged to use standard social messaging systems to text questions to the instructor through the moderator. The moderator summarized and presented the questions to the instructor at appropriate intervals via a handheld whiteboard. The professor would either respond immediately, later by email, or in the following class. Results showed that a total of 58% of students used the texting system, or an average of 7.5 students (Fall semester) and 5.4 students (Winter semester). While the numbers are

43 Id.
44 Haak et al., op cit., fn 37, passim.
46 According to the authors, each method of question/response used a closed loop to ensure a trusted system.
47 Text messaging was filtered by the GA for questions that could be answered through course materials or that related to non-lecture matters (p. 2).
48 N=830. The authors calculated the additional staff time to manage the texting feature to be 140 hours over two semesters (p. 3).
49 If more than one question were asked per lecture, it was recorded as one question.
low, the authors endorsed the system for bringing another aspect of interactivity to the classroom. Texting ‘increased the concentration level’ and ‘provide[d] the instructor with a good sense of where the student’s overall concerns are’. At minimum, the texting function is ‘not as distracting as hand raising’ and at best has had a positive effect on the learning of hundreds of students. Improvements for future use that would reduce administrative costs and increase student access include making the course phone number available at all times for all students and using commercial and free software to extract texts from the cell phone into a user-friendly file format.

Less optimistic about interactive systems is Professor Melissa Cole of the Information Systems Program at Brunel University in the United Kingdom. She integrated the use of a wiki system into her lectures to seventy-five third-year undergraduate students and found, five weeks into the course, that there had been no posts to the wiki. Cole could see that two thirds of the cohort had visited the wiki, and when canvassing her students as to why no posts were made, found that answers ranged from the pressure of other courses to concerns about how to use the technology, issues of self-confidence, and a total lack of interest. Another discouraging factor for Cole might have been the decision to employ wiki postings in the creation of one exam question that comprised 25% of the final mark. Cole concluded that such technology, when put to educational use, must be supported with ‘instructional scaffolding’ such as classroom exercises in editing and publishing content to reduce ‘some of the anxiety...of peer-based editing’. As well, potential users of such technology could benefit from a discussion about the cost-benefit outcomes for both lecturers and students before proceeding.

50 About one third of the class population did not find the system useful. Data was collected through qualitative questionnaires twice during the course and students’ attitudes to the wiki were recorded by group interviews. Participation in groups was voluntary.
51 Bazylak, op cit., fn 44 at p. 4.
52 Ibid., p. 5.
54 Id.
55 With respect to time pressures, Cole notes students prioritize their time according to the greatest perceived benefit.
Finally, Mazur maintains that the retention of knowledge is increased with interactive methods. He supports that belief with data from his students' performance and suggests that data, rather than student evaluations of professors, is a much more useful tool for measuring learning success. With such interactive methods as clickers, texting, and web-based response systems, that data is available by tracking student performance over the semester on in-class quizzes, and by incorporating those concepts into application-based questions on the final examination.

Part II SETs in the Law Classroom

The pronounced growth in clicker and web-based methods, particularly in the science disciplines, is well documented. Uptake in the social sciences is developing at a slower rate and in law the growth of active learning used by professors is even more conservative.

In making a case for SETs in the law classroom, Paul Caron explains how clicker questions can generate peer discussions:

[A]fter calling on students to relay the facts of the case, I ask the students [to indicate by clicker] which of the opinions best resolves the legal issue at hand and call on students to explain their choices. When the discussion is complete, I ask the students to again choose their favorite opinion [by clicker vote] and several students typically will

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57 Mazur claims that student evaluations demonstrate "There is zero correlation between course evaluations and the amount learned,"
61 Sankoff, P. ‘Taking the Instruction of Law Outside the Classroom: What Does the Khan Academy Have to Teach Us About Law Teaching?’ paper for The Future of Law School conference held at the University of Alberta in September 2013 as accessed 21 May 2014 at <http://dx.doi.org/10.2139/ssrn.2344879>. Easton at fn 59 cites interactive technology use in large format classes at Harvard, Vanderbilt, Duke, MIT, Yale, Brown, University of Massachusetts-Amherst, and the University of Virginia but notes ‘the paucity of studies outlining the tailoring of [clicker] technology to legal education.’ (abstract).
change their ‘vote’ in light of the discussion and choose another of the opinions as their favorite.62

In their subsequent work on interactive learning in the law school context, Caron and Rafael Gely point out one shortcoming of Socratic methodology that clicker technology overcomes: the ambit of communications. Instead of engaging one student at a time, traditionally in inquisition style, the clicker ‘extends the dialogue to the entire class by requiring each student to respond to each question’63 without ever having to speak. By displaying correct answers in class, with the distribution of student answers in graph format, students can compare their responses to those of other students, a discreet self-assessment method that motivates students to conduct readings more carefully or assures them, early in the term, that they are on the right track.

Criminal Law Professor Peter Sankoff of the University of Alberta offers his teaching and observation experience in six law schools in five years to confirm that large law classes remain lecture intensive, with teachers remaining static behind the podium and ‘students typing frantically to keep pace.’64 Sankoff detects a change in the wind, however, as the lives of students become more inter-operative with developing digital communication technologies. A Top Hat user for upper level law classes, Sankoff observes that the use of lecture and Socratic pedagogies as the sole methods of legal education is diminishing for three reasons: the wealth of technologies available for student distraction and disengagement in class; the lack of student learning that emerges from those methods; and the tendency of the lecture format to consign a professor to ‘a lifetime of performance repetition’ that amounts to a ‘wasteful expenditure...of the professor’s experiences, knowledge and abilities’.65

The perceived benefits to learners of using the clicker in law classes are

63 Caron & Gely, op cit., fn 24.
64 Sankoff, op cit., fn 60 at p. 2 & email communication with the author.
65 Id.
the same as for other disciplines: every student in the class is involved, participants enjoy anonymity, students can recognize differences in thinking within the class, concepts are given practical application, peer learning accelerates assimilation of principles, and marks and attendance are calculated autonomously and without instructor bias or human error.

So, is law a discipline uniquely unsuited to professorial use of SETs? Anecdotal evidence comes down on both sides. Law Professor Saul Levmore of the University of Chicago, for example, suggests the benefits as a law professor are considerable:

I like the feedback. I find my questions can be harder afterward...[c]lass can go much quicker—I’m not pulling teeth.67

Levmore limits clicker use, however, not integrating it into every class. When he does use the program, it is only active for less than 20 minutes, and he prepares the students with a worksheet before class so they can review the questions in advance.

Steven Penney of the Faculty of Law at the University of Alberta similarly uses the web-based Top Hat system selectively for upper level Criminal Procedure courses. One benefit he sees is his ability to quickly gauge comprehension of assigned readings and to track new users to determine areas where they are experiencing difficulties.68 The benefit of Top Hat is that students use whatever digital devices they bring with them (smartphones, laptops, tablets, older cell phones), eliminating the problem of forgotten clicker remotes or dead batteries. While there are occasional technical ‘glitches’ to overcome, Penney admits ‘students understand and are patient’. As a result, complaints about the time involved in setting up the system are ‘low’.69 Penney does not grade Top Hat participation although he does assign a mark for using the device.

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67 Id., citing Levmore.
68 Telephone communication with the author 29 May 2014.
69 Id. For student acceptance of technology issues see also Silliman, S.E., Abbott, K., Clark C., and L.H. McWilliams, 2006. ‘Use of a Tablet PC and Wireless Connectivity for Effective Lectures
Seniour Law Lecturer Catherine Easton of Manchester Metropolitan University employs clicker technology for the teaching of public law to fulltime students and criminal law to part-time students. She has used the technology for a number of reasons: to assess prior understanding and misconceptions regarding the topic; to examine how well students engage with pre-class readings; to provide formative feedback in a timely fashion; to break up the lecture; to hold learner attention with early morning or late evening classes; and to create a sense of community within larger classes. The device is suited to law pedagogy, Easton maintains, because of its ability to engender high-level conceptual skills and deep understanding.

Objections by law professors might include the forfeiting of class time for set-up, quizzes, student technical problems, and the added features requested by seasoned SET users such as tournaments and narrative input. As law is a discipline under considerable pressure by external professional bodies to cover an allotted amount of content, such worries could be legitimate. Students share those concerns as well, as Easton found out through her feedback questionnaire of students in her LL.B. study. A fulltime student commented that ‘Better understanding however can waste info time’ while a


70 N=242; one two-hour lecture in a series of six was taught to fulltime undergraduate LLB students at the School of Law, Manchester Metropolitan University.

71 N=18; one one-hour lecture to second year undergraduate LLB students.

72 As distinguished from delayed feedback with hand-in assignments.

73 As documented by Draper, S., Cargill, J. & Q. Cutts. 2002. ‘Electronically enhanced classroom interaction’, Australian Journal of Educational Technology, vol 18, no 1, pp. 13-23 as accessed 27 May 2014 at <http://www.ascilite.org.au/ajet/ajet18/draper.html>. The study used a remote handset to respond to multiple choice questions; answers were transmitted to a PC laptop and projected to the class, including a bar chart showing distribution of class responses. The process reflects that offered by the clicker. In order to engender ‘community mutual awareness building’, at the start of class students were asked ‘whether each student is straight from school or not, their gender, which faculty they belong to, whether they signed up for the course because it is their main interest, a side interest, or are just making up the number of courses they do.’

part-time student pointed out that with clicker use contact time with the professor becomes more limited.\textsuperscript{75}

Concern of professors might include student reluctance of the technology. Adopting SETs certainly involves learning curves. Both i-Clicker and web-based systems call on a major infusion of set-up time at the beginning and, depending on your adeptness with new technology and your understanding of the basic affordances of the podium system in your institution, a ready accessibility to its Teaching and Learning resources, both during course development and as the semester unfolds. While the customer relations staff of iClicker and Top Hat companies energetically promote the availability of their trained personnel to assist with technical troubleshooting, that assurance is of little comfort in a tightly-orchestrated class when the iClicker or Top Hat icon does not appear on your screen or student responses cannot be read. Students take their cues, in general, from the response of the professor to such ontoward surprises, and a certain instructor flexibility is reassuring to them. As familiarity with the system builds, students find it quite impressive and inspiring for a professor to be calmly and adeptly troubleshooting on the spot. I discuss in Part III my particular precautions to forestall such unsavory experiences.

In addition, faculty might harbor apprehensions about class management during the use of learning technology. They might have genuinely held beliefs that the lecture method imposes order on the learning process and that student engagement can be achieved without technological boosting. In her discussion about banning laptops in her classes after a number of years of encouraging classroom technology, law professor Nancy Maxwell of Washburn University found that some students were unwilling to become engaged in discussions or even make eye contact with her because they were attempting to transcribe everything said in class.\textsuperscript{76} With wireless Internet access available, that denial of

\textsuperscript{75} Easton, \textit{op cit.} fn 59 at §2.3.1.

\textsuperscript{76} Maxwell, \textit{op cit}, fn 3.
engagement grew, more the product of the constant increase in classroom distractions from which students could not seem to detach themselves. Maxwell specifically noted the growing practice by students of messaging each other when another student was called upon to answer. If the targeted student could access those messages, he suffered the debilitating effect of their derogatory content while attempting to answer the professor. Such behaviours are more commonly associated with undergraduate experience, but are valid concerns nonetheless, particularly given the device-centered capabilities of Top Hat and other web-based technologies.

Maxwell’s anecdotes suggest that, while SETs demand student concentration, the variety of communication technologies that compete with, rather than aid, learning is increasing. That concern is not unique to the law discipline, nor to professors, as students frequently complain about the distraction of clicking keys and colourful screen displays of laptops around them. Once technological distractions were removed, Maxwell discovered freely volunteered answers, respectful listening, and ‘rich and nuanced’ discussions. She also noted a slightly favourable grade deviation for her digital-free classroom.

For Peter Sankoff, on the other hand, students’ propensity for ‘checking out’ from time to time demanded a technological infusion that would allow a switch from case analysis to problem solving. As Sankoff’s website illustrates, his evidence law students have access to a ‘capsule’ of key principles posted on his website for preparation before each class. 77 That teaching aid is accompanied by assigned readings, including a reduced set of relevant cases. When students arrive in class, the Top Hat technology is used for a rapid response to a series of posted questions, followed by a 20-minute lecture to cement fundamental concepts in order to spend the majority of class in more complex problem solving. 78 Craig Forcese of the University of Ottawa law

78 Email communications with the author.
faculty employs a similar ‘flipped classroom’ format employing the PIRAC method of case analysis that expands the standard IRAC formula (issue, rule, analysis and conclusion) by adding a ‘P’ to emphasize process. Both Sankoff and Forcese speak of the flipped methodology as freeing up classroom time for real life applications by having students complete the lecture material on their own time before class. Students who struggle are those who either have not listened to the pre-class podcast or watched the capsule video.

Part III The Ryerson Experience

Overview

In teaching criminal law and criminology to large format classes, the author chose the iClicker for five undergraduate classes at Ryerson University in Toronto for the 2012-2013 academic year. The decision to use SETs was prompted by class size, the intensifying debate in the literature about whether to ban laptop and mobile phone use in university classes, concern over engaging students for three-hour classes, the lack of seminars for real world problem solving, and the administrative opportunity offered by clickers to organize the presentation of material around key concepts. Institutional incentives included endorsement and promotion of clicker technology use by Ryerson’s Learning and Teaching Office, the accessibility and enthusiasm of the University’s Digital Media Projects (DMP) Office that oversaw technical implementation of the model, and the strong support of the Department Chair. An additional boost to the decision was the impressive

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79 There is a growing literature on the flipped classroom. For the concept within the legal education context, see Berrio Matamoros, A. ‘Answering the Call: Flipping the Classroom to Prepare Practice-Ready Attorneys’ CUNY School of Law Working Paper series for 18 November 2013), abstract available at <http://ssrn.com/abstract=2357594>.


81 © 2014 i>clicker.

82 Course enrollment ranged from just under 100 to approximately 150 students and class time ranged from 9 am to 9 pm.

83 Including availability of Instructor remotes in the Learning & Teaching office and iClickers in the campus bookstore.
curiosity of grading assistants (GAs) who expressed appreciation for the savings to their marking and grading time provided by the iClicker system.\textsuperscript{85}

**Methodology**

As a result of polling students in all classes at the beginning of each term, the clicker was adopted for three first year classes in Criminology and Introduction to the Criminal Justice System, and two third year courses in Policing and in National Security. All classes contained a component of criminal law, both domestic and international. Students of the second year Criminal Law course, however, voted not to employ clicker technology.\textsuperscript{86} The clicker was first used in the remaining classes during the third week of courses\textsuperscript{87} and used for every class thereafter. GAs and a representative from the on-campus DMP Office attended the third class for all sections for a brief how-to presentation as well as for troubleshooting with students’ individual clickers.\textsuperscript{88} Students were also told of empirical studies that examined the benefits of interactive learning and peer discussions. They learned that clicker questions would be used for three pedagogical functions: polling, recall, and extrapolation. *Polling* would be used to elicit personal experiences and normative attitudes (e.g., ‘I have been arrested, true or false’; or ‘I believe use of the burka should be confined to private homes and religious ceremonies’). Polling questions were particularly helpful in assessing levels of knowledge when introducing a new concept; questions proved helpful for students to examine their choices compared to their classmates, and for the professor to understand, via projected bar graphs of results, prevailing attitudes, biases, and normative beliefs. The system also accommodated self-paced polling for group work or for

\textsuperscript{85} The GA attended many classes voluntarily to ensure the proper functioning of the technology.
\textsuperscript{86} The vote was 43 to 42. As a result, the Criminal Law class provided a ‘control’ group for comparison with the clicker-enhanced classes. A quantitative comparison would have been very helpful but was not available.
\textsuperscript{87} To provide students time to purchase and register clickers, or to borrow from colleagues.
\textsuperscript{88} TA attendance at the clicker initiation class was critical to ensure all grades would be recorded accurately; the autonomous grading for the clicker component lessened the GAs’ grading load by 10%. 
students enrolled with the on-campus Disability Services Office. Recall questions tested students’ comprehension and retention of legal concepts contained in pre-assigned readings or audio/video assignments (eg: ‘Which of the following answers correctly states the legal principles behind plea bargaining?’). Extrapolation engendered critical reasoning through peer discussions: students would attempt an individual response to more broadly framed questions (‘How do penal sanctions perpetuate state sovereignty?’) and then break out into small groups to further discuss their choices, after which students answered the clicker question once more. Students were encouraged to use their devices to conduct a quick research of the issue to inform such peer exchanges. They also provided a ready springboard for later discussion of cases. The graphing function of iClicker afforded a comparison of individual answers and those chosen after peer discussions.

Regarding evaluation administration, clicker grades contributed to 10% of their final mark, including a 5% participation mark for completing 70% of clicker exercises. Anonymized grades were made accessible online to students after class and technical discrepancies were reported to the GA. Questions regarding the formatting or wording of the questions were referred to the professor who might create a Q&A for frequently asked questions that was posted on the class website for the benefit of all. Extrapolation involved answers conceptually more open to interpretation and so could reinforce for learners the complexity of the issue at hand. Classes would typically begin with a ‘rapid fire’ series of recall questions regarding pre-class assignments; that arrangement energized students while focusing them to settle into the class quickly. Through accessing results in graph form, easily accessible with the clicker system, the professor could measure assimilation of class content before proceeding. By moving to a polling question prior to introducing the lecture portion, the professor was able to gauge class attitudes or preconceptions or to question normative assumptions. Slides that posed critical

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89 Such use addresses the attention span challenges noted within the first portion of a class according to Bunce et al., op cit. at fn14.
thinking questions were interspersed throughout the PowerPoint presentations, often generating discussions about practical problem solving throughout the three-hour sessions. As students gained familiarity with the technology, they would indicate how wording of some questions was faulty, an opportunity for ‘teaching moments’ or levity.

Response analysis

Although the iClicker system provides autonomously generated quantitative analysis of student performance, the author’s learning curve for the Ryerson experience was sufficiently steep that such helpful data was not accessed during the academic year. A macro picture of student responses to clicker questions was available upon completion of the program, however, as shown by the two examples represented below. Figure 1 indicates student grades for an Introductory Criminal Justice class in the Fall semester. As indicated, the beginning average grade was 0.903 out of a possible 1.5 and the final average grade was 0.881, peaking in weeks two and eight to 0.946 and 0.948 respectively, and dipping to a low of 0.777 in week five. The lowest score coincides with the timing of midterm exams and suggests students were, on average, left with reduced time to prepare for classes. The gradual decline in scores from week two to week four might indicate an increased complexity in questions posed; it could also suggest a decline in student pre-class reading. It is reassuring that scores reached a high in week eight, and not surprising that scores show a subsequent decline as content becomes most difficult and students begin intensive review before finals.\textsuperscript{90}

\textsuperscript{90} The results were slightly skewed, but not to a significant extent, by the inclusion of 0 scores from students who have practically, but not officially, withdrawn from the course.
Student responses to clicker questions for a third year National Security course are plotted in Figure 2 below, and take a more dramatic course throughout the semester than those plotted for the first year class in Figure 1. A beginning average grade of 0.921 out of 2.0 climbs to a final average grade of 1.78 and peaks in week two at 1.18 and in week four at 1.83 respectively and dips to 0.969 in week three and to 1.03 in week five. The graph is telling in that beginning competencies are far exceeded in weeks four and six, showing an accomplished facility with the material and the technology but a corresponding drop when students enter the midterm test time crunch or final exam preparation and review period. Those pressures are reflected in Figure 2 with dramatic
drops shown at weeks three and five. One notable discrepancy

![Graph showing clicker results for National Security Third Year Course]

*Figure 2: I-Clicker Results for National Security Third Year Course*

Source: Digital Media Program Office, Ryerson University

between *Figure 1* and *Figure 2* is the sharp escalation of proficiency with clicker questions shown between weeks one and two in *Figure 2*, indicating that by third year of the undergraduate program, students have acquired skills in extrapolation and critical thought as required for that senior level. As well, third and fourth year students at upper levels tend to aggressively challenge the professor’s wording of clicker questions, a healthy sign of expanded reasoning capabilities and general engagement of students in the SET process. Such occurrences require administrative adjustments such as the discounting of responses and the injection of a make-up session into the final weeks of the term. Those marks would be higher as they reflect a second testing of particular material.

A calculation that would be helpful for determining the quantitative benefits of SETs use is a comparison of mean and median values between classes that employ SET systems and those that use more traditional methods.
Such values were not available for the Ryerson experience but could be the subject of further study.

Student Anecdotal Feedback

The key benefits expressed directly to the professor by students were the objectivity and frequency of evaluation and the anonymity afforded by the clicker system. All students were aware of their standing by the course drop date in each semester, as objectively calculated without educator bias or error. Each student was heard from several times in each class, regardless of her threshold for embarrassment or limited abilities to articulate her views. Such a feat was not possible without the clicker technology in large format classes. Given the ability of students to map their progress through unlimited private access to their own marks, and the breakdown of their responses to each clicker question, learners were able to gauge their areas of weakness and to use such results for test and exam preparation. Learners found most concepts easy to grasp and distractions not as tempting or bothersome as in non-SET classes. Overall, students expressed satisfaction with the fast pace of each class that allowed little time for attention lapses.

The principal concern to students was cost. When it was pointed out they could share a clicker with colleagues not attending the same course, or could use second-hand devices or older iClicker models, those complaints subsided. A few students confided they could not afford the device and were provided with a clicker on loan from the DMP Office at the commencement of the semester. The second most common concern was the time entailed in troubleshooting technical glitches. As students communicated with the DMP Office representative, and as the classroom format became more routinized

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91 While student evaluations are conducted each semester at Ryerson, they focus on teacher abilities and performance and do not contain specific questions on digital technology methodology.

92 iClickers retailed for approximately $40CDN plus tax.
over the term, some of those concerns subsided. Of significance were the few complaints that in-class responses were not being registered accurately, an occurrence that was taken seriously for each student and rectified by working individually with the student outside of class. Such issues were attributed to improper registration of the clicker remote, faulty settings on the remote, or responses given outside of the time limit. A negative factor anticipated by the author was the technological aversion of students; no such complaints were observed, however, nor expressed by students. While participation data indicated a 2% gap compared to enrollment, that discrepancy could be attributed to the few students who discontinued the course without formally notifying university authorities.

Overall, students showed a comfort level with peer instruction and interaction; they also showed a progressive comfort with the constructive ‘busy-ness’ involved in problem solving during a major portion of the class. Students exhibited a general learning energy even in early morning and evening classes, and kept attendance to a high level in all classes throughout the semester. Very strong opinions about the use of laptops surfaced during the first class; students were asked to solve the issue themselves and each class devised a system of laptop zones, primarily at the front of the class, which left the back rows laptop free. Laptop note-taking actually declined over the semester as the level of peer discussions grew and it became apparent that syllabus content was covered quite comprehensively through pre-class assignments, posted PowerPoint lessons, in-class exercises, clicker results, and clicker-provoked discussions. Initial rules about disengaging smartphones during class could not be maintained throughout the semester as a significant number of students used the data capabilities and search functions for class research.

Regarding the workings of the clicker system itself, students became quite vocal as the semester progressed if they perceived that the wording of a question was faulty or misrepresented concepts presented in pre-class assignments. When challenged to devise a more accurate question, students worked collaboratively to arrive at alternatives. Those exercises brought
awareness of the limitations of binary question models and their use was gradually replaced over the semester with questions having more than one correct answer. When students gave oral reports from group work, or guest speakers addressed the class, they were encouraged to construct a clicker question for the class, an exercise the majority of students seemed to relish.

Some of the key shortcomings of the clicker system for students, as detailed above, are addressed by web-based response systems such as Top Hat. Improvements include student use of their own devices, a reduced participation cost, the ability to create text-based student input, an expansion of response periods to include homework questions and text answers over a matter of days, the facility to leave questions open all during class for more reflective responses by students, and the ability of both student and instructor to submit a query to the Top Hat administrative team with response times promoted by Top Hat to be under two hours during the day or by early the next morning for night time queries. With the latter facility, students direct their technological questions to the Top Hat administration thereby saving instructor time. It is currently unclear how responsive that system might be. In addition, the TopHat ‘tournament’ function aims at learner review of course content through one-on-one online gaming, a feature of early clicker technologies and of potential interest to the more competitive student.

Instructor Feedback

Clicker use, coupled with peer interaction and problem solving in the Ryerson model, relieved this instructor’s anxiety over engaging large format classes. It exhibited all the pedagogical benefits outlined in the literature on SET learning as detailed above. Most rewarding was the level of learner

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93 Top Hat advises it charges student users a $20 CDN registration fee that covers all courses for which the student uses Top Hat’s website or phone line.
94 As suggested in Top Hat training webinar viewed 4 June 2014.
95 ‘Clickers Background’, Digital Media Program as accessed 29 September 2014 at <http://www.ryerson.ca/dmp/clickers/index.html> (describing the earlier gaming functions of clickers and its adaptation for use on the Ask the Audience portion of the television game ‘Who Wants to be a Millionaire?’).
interest, the ability to get responses from every student - in some cases within less than a minute. Other benefits include connection of content with real world situations, the animation of legal cases through peer discussions ignited by clicker technology, high attendance even during midterm and final periods, and reduction in the tension caused by classroom use of laptops and other student-owned devices. On a more conceptual level, interactive communications technology can be presented as a personalized pedagogical tool rather than a distraction issue demanding administrative management. Other administrative benefits include a clearer organization of course content, the autonomous calculation and recording of grades and their immediate availability to students prior to drop-add deadlines, as well as easier spotting of integrity issues. Pedagogical benefits include continuous assessment of student grasp of course content, indications of student preconceptions and biases, avoidance of attention-span gaps, generation of noisy and active learning, reduction in the need for review sessions prior to exams, and decreased focus on instructor-generated learning. Lectures are also improved due to avoidance of repetition of materials, lengthy sidebars, and choppy or non-sequitur segments.

Unfortunately, web-surfing and texting by back-row students using smart phones did exist in some classes, mainly during the last hour of class. Although no encounters of integrity issues were experienced, the professor frequently moved about the large lecture theatre during class, looking primarily for students wielding two or three clickers at once. The tighter orchestration of classroom events required by clicker use, however, meant students generally found they had to pay attention to keep pace. Grading most clicker responses might also have discouraged prolonged distractions. There also seemed a genuine appreciation by students of the endeavours of the instructor to go the extra distance to incorporate student devices into the learning environment and to incorporate legal and criminal justice practice into the classroom.

96 Students were warned in the syllabus that, if caught, they would forfeit any further use of the clicker and all clicker marks, and would meet with the Integrity Officer to determine further sanctions.
The vote by students not to use clicker technology in a second-year Criminal Law course provided an informal control group against which to measure SET benefits and drawbacks.\(^\text{97}\) Student enrollment was around 80; learners met early for a three hour weekly class. Students had completed prerequisite courses and thus had solid grounding in general legal and criminal justice concepts. Active learning was encouraged through peer discussions, a pedagogical device that produced animated discussions in the first few classes but that diminished in energy as the term progressed. Attendance never waned significantly, with a drop to three quarters of the class complement as exam time neared.\(^\text{98}\) Within a matter of a few weeks, however, students sorted themselves into responders (about 10% of students) and listeners. That pattern did not alter appreciably throughout the course, which made difficult the gauging of comprehension of the other 90% as the course progressed. Pop quizzes gave some indication of whether students had read the pre-assigned materials, but did not give an indication of deeper understanding of underlying concepts. It also created additional marking and recording for the instructor, an automated task with clicker use. Participation marks were based on in-class responses rather than the silent engagement permitted by clicker technology. For students and instructor, a comprehensive picture of student progress was only possible after the midterm exam. Students also requested ‘review’ sessions in order to prepare for midterms and final exams, a need met in the other five classes through student review of previous clicker questions.

Finally, in hindsight, this author could improve upon her first venture into SET instruction by providing a smoother transition from lecture to clicker/web-based portions of each class.\(^\text{99}\) She could do that by providing students with a question set prior to class that focuses on assigned readings. Her facility with the technology could certainly be improved to reduce set-up

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\(^{97}\) The decision was made by a 48/52% vote during the first class; students identified cost as the primary concern.

\(^{98}\) All the more noteworthy when considering that over 80% of Ryerson students have a lengthy commute to class and a significant portion hold part-time jobs.

\(^{99}\) As suggested by one colleague who sat in on a class.
time and other delays at the commencement of class. In addition, as discussed below, a scaffolding approach can be undertaken to smooth student transitions from known to unknown learning methods.

**Suggestions for SETs Use in Legal Education**

Given the emergent interest in SET use in law schools, and its proven ability to accommodate conceptually complex subjects such as physics, engineering, and psychology, this author sees no impediment to their wider use in legal education. While SETs are support tools and not a discrete pedagogical approach in themselves, and hence do not allow the full exploration of the contours of difficult legal issues as with the Socratic method, they facilitate an interactive environment that fosters critical thinking. They also have built into their design the ability to engender legal practice skills at an early opportunity.

From a technological perspective, web-based SETs such as Top Hat are promoted as improving on the clicker technology in three ways: learners can use any digital device to hand, thereby overcoming issues of forgotten clickers, non-functioning batteries, a start-up learning curve, or additional expense. Second, question types are expanded from binary true/false or multiple choice to those generating anecdotal responses and spontaneous retorts as used in texting. Questions can be submitted as well, whether from home or classroom. Third, users can log into the class website via a code number issued in each class, thereby eliminating the need of professors to carry desktop receivers into each classroom. Top Hat staff suggest the latter feature cuts down on integrity issues as well by confining participation to students physically present in the lecture hall and reinforced by changing the code with each question.

Based on her clicker experiences over the 2012-2013 academic year, this author can offer suggestions for future SET use in legal education, framed by the emerging concept of ‘scaffolding’ or the provision of clear foundational steps as the learner enters unfamiliar learning situations.  

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accessed for three purposes: technical, pedagogical, and professional functions. Technical scaffolding can provide instructors new to SETs technology with institutional support through training and accessibility during classroom technical glitches. As shown in the Ryerson experience, that support came from internal training by staff members who were available to bring both instructors and students up to a necessary level of competency. The voluntary participation of a GA provided an exemplary model of instructor scaffolding and should be considered, on a remunerative basis, by administrative decision-makers when introducing SET technologies for campus-wide use. On-the-spot trouble shooting, however, although calling on the expertise of institutional technology staff, is primarily left to the instructor who must find an approach to deal with such impromptu set-backs in the moment. Instructors must adopt a flexible and non-flustered approach to such occurrences, a strategy that should inspire students to assume control of their own technology phobias.

Pedagogical scaffolding within the law school context involves the timeworn IRAC approach to case study\textsuperscript{101} as reinforced through the active learning environment provided by SETs. With expanded time settings that permit more reflective answers, web-based systems allow student submissions either from class or from home, so off-campus case analysis can be accommodated and meaningful peer discussions are possible. Content might need to be quantitatively smaller, in order to allow for more peer interaction,\textsuperscript{102} but the trade-off in active learning would seem to warrant the reduction.

Professional scaffolding in the legal context suggests that more practice-oriented problem solving can be accomplished through SET technology and peer interaction in class. Forcse admits to urging students to consider whether they are giving clients their money’s worth when reviewing their answers to classroom problems from real law practice.\textsuperscript{103} By using practice related exercises to buttress the SET experience, learners are given the message that

\textsuperscript{101} A pneumonic device for case analysis.
\textsuperscript{102} As suggested by Sankoff in his online video presentation \textit{op cit.}, fn 75.
\textsuperscript{103} \textit{Id.}
digital devices are not just ancillary to practice but integral to arriving at the most professionally feasible solutions.

**Conclusion**

Understanding how we learn is often overshadowed by technological innovation expanding the quantum of what we access. The accelerating acceptance of personal communication devices in the classroom by learners and instructors alike might soon relegate the laptop ban imbroglio to the archives of pedagogy. In fact, recent developments of mass open online courses (MOOCs) turn the issue on its head by making interconnected devices the learning environment. The capability of educators and learners to wear interactive learning technologies to extend human body knowledge gathering has already arrived. Students will soon appear at their first classes in future months with communication and information gathering devices on their wrists or appended to eyewear, a technological segue into interoperability in education.

The Internet of Things (IoT) is a growing phenomenon by which people and things are linked through microchips and sensors to networks that are connected to the Internet. For example, the IoT or the interoperability of human and computer intelligence, already functions in the operating theatre through the O.R. Black Box, the brainchild of a Toronto surgeon. The box simultaneously records, in video and audio, what is occurring both in the operating room and within the patient’s body. That monitoring of human

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physiological processes indicates that IoT could well offer insights into information processing and comprehension - learning in other words.

Such man-machine interaction raises myriad ethical and legal questions, policymaking challenges, and inquiry into which values we will continue to ask our laws to protect. Google Glass and the smartphone are two contemporary examples that presage a significant interoperability between learners and the digital devices that, so far, service human needs. Michigan State University professor William Dutton warns that the nature of that relationship could shift to the detriment of humankind depending on the use to which IoT is put and the policies we implement to harness its potential.¹⁰⁷

Issues of learning and teaching the law raised by the Ryerson experience call for broader deliberations by all educators to inform the pending ethical debate: if student engagement systems offer more advantageous learning outcomes than passive, podium-focused ones, how long will educators be able to ignore their ethical obligation to employ ‘intelligent’ systems that improve learning and make life richer?¹⁰⁸ By exploring interactive processes that are enabled by the clicker and web-based response systems, this paper invites dialogue that will answer that question.

¹⁰⁷ Dutton, W. H. ‘The Internet of Things’ (June 20, 2013) as accessed 30 September 2014 at <http://ssrn.com/abstract=2324902 or http://dx.doi.org/10.2139/ssrn.2324902> (proposing that the Internet of Things will connect ‘billions of objects - ‘things’ like sensors, monitors, and RFID devices - to the Internet at a scale that far outstrips use of the Internet as we know it, and [that] will have enormous social and economic implications.’
