THE BEST USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN COLLEGE:
THE STUDENTS' PERSPECTIVE

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Knowing that motivation is at the heart of learning, we were interested in information and communication technologies (ICTs) that could increase students' motivation to engage in their learning and course activities. More and more teachers in postsecondary education are joining the modern trend of emphasizing the use of technology in the classroom. In fact, several studies have already examined the integration of ICTs into college education (Cassidy & Scapin, 2013; ARC, 2013) but few have delved into its complex pedagogical implications (Abrami *et al.*, 2006; Bernard *et al.*, 2004; Bell & Federman, 2013; Johnson *et al.*, 2013). These implications stem from the fact that technology is not used within a vacuum. Barrette emphasizes that the successful integration of ICTs must include a framework that adheres to certain pedagogical principles and that ICT-related learning activities 'must be coherent with the methods used to achieve specific goals' (2009, p. 2).

We wanted to better understand how to promote learning and student participation through the use of ICTs in the classroom, focusing on students' perceptions of different technologies and how they are used by their teachers during the semester (King *et al.*, 2015).

This article examines the findings of this research by exploring students' perspective on the ICTs that they prefer or that may have a positive impact on their learning. This text will also present some problems related to the technologies that students encounter, along with strategies that can be put in place to address them. Finally, we will provide teachers with some suggestions about how best to integrate ICTs into the classroom that are based on the student perspective.

▶ STRAIGHT FROM THE SOURCE: THE STUDENT POINT OF VIEW

The participants of our on-line survey consisted of 311 college students (126 males, 183 females) from pre-university and career/technical programs; 150 from an English college, 161 from a French college. We first examined certain demographic characteristics that might influence their responses, such as age, program of study, gender, language of instruction, presence of disabilities and if they were born in Canada.

We analysed each of these demographic characteristics to determine if they had an impact on the responses given to the seven questions[2] listed opposite.

When we compared the responses, taking into account all the demographics, surprisingly, we found that there were no significant differences. At first, we were disappointed in these non-significant findings. However, we then realized that our findings indicated that it is possible to implement ICTs within a Universal Design for Learning (UDL) framework in order to teach in an inclusive fashion to a diverse group of students. Let us examine the results of this study in more detail.

QUESTIONS FOR STUDENTS

1. *Do you like courses where your teachers use technology?*

2. *Do you like courses where your teachers allow you to use your own technology in class?*

3. *Do your teachers allow you to use your own technology in class?*

4. *What types of technology have your teachers used in their teaching?*

5. *Which of these technologies worked well for you?*

6. *Which of these technologies did not work well for you?*

7. *What suggestions do you have for teachers who want to effectively use technology in their teaching?*

▶ RESULTS OF THE SURVEY

First and foremost, students like it when their teachers use technology in class; 96% of the students answered positively to the statement "I like courses where my teachers use technology" (Question 1). Figure 1 shows details of the responses to this question.
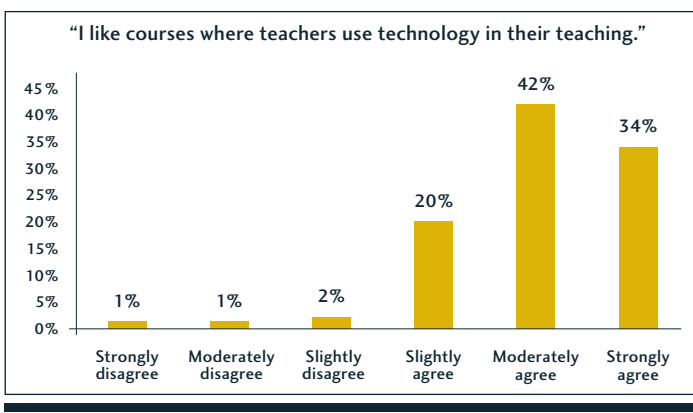
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[1] All the authors are members of the Adaptech Research Network.

[2] The series of ICT-related questions were answered using a 6-point Likert scale.

FIGURE 1	RESULTS OF QUESTION 1

"I like courses where teachers use technology in their teaching."

Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree
1%	1%	2%	20%	42%	34%

With regards to the possibility of students using their personal technology in class, there seems to be a marked difference between the number of students who like courses where they can use their personal technology in class and their actual experience. In fact, 92% of participants answered positively to the statement "Do you like courses where your teachers allow you to use your own technology in class?" (question 2), while only 51% of students stated that their teachers allow them to do so (question 3).

Students clearly like courses where ICTs are used and where they to have the opportunity to use their personal technology such as laptops, tablets or smartphones in class.

The results for questions 4, 5 and 6 are presented in Table 1. It demonstrates that most of the ICTs used by their teachers generally work well for students. For this study, 'works well' was defined as technologies that were used by teachers in a way that helped students learn.

TABLE 1	RANK ORDER FOR FREQUENCY OF USE OF ICTS BY TEACHERS AND STUDENTS' PERCEPTIONS OF THOSE THAT WORKED WELL (NUMBER AND %)

RANK	TECHNOLOGIES USED BY TEACHERS, ACCORDING TO STUDENTS			TECHNOLOGIES THAT WORKED WELL, ACCORDING TO STUDENTS	
	MATERIALS AVAILABLE ONLINE				
1	Grades	(298)	98%	(294)	99%
2	Course outline	(296)	98%	(277)	96%
3	Assignments	(297)	96%	(286)	97%
4	Course notes	(271)	90%	(262)	97%
5	Weblinks	(251)	81%	(216)	87%
6	Calendar	(217)	70%	(188)	87%
7	Tutorials/practice exercises	(212)	69%	(176)	84%
8	Attendance record*	(191)	62%	(169)	90%
9	Tests/quizzes*	(181)	59%	(156)	89%
	TECHNOLOGY USED IN CLASS				
1	Presentation software (PowerPoint or Prezi)	(298)	96%	(293)	98%
2	Grammar tools and checkers (Antidote)*	(167)	54%	(148)	90%
3	Language learning software*	(106)	35%	(90)	87%
4	Simulations/virtual experiments*	(94)	31%	(83)	89%
5	Mind mapping (Inspiration or Cmap)*	(52)	17%	(37)	73%
6	Web conferencing (Skype or Adobe Connect)*	(26)	8%	(18)	69%
	HARDWARE USED				
1	Multimedia projector	(293)	95%	(280)	96%
2	Computer to teach	(284)	92%	(255)	91%
3	Computer lab	(279)	91%	(251)	90%
4	Smart Board**/*	(95)	63%	(73)	78%
5	Digital textbooks available online	(82)	27%	(52)	64%
6	Clickers*	(78)	25%	(57)	73%

TABLE 1, PART 2	RANK ORDER FOR FREQUENCY OF USE OF ICTS BY TEACHERS AND STUDENTS' PERCEPTIONS OF THOSE THAT WORKED WELL (NUMBER AND %)		
RANK	TECHNOLOGIES USED BY TEACHERS, ACCORDING TO STUDENTS		TECHNOLOGIES THAT WORKED WELL, ACCORDING TO STUDENTS
ONLINE TOOLS			
1	Online submission of assignments	(273) 89%	(255) 95%
2	Videos	(208) 68%	(174) 84%
3	Style guides	(200) 64%	(35) 18%
4	Blogs	(94) 30%	(57) 61%
5	Collaborative work online (e.g., Google Docs)	(79) 25%	(49) 62%
6	Wiki sites*	(73) 24%	(54) 76%
7	Portfolios	(56) 18%	(48) 86%
8	Podcasts*	(28) 9%	(20) 71%
COMMUNICATION TOOLS			
1	E-mail	(261) 85%	(225) 87%
2	Discussion forum	(111) 36%	(58) 53%
3	Virtual office hours*	(93) 30%	(79) 86%
4	Chat rooms	(66) 21%	(39) 59%
5	Instant messaging	(28) 9%	(5) 46%
SOCIAL NETWORKING			
1	Facebook	(45) 15%	(25) 56%
2	Twitter	(17) 6%	(9) 56%
3	LinkedIn	(11) 4%	(7) 64%

Note: Ranking is done by percentage of students who said the technology was used, and not by the total number of students.
*   The technology worked well according to the students but was used infrequently by teachers.
** Smart Board percentages are based only on the English language college. Ranking is done by percentage, not by the total number of students.

This table highlights that according to the students, many technologies used by more than 90% of teachers seem to have a positive effect on their learning. Noteworthy among these are:

- grades available online;
- course outline available online;
- assignments and course notes available online;
- online submission of assignments;
- presentation software;
- hardware used (multimedia projectors, computers used to teach or computer labs).

According to students, several technologies did not facilitate their learning. At least one third of respondents indicated that the following did not work well for them:

- digital textbooks;
- blogs;

- discussion forums and/or chat rooms;
- instant messaging;
- all forms of social networking such as Twitter, Facebook or LinkedIn.

In contrast, students claimed that certain ICTs worked well for them even if their teachers did not use them, or only used them infrequently, such as:

- online tests and/or quizzes;
- technologies that could be used in class such as grammar tools and checkers, language learning software, simulations and virtual experiments, mind mapping and web conferencing;
- interactive whiteboards (Smart Boards);
- clickers;
- Wiki sites;
- podcasts;
- virtual office hours.

QUALITATIVE EXPLANATIONS FOR CERTAIN RESPONSES

For two research questions "Which of these technologies worked well for you?" (Question 5) and "Which of these technologies did not work well for you?" (Question 6) students had the opportunity to provide qualitative data to support their responses. Tables 2 and 3 show the comments most frequently made by students regarding the efficacy of various ICTs.

It is interesting to note that certain technologies are found in both the list of those technologies used in teaching that worked well, and those that did not work well.

TABLE 2	REASONS STUDENTS GAVE WHY CERTAIN TECHNOLOGIES WORKED WELL

1. PRESENTATION SOFTWARE: POWERPOINT

The software helps me to:
- easily keep track of what is being said during lectures;
- readily take notes;
- better understand the course material.

2. VIDEOS
- Videos facilitate the understanding of course material.
- Audio-visual media helps the teacher to explain the subject matter in class.

3. COURSE NOTES POSTED ONLINE
- Powerpoint presentations posted online can be referred to later.
- They can be used to study for exams.

4. COURSE MANAGEMENT SYSTEM: FEATURES
- Calendar allows students to keep track of assignment due dates and teachers' office hours.
- Practice quizzes available online.

5. GRADES POSTED ONLINE

Having my grades online lets me:
- access my results quickly;
- know if I should be focusing on a specific course;
- receive instant feedback.

TABLE 3	REASONS STUDENTS GAVE WHY CERTAIN TECHNOLOGIES DID NOT WORK WELL

1. PRESENTATION SOFTWARE: POWERPOINT
- Moving too quickly through slides; the teacher does not spend adequate time on each topic.
- The information on the PowerPoint is sometimes too vague and the slide is often too cluttered.

2. TEACHERS' KNOWLEDGE AND USE OF TECHNOLOGIES
- The teacher spends more time trying to operate the technologies than teaching.
- Links do not always work.
- Uploaded files do not always open.

3. ONLINE COMMUNICATION
- Sometimes teachers do not respond to students' emails.
- Certain synchronous communication tools are a hassle to use.
- Occasionally there are too many different means of communication (Facebook, email and Twitter).
- Doing group work in an online discussion forum is difficult as peers don't necessarily respond in a timely fashion.

4. COURSE MANAGEMENT SYSTEM: FEATURES
- Materials are sometimes uploaded late; this does not allow student adequate time to prepare for the course.
- There are occasionally too many course management systems to consult (including teachers' own web sites) which causes confusion, wrong dates of exams or quizzes listed on the calendar.

5. PERFORMANCE OF TECHNOLOGY AT COLLEGE
- Technology does not work and interferes with the class because teaching and learning can't take place as planned.
- Certain videos have no sound.
- Portions of the course management system do not work.

STUDENT SUGGESTIONS

The last question (7) of the survey asked students to provide suggestions to teachers who would like to use technologies more efficiently in their courses in order to facilitate learning. Table 4 lists the top 10 ICT-related suggestions, along with examples, in rank order from the most to the least popular. Even if we are targeting suggestions directed towards teachers, some of the responses were more about the college infrastructure. However, as they rank high on the list, we have included these suggestions.

TABLE 4	TOP TEN STUDENT SUGGESTIONS ABOUT HOW ICTS CAN BE USED MORE EFFECTIVELY

INFRASTRUCTURE

1. **Use and availability of technology at school (22%)**
   - Install more wall plugs.
   - Make more printers available.
   - Provide better access to computer labs.
   - Expand the Wi-Fi coverage.
   - Install more Smart Boards.

2. **Performance of technology at school (19%)**
   - Improve the quality of the projectors.
   - Improve the speed and accessibility of Wi-Fi.
   - Increase the speed of computers in the computer labs.
   - Make sure that all technology is working (speakers, webcams etc.).
   - Purchase more licenses leases.

TEACHER-RELATED

3. **Teachers' knowledge and use of technology (19%)**
   - Make sure that all teachers have a basic understanding of how a projector and a computer work.
   - Make sure that technology does not replace the teacher but rather that it is used as a tool to support teaching.

4. **Presentation software: PowerPoint (19%)**
   - Use more visual supports such as PowerPoint during lectures.
   - Create PowerPoint presentations that highlight key terms, include interesting visual components like photos and have slides with less text.
   - Avoid presentations where the teacher simply reads the PowerPoint.

5. **Course Management System: Features (due dates; calendar; on-line practice/exercises) (18%)**
   - Post course announcements online (e.g. notifications).
   - Upload practice exams/questions/quizzes/exercises.
   - Use a single course management system.
   - Create a calendar online.
   - Put a digital version of all documents online.

6. **Allowing use of personal technology in class (17%)**
   - Allow students the option of using their personal technologies for note taking.
   - Allow students to use smartphones to record lectures and to look up definitions or verify information.

7. **Online communication (14%)**
   - Allow classroom group chats where classmates can talk to each other and to teachers at specific times.
   - Provide online office hours (e.g. by Skype).
   - Do not use social media because not all students use this.
   - Answer quick questions by email, rather than forcing students to attend office hours.

8. **CMS course notes posted online (13%)**
   - Post PowerPoint class notes on the CMS.
   - Post course notes online before the class to allow students to prepare.

9. **Videos (11%)**
   - Use short videos.
   - Use videos that are easy to access, like on YouTube.
   - Use more videos as examples and illustrations.

10. **Interactive white board: Smart Board (11%)**
    - Provide more substantial notes on the Smart Board, rather than just using it for exercises and examples.
    - Allow the use of Smart Boards for group exercises.

SOME REFLECTIONS ABOUT THE USE OF ICTS

According to our research, students obviously like courses where ICTs are used and they want to be able to use their own technology in class, be it a laptop, a tablet or a smart phone. This is in line with other recent studies (Belardi, 2015; Schaffhauser, 2015). These findings should encourage teachers to continue to integrate ICTs in their courses. Moreover, they should motivate teachers to allow students to use their own technological tools to class.

Some teachers may be concerned that all of these personal technologies are used for non-educational purposes such as browsing Facebook, searching the Internet, or sending personal text messages. This is a contentious issue (Fischman, 2009); studies have shown that multitasking in class results in substandard learning (Dietz & Henrich, 2014) not only for the user but also for those who can see the user's screen (Sana, Weston, & Cepeda, 2013). However, there are numerous benefits for students to use their devices in an educational setting: to take lecture notes, look up definitions and verify information before asking a question in class, etc. Another frequently controversial issue is the request by students to record lectures. The educational benefits are obvious for students with disabilities. It is up to the teacher to assess for themselves how comfortable they are with various requests and to establish personal guidelines that suit them.

Table 1 and Table 2 highlight the ICTs college teachers use and which ones the students prefer. Overall, there is consensus that the most popular forms of ICTs used by teachers were also the ones which students said worked well for them. At the same time, it is concerning that there are several forms of ICTs that many students indicated worked well but were used infrequently by teachers. The latter should take note of these technologies and attempt to make greater use of them in their courses.

Students clearly like courses where ICTs are used and where they to have the opportunity to use their personal technology such as laptops, tablets or smartphones in class

While students liked courses with online learning resources, they did not seem to like digital textbooks, even though they potentially have many advantages over paper textbooks: they are cheaper, make it easier to search for word definitions, are accessible to students with print impairments and are compatible with many portable devices. However, digital textbooks have drawbacks such as causing eye strain, having complex navigation tools, requiring an Internet connection to access them and enforcing an expiration date (many digital books expire and therefore become unavailable after a pre-defined period of time) (Mann, 2013). Once students have experience with digital textbooks, however, they are more likely to use them in the future (Dennis, 2011; Weisberg, 2011). If a teacher decides to use digital textbooks, in order for the students to

benefit from this format they would need to be shown how to use them effectively.

Table 3 presents qualitative data on the negative comments reported by the students. It is in the teacher's best interest to evaluate their own practices to ensure that common errors are avoided and to use ICTs as effectively as possible within their classes.

Finally, Table 4 allows us to think about students' suggestions regarding the integration of ICTs into the classroom. They want teachers to be more proficient with technology and want ICTs to be better integrated into pedagogy rather than to be used without a clear pedagogical purpose. Moreover, students suggest that teachers teach them how to use any technology required for the course.

The survey allowed us to better understand our students in terms of their experiences with and perceptions of ICTs used in the classroom. Their views are, of course, subjective as we have no objective measure of performance. As well, students may not always know what is best for them in terms of their learning. Although our findings cannot prove that learning is actually improved by the use of ICTs, the findings can provide insight into three fundamental aspects: current ICT-related practices among college teachers, ICTs that are considered engaging versus non-engaging by students and what ICT-related teaching practices students feel need to be improved for more successful integration of ICTs in colleges. ◑

THE ADAPTECH RESEARCH NETWORK

Based at Dawson College, the Adaptech Research Network consists of a team of academics, students and consumers. Since 1996 it has conducted research on the use and accessibility of information and communication technologies in postsecondary education, on the facilitators and barriers to academic success, and on free or inexpensive software useful to students with various disabilities.

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