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Factors that Influence College Faculty to Adopt Digital Technologies in their Practice

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Abstract[61]

College faculty in Ontario are using a variety of digital technologies, at differing levels, in their teaching and learning practices. College administrators are looking to faculty to help meet the challenges associated with increasing enrolment and the need to deliver curriculum to a diverse student population with a range of learning needs who have unlimited access to information and communication channels through the World Wide Web. This research provides some understanding of specific motivating factors that have led many in community college faculty to adopt digital and Web technologies into their teaching and learning practices as well as those factors that may lead other college faculty to adopt similar technologies into their practices. Data collection was undertaken using a mixed-method approach in an effort to fully realize and categorize the factors necessary in a faculty decision to adopt digital technologies into their teaching practice. Findings indicate that digital technologies are employed by faculty in some cases only to achieve efficiency in communication and administrative tasks favouring traditional teaching methods in their classrooms. Others are exploring and experimenting in exciting new ways with digital technologies in an effort to enhance the learning experience for their students in and out of their classrooms. Many factors have also emerged that should be considered by college administrators when attempting to motivate faculty to adopt digital technologies when assigning workload, providing support and training, as well as by faculty deciding on the overall approach to teaching and learning, all of which carry with them financial and cultural implications.

Key Words[62]: motivation, adoption of digital technology, teaching and learning, theory of planned behaviour, postsecondary education, college of applied arts and technology

Research Context

The tools that individual learners use are changing the way collaboration and critical thinking occurs as well as transforming the roles of faculty who facilitate the learning (Siemens, 2010). The 2013 Horizon Report for Higher Education (Johnson et al., 2013) reports that today's workforce requires graduates to possess communication and critical thinking skills that can be nurtured through the type of informal learning afforded by new and emerging Web and digital technologies. The rapid advancement of Web and digital technologies has created an atmosphere for today's learner that provides access to content and experiences far beyond what the traditional learning environment of the late 20th century provided allowing now for rich collaborative problem-solving and self-directed learning experiences (Groff, 2013). Existing, new and emerging digital tools in use and coming available for use in higher education include Learner Management Systems (LMS),

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[61]This work is based on the author's Master's thesis and portions of this paper and data reported on can be directly attributed to that thesis. Correspondence concerning this article should be addressed to Kevin Dougherty, School of Business, IT and Management, Durham College, 2000 Simcoe St. N., Oshawa ON Canada L1H 7K4.
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[62]Wherever the words behavioural or behaviour appear within a direct quotation, or as part of a theory name taken from existing research, the American spelling, *behavioral* or *behavior* are used when it reflects the spelling used in the original source. In the remainder of the text the English spelling, *behavioural* or *behaviour* are used.

blogs, wikis, social media, video and image sharing, simulations, games and gamification, handheld and tablet computing, digital cameras and scanners, Web apps, virtual environments, augmented reality and wearable technology (Groff, 2013; Johnson et al., 2013).

A full understanding of faculty beliefs and teaching needs regarding the adoption of a specific digital technology into their personal teaching practices is essential. With this understanding, the organization can help promote the personal benefits of adoption to individual faculty by demonstrating a degree of perceived usefulness that will entice faculty to move toward adoption (Sugar, Crawley, & Fine, 2004). Overall, given the time to train, implement and reflect on the impact of the technology on their practice, individual faculty may become motivated to continue on to further adoption of digital technologies and may be further motivated to become change agents for the adoption of technology (Huang & Jabor, 2011; Sugar et al., 2004).

It may prove beneficial to engage those who have successfully adopted in discussion with other faculty in an effort to build a "collaborative professional practice – actively exploring new ideas, with colleagues, and vetting them for effectiveness together" (Groff, 2013, p. 23). Faculty are continuously attempting to understand and balance the numerous innovative approaches to teaching and learning with, and without, technology that are presented to them on a regular basis (Fullan, 2007). Any innovation involving the adoption of new digital or Web technologies must fit within each faculty's learning environment and within their pedagogical beliefs for that environment (Levin & Wadmany, 2008). These technologies should not be mandated by the institution without this consideration. Rogers (2003) maintains that "adoption or rejection is always 'right' in the eyes of the individual who made the innovation-decision….individuals' own perceptions count in determining their innovation behavior" (p. 116).

The study reported on in this paper attempted to address an apparent misalignment in faculty adoption with institutional needs and student demands using the guiding research question: What factors influence college faculty to adopt digital technologies in their practice?

Theoretical Framework
With the focus of the study being on factors affecting an adoption, it was necessary to examine the concepts associated with the resulting or desired changed behaviours, as well as concepts around the intents and the beliefs affecting a decision to adopt. Accordingly, Taylor & Todd's, (1995) decomposed theory of planned behavior (DTPB) presents itself as a most appropriate framework for studying this problem. This model actually encompasses two other important theoretical models, both highly relevant to this study: the theory of planned behavior (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1986). The decomposed theory of planned behavior suggests that an individual's actions are based on their *behavioural*[1] *intentions* and perceived behavioural control toward the action (Ajzen, 1991). Within the context of the adoption of technology, the individual's intention to adopt a technology also depends in large part on their *attitudes* and beliefs

regarding the technology (Davis, 1986). It became clear through a review of existing research that motivating factors could be grouped into one of two broad categories, personal or *intrinsic* factors and institutional or *extrinsic* factors (Levin & Wadmany, 2008; Taylor & Todd, 1995; Davis, Bagozzi & Warshaw, 1989). Additionally, the existing research indicates that demotivating factors could be at play in preventing faculty from adoption. While looking at all possible intrinsic and extrinsic factors it is important to consider which factors may act in a *positive* way and which may act in a *negative* way in the decision to adopt digital technologies (Levin & Wadmany, 2008; Taylor & Todd, 1995; Davis et al., 1989).

For this study, the DTPB was modified (Figure 1) in an effort to better identify the intrinsic and extrinsic factors that may inform college faculty attitudes toward, and behavioural intention to adopt, digital technologies into their teaching practice. Those factors include: perceived ease of use and perceived usefulness of a technology; subjective norms such as peer, administrative and other institutional influences; perceived behavioural control, based on a combination of institutional supports and self-efficacy or the individual's belief in their own abilities (Bandura, 1997); and a measure of compatibility between an individual's attitudes toward a technology adoption and the institutional norms regarding the adoption of a technology.
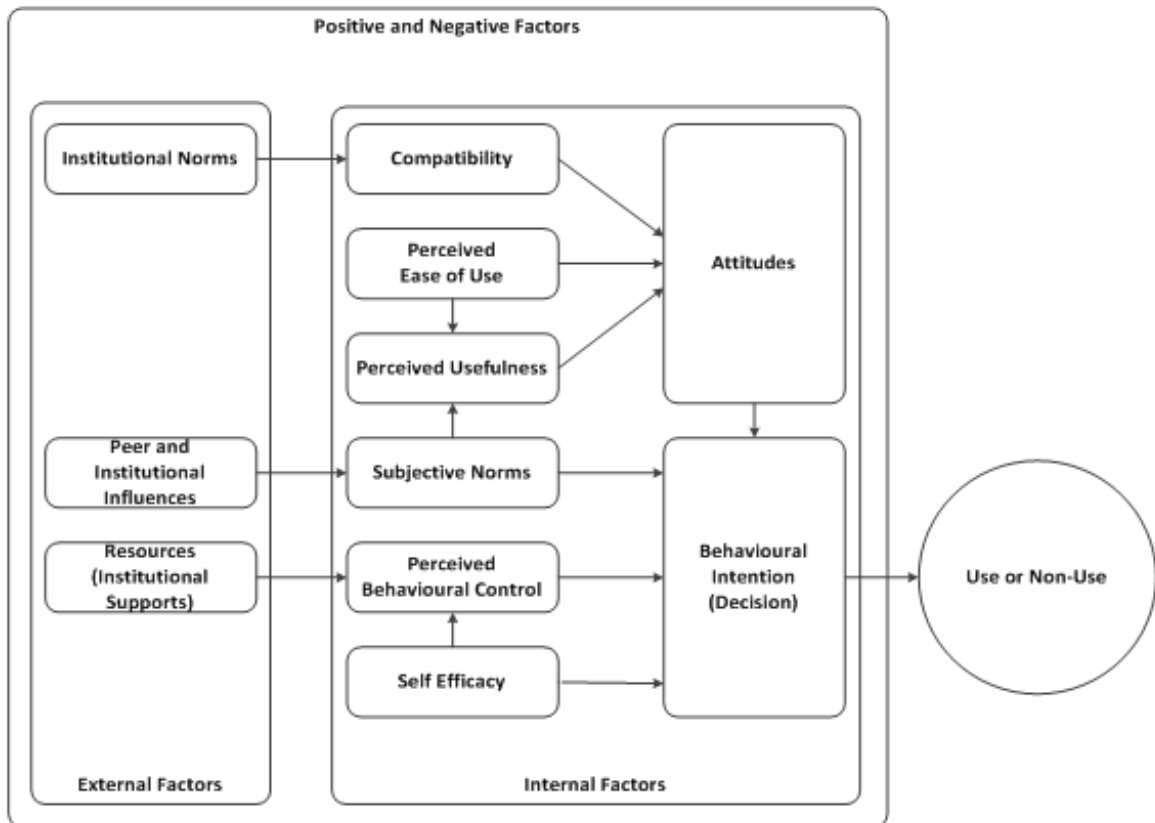

Figure 1. Modified decomposed theory of planned behaviour (DTPB).

The theoretical framework implement in this study of understanding factors that influence college faculty in deciding to adopt digital technologies in their practice.

The first modification to the DTPB was to group factors into clusters of intrinsic and extrinsic factors that may have an effect on an individual's attitudes or behavioural intention but do not directly influence an individual's behaviour (Ajzen & Fishbein, 1980). To this, Davis et al. (1989) further assert that outside of personal or intrinsic factors, external or extrinsic factors can only indirectly influence behaviour. A second modification to the DTPB was to acknowledge that all factors may influence an individual's behaviour positively or negatively. Self-efficacy has an effect on behaviour directly and indirectly by influencing an individual's intention to perform a given behaviour (Bandura, 1997). It is with this in mind that a third modification was made to the DTPB for the purposes of this study that sees self-efficacy included as both an indirect and direct predictor of behavioural intention. Taylor and Todd (1995) found that perceived usefulness can be directly affected by perceived ease of use further supporting Davis (1986) in his claim that "all else being equal, a system which is easier to use will result in increased job performance" (p. 26). This assertion was supported by Venkatesh and Davis (2000) in their study, in which they found that perceived ease of use directly determined perceived usefulness. For this study, the DTPB includes a fourth modification to indicate perceived ease of use as a determinant of perceived usefulness. Venkatesh and Davis (2000) further found that subjective norms influenced perceived usefulness in a significant manner. Accordingly, a fifth modification was made to the DTPB for this study to include subjective norms as a determinant of perceived usefulness.

Methodology

During the spring and summer semesters and ending in October of the fall semester of 2013 a survey was conducted with the aim of building an understanding of the factors that influence college faculty in deciding to adopt, or not to adopt, digital technologies in their practice. Participants to the survey were invited from four Ontario community colleges, Confederation College, a small, rural college in northern Ontario, Durham College, a medium to large college in Durham Region just east of Toronto and two large city colleges, Centennial College and Seneca College, both in Toronto. Prospective participants to the survey were invited through email by a representative from each of the centers for teaching and learning at each of the four colleges. The survey was completely voluntary and was open to all full-time and part-time faculty at all four colleges. In total, 273 participants from all four colleges across all college disciplines and a wide variety of college programs completed the survey.

The online survey had five sections, questions in the first section were aimed at defining each participant in terms of: gender; age; years of teaching experience full-time, sessional and part-time; and program areas that they currently teach in or have taught in. The second section was designed to determine the types of, and current level of use of, digital technologies for teaching and learning (DTTL) by each respondent in five categories; (a) communicating with students, (b) delivering learning materials to students, (c) assessing students, (d) providing feedback to students, and (e) managing student grades. The third section of the survey was adapted from existing studies (Taylor & Todd, 1995; Ajjan & Hartshorne, 2008; Huang & Jabor,

2011) and concentrated on determining a respondent's belief system with regard to the adoption of DTTL into each respondent's practice. Statements in this part of the survey allowed for responses measured against a five-point Likert scale with levels of agreement including disagree, slightly disagree, neutral or not applicable, slightly agree, and agree. These statements were each aligned to one discrete factor from the modified DTPB with the intention of gaining insight into factors that may influence faculty to adopt, or not to adopt, DTTL into their teaching practice.

In the spring semester of 2014 a smaller group of 14 faculty members from three of the four colleges took part in individual, face-to-face interviews. The five males and nine females who came forward represented a diversity of teaching experiences and levels of adoption, and resistance to adoption, of digital technologies in their practices. The interviews were semi-structured in design and included 12 open-ended questions with three additional supplemental questions that were asked dependent upon the interviewees' previous responses. The questions, like the online survey, were designed using the modified DTPB as a guide with the purpose of allowing each interviewee to fully express their personal comfort level with digital technologies and what factors led to their past, or impending, DTTL adoption decisions. Time was allotted for each interviewee to comment on what might motivate them to initiate a change, or further change, in their practice based on the introduction of DTTL.

Research Data

Survey Responses
The study was not intended to look at adoption or motivation to adopt by a population but focused on building a list of motivating factors using the modified DTPB as a framework for classification of those motivators. Therefore, all survey data gathered on faculty DTTL usage and their views regarding the use of DTTL in their practice were examined using frequency measures. The objective of this approach was to obtain the range of levels of usage of various digital technologies by college faculty as well as their levels of agreement with the survey statements which were each associated with discrete factors defined in the modified DTPB.

One of the potential discrete factors that emerged through responses to a question regarding intuitional supports may be the availability of time for faculty to integrate DTTL into their practice. Figure 2 illustrates the level of agreement by respondents to the statement "My College supports me with release time and/or professional development to integrate the use of DTTL into my teaching practice". For roughly half of the 266 survey respondents who took part in this section of the survey time may be a factor to consider in an adoption decision.

Frequency measure of agreement to the survey statement aligned to the institutional supports (IS) factor found in the modified DTPB that addresses the availability of time for faculty to integrate DTTL into their teaching practice. Two hundred and forty four survey participants took part in the open-ended questions section of the survey with all answers to this section of the survey remaining anonymous. Once the answers to all open-

ended questions were compiled, they were reviewed and analyzed based on the objective of each question. The approach employed was to code for specific themes emerging from each set of responses followed by identification of any factor or factors from the modified decomposed theory of planned behaviour (DTPB), the theoretical framework for this study, that could be attributed to each response and theme identified.
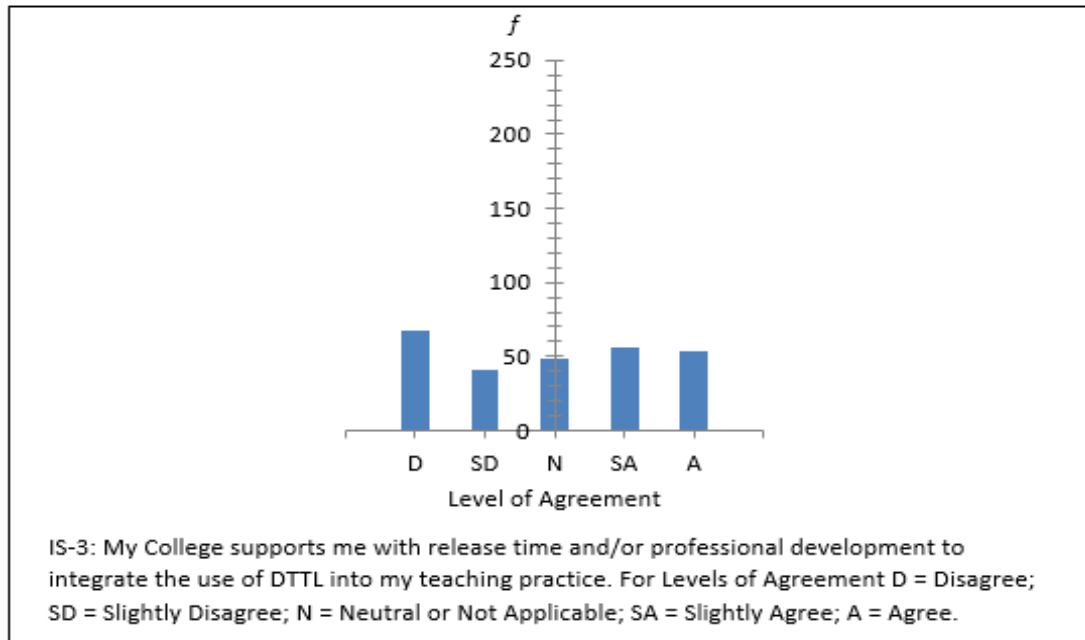

Figure 2. Responses to an institutional supports statement.

As an example, the third open-ended question in this section asked participants to identify what it is that they might require from their Dean, or any other college administrative leader, as an incentive to adopt digital technology into their teaching practice. This question was designed to elicit specific details of the institutional supports or resources factor from the modified DTPB that could encourage faculty to move toward the adoption of DTTL. Coding on this question was first undertaken to confirm that responses were aligned to the institutional supports or resources factor from the modified DTPB or to identify any other factor or factors that emerged from the responses. A second pass of coding was undertaken to identify the specific details of those factors with the intention of creating a list of tangible actions or incentives that college administrators could provide, or employ in the effort to increase usage of DTTL by their faculty.

The majority of responses to this question indicated various resources or institutional supports as key factors that may influence faculty to adopt DTTL in their practices. Resources and other institutional supports, or facilitating conditions have been shown to be determinants of perceived behavioural control leading to intention to use digital technologies (Lau, 2011; Taylor & Todd, 1995). With regard to digital technology usage, those resources and supports include the following tangible items and incentives: (a) time; (b) training; (c) the availability of, and access to, technology; and (d) the infrastructure and personnel to support the technology (Lau, 2011; Taylor

& Todd, 1995). Close to half of the respondents to this question indicated that the availability of time was crucial to their development of the skills necessary to implement the tools provided, to learn about or experiment with those tools that might best fit their practice, to manage the new demands of using DTTL, or to develop materials using a new DTTL. Some responses explicitly aligned time with the need for financial compensation for additional workload time to investigate various tools, learn the skills necessary to employ the tools and to develop course materials using those tools as illustrated in the following sample response.

> *Survey Participant Response: Perhaps add time to SWF (Standard Workload Formula) to take courses during the academic year or allow faculty to use training as PD during spring/summer period. Pay for courses that must be taken outside of the college due to [overtaxed] resources within the college…unable to accommodate my schedule to allow me to take a course in online creation. I have classes scheduled at the time the next course is being offered. (IS), (Time, Financial Support)*

This is consistent with Finley and Hartman (2004) who found that funded release time to experiment with technology to be essential when requiring faculty to consider significant changes to their teaching practice. Furthermore, Owen and Demb (2004) found faculty were frustrated in part due to "the fact that their efforts are not captured in old workload models whose structure does not accommodate this new work, thus failing to provide the base for appropriate recognition and reward" (p. 663).

Interview Responses

The semi-structured interviews provided an opportunity for the 14 individual participants to fully express their personal comfort level with digital technologies and what factors led to their past, or may lead to their impending, DTTL adoption decisions. To maintain confidentiality, all interview data was encoded with a random alphanumeric identifier in place of each interviewee's name. The repetitive interaction with the information gathered from the interview process allowed the interviewer to develop a very clear picture of the data and the themes as they emerged throughout the data collection, transcription and preparation processes.

Coding was initially carried out on five sets of interview data according to the specific themes that emerged from each set of responses followed by the identification of any factor or factors from the modified DTPB that could be attributed to each response and theme identified. Once coding was completed on the initial five sets of interview data the remaining nine sets of data were examined and coded to seek out any differing themes or factors that appeared inconsistent with the initial five sets of data. Although the investigation of the remaining nine sets of interview data did not reveal any new information that hadn't been revealed through the first five sets, overall this approach resulted in additional evidence of the validity of a number of factors to be considered by administrators looking to increase the level of adoption of DTTL by college faculty in Ontario.

One of the interview questions asked interviewees to "describe the role of the dean and college leaders in supporting or enabling adoption of a digital technology in [that interviewee's] practice". This question was designed, in part, to discover any institutional supports that must be in place to enable a successful adoption and could be provided by the interviewee's dean or other college leaders. The first level of coding applied to the responses to this question determined that, in fact, all 14 interviewees saw a role for their deans and other administrators when it came to the individual interviewee's own DTTL adoption decisions.

A second coding pass was made to identify the types of roles college deans and administrators held, or should hold in the opinion of the interviewees. A final coding pass undertaken on the responses to this question to align the roles identified to factors from the modified DTPB and the three factors that emerged were, in order of the frequency with which they occurred were: (a) resources or other institutional supports, (b) perceived behavioural control, and (c) institutional norms.

With regard to resources or other institutional supports, many of the roles that interviewees saw for their deans and other college administrators fall under the categories of support for time, training and licensing of software and facilitating technical or classroom support all of which require financial support. Lau (2011) and Taylor and Todd (1995) both found institutional supports, or "the availability of resources needed to engage in a behavior, such as time, money or other specialized resources" (Taylor & Todd, 1995, p. 150) to have a direct impact on perceived behavioural control in an adoption decision. The following two individual interviewee responses highlight some of those different institutional supports (IS) that deans and other college administrators could provide.

> DT75J9 Response: I think the obvious role is to provide me with time to learn, the expertise to support me in that learning but I think their other role is to fully understand what it is that they are asking of me. (IS), (Time)

> DT75Q3 Response: Well, I guess more I think about support, there are different technologies I'd like to have access to that we don't have licences or institutional support for so that would be where I'd see from a higher level, where they would maybe be responsible for that...finance and other resources, a lot of the time, we need support from IT. (IS), (Licensing, Financial, Time, IT Support)

Interpretation

Current DTTL usage. From the data, it appears that faculty are currently using, and looking to increase their use of, digital technology in their teaching and learning practices to communicate with students, deliver learning materials and content to students, assess student progress, provide feedback to students on their progress, and to manage student grades.

DTTL usefulness and added value. DTTL tools are perceived by the

respondents as useful by faculty, however, the degree of usefulness is tempered by reservations regarding the appropriate use of DTTL to support teaching and learning within faculty members' practices and with regard to specific subject matter needs.

Pressures to increase DTTL usage. It appears that deans and other administrators from the study sample are applying pressure on faculty to utilize the institutional LMS for a variety of tasks and to varying degrees college to college. With regard to the development of online and hybrid courses some faculty are feeling pressured to move to this type of course delivery based on recommendations or suggestions from their deans. Although not mandated, the sense is that there is an expectation by college leadership that more online and hybrid course development should be undertaken by faculty.

Time as a factor leading to adoption of DTTL. Time was identified as a key factor necessary for faculty to feel comfortable in adoption of digital technologies for teaching and learning (DTTL), time to explore, time to experiment, time to learn, time to plan, time to collaborate, time to implement and time to evaluate DTTL. Administrators should consider providing time to faculty in a way that suits each faculty member's learning needs. "Teachers constantly feel the critical shortage of time. And there are few intensive, ongoing learning opportunities for teachers individually or in concert to deeply acquire new learning concepts and skills" (Fullan, 2007, p. 24)

Perceived Usefulness as a factor leading to adoption of DTTL. Faculty have a desire to understand if technology increases the learning for students in their practice or if it simply enhances the delivery of learning materials to their students. If faculty can see the benefit of adopting a DTTL in their practice in terms of enhancing teaching or managing content they seem to be inclined to move to that adoption.

Training as a factor leading to adoption of DTTL. It was suggested that any institutional strategy for training should include opportunities for training that allows for exploration of new and emerging DTTL as well as ongoing reviews of research on the effectiveness of the use of digital technologies for learning.

Other institutional supports as factors leading to adoption of DTTL. In addition to time, and the added cost of that time through modifications of faculty workload, many of the respondents see the need for improved institutional supports in terms of funding for external professional development and licensing of DTTL that differs from existing institutional technology. Furthermore, there is a need for improved efficiency and ongoing reliability of existing and new systems that provide a dependable user experience and reliable technical and classroom support. This all results in a further financial burden on institutions that are continually facing funding that is falling behind rising costs.

Institutional Norm as a factor leading to adoption of DTTL. College faculty are being encouraged to increase their adoption of DTTL in their practices, specifically with regard to the use of the institutional LMS, the development of new online and hybrid courses and the conversion of existing courses to hybrid or online. There is a belief that college leaders have a limited view of how DTTL should be implemented to best improve teaching and learning.

Compatibility as a factor leading to adoption of DTTL. Most faculty respondents maintain that they should be leading the research, planning, implementation and evaluation of DTTL rather than leaving it in the hands of college and IT leadership who may not necessarily understand the needs of students in a particular teaching and learning environment.

The rewards of successful DTTL adoption. The reward for faculty in a successful implementation of DTTL is perceived to come primarily from student success and an appreciation by students of faculty efforts. Recognition is also realized by faculty in the appreciation of their peers. Recognition of a faculty member's successful efforts could be provided by administrators through opportunities for faculty to share their own successes and experiences with other faculty in their program group, their school, across their college or at teaching and learning conferences.

Conclusion

The purpose of this study was to develop a list of factors that influence college faculty in a decision to adopt digital technologies in their practice. This was accomplished through an examination of current usage levels of digital technologies for teaching and learning (DTTL), the factors behind the decisions to adopt those DTTL in individual faculty's practices, concerns that faculty have regarding further adoption of DTTL in their practice, faculty views on where DTTL should be situated in a teaching and learning practice, and whether or not DTTL is changing teaching and, or, learning in any significant way. Given the necessary time and opportunity to learn the skills, collaborate with their peers, and implement successful changes to their teaching and learning practices, as measured by student success, through the adoption of DTTL and rewarded with rich opportunities to share their experiences with other faculty, college administrators may realize an increase in the usage of digital technologies by faculty.

Future researchers in this area should consider including faculty focus groups in an effort to leverage the sense of community and collaboration that emerged through the interviews undertaken in this research. A longitudinal approach to this research could test the prevalence and progress of adoption over time. Any further research should include a larger population in an attempt to build a comprehensive list of all of the factors at play in a decision to adopt DTTL in a teaching practice.

The modified decomposed theory of planned behaviour (DTPB) implemented in this study appears to be a sound framework for the study of digital technology adoption decisions by college faculty. Future research using the modified DTPB as a framework could look at digital technology behavioural intentions, or decisions to adopt by college students in Ontario. Armed with such research those results could be compared with the results of this and other research on faculty decisions to adopt to discover if the factors at play in adoption decisions for students are in any way similar to the factors that influence faculty decisions in adoption of DTTL. Such research might yield some interesting data on the alignment of desired levels of adoption or whether current faculty adoption of digital technologies aligns with student learning needs.

This research study has given rise to a number of questions regarding the culture of faculty groups, the need for institutional change, and the best approach to teaching and learning for students attending college. This study has also identified a number of challenges regarding implementing the changes necessary for an enriched learning environment that leverages the power of digital technologies, the capacity that colleges have in supporting and financing those changes, and the need for faculty to re-evaluate their roles in their own teaching and learning practice and their current approaches to teaching and learning.

Digital technologies offer the opportunity for faculty and students to reshape their teaching and learning environments, and redefine the roles of teacher as the provider of content and student as the consumer of content. Working with digital technologies inside and outside of the physical or virtual classroom, faculty and their students can become partners in teaching and learning through improved interactions and access to content. With the enriched learning environments that digital technologies can support and encourage, colleges in Ontario could become leaders in providing learning that nurtures the development of real-world problem solving and communication skills required by today's and future graduates. Additional and ongoing research is essential to building an understanding of how faculty culture and institutions can support the changes necessary and to identify the best approaches to implementation of appropriate digital technologies that would best support learning for today's students as well as future generations of college learners.

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