Refereed paper

Emergency medicine residents' beliefs about contributing to a Google Docs™ presentation: a survey protocol

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ABSTRACT

Background Web 2.0 collaborative writing technologies have shown positive effects on medical education. One such technology, Google Docs[TM], offers collaborative writing applications that improve healthcare students' sharing of information. Since 2008, all graduating residents in emergency medicine in Canada have had access to an online Google Docs[TM] slideshow designed to help them share summaries of landmark articles in preparation for their Royal College of Physicians and Surgeons of Canada certification exam. A recent evaluation showed that contributions to the presentation were low.

Objective This study will identify the factors that influence residents' decision to contribute or not to contribute to this online collaborative project.

Methods Using the Theory of Planned Behaviour, semistructured interviews will be conducted with 25 graduating emergency medicine residents in Canada. Content from the interviews will be analysed to determine the most important beliefs in relation to the defined behaviour.

Conclusion To our knowledge, this study will be the first to use a theory based framework to identify healthcare trainees' salient beliefs concerning their decision whether to contribute to an online collaborative writing project using Google Docs[TM].

Keywords: cooperative behaviour, internet, medical education

Introduction

The advent of the World Wide Web (Web) in 1991 created a host of innovations in medical education.[1,2] Twenty years later, another internet innovation, Web 2.0, is again expected to change the way we teach medicine.[3–7] Web 2.0 is a term used to describe a group of loosely related network technologies (cloud computing) that share a user-focused approach for creating content and facilitating open collaboration between individuals.[8] The interactive content of Web 2.0 contrasts with the static content of the older Web 1.0, where few people had the power to modify content. In medical education, new collaborative Web 2.0 technologies, such as Google Docs[TM], are rapidly gaining popularity in medical schools around the world because they support collaboration and the decentralised production of content.[3,4,8–13] Google Docs[TM] is a series of free web-based applications that offer a word-processing program, a slideshow program and a spreadsheet program similar to Microsoft Office[TM]. Google Docs[TM] applications allow multiple authors to contribute synchronously and asynchronously to a single document.

In 2008, the research team used the Google Docs[TM] application to create a collaborative online presentation (a Google Docs[TM] slideshow named *Literature review for the RCPSC exam*) designed to help graduating emergency medicine residents share summaries and brief critical appraisals of landmark articles they had to read for the Royal College of Physicians and Surgeons of Canada (RCPSC) certification exam (see Box 1).

The central underlying principle of this online presentation is to foster broad collaboration among emergency medicine residents in Canada and to maintain an up-to-date database of summaries of articles important to the RCPSC's annual certification exam. The Google Docs[TM] online slideshow allows all who access it to work on it synchronously and asynchronously. The application keeps track of each change so that nothing is ever lost. Users access the slideshow by invitation only; invitations are moderated by the principal author of the online presentation (PA). The Google Docs[TM] slideshow supplements a 3.5-day review

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Box 1 The Royal College of Physicians and Surgeons of Canada (RCPSC)

Founded in 1929, the RCPSC is the national professional association that oversees the medical education of all specialists in Canada. It sets standards for postgraduate medical education, accredits specialty residency programmes, and develops and administers certification examinations. Certification exams (oral and written components) are completed after four or five years of residency training, according to the specialty. The College also supports lifelong learning through a maintenance of certification programme for practising specialists.

Data from Royal College of Physicians and Surgeons of Canada. 2011. http://rcpsc.medical.org/

course offered to fifth-year residents enrolled in a RCPSC training programme in emergency medicine (see Box 2). The author (PA) has presented the slideshow to three groups of graduating residents (2009–2011). This slideshow, which now contains 142 articles, remains accessible after the course. This Google Docs[TM] slideshow is part of an ongoing pilot project.[10]

Efficacy of Web 2.0 in education

A recent meta-analysis (2008) assessing the efficacy of internet-based learning in medical education indicated that such learning has a consistently positive effect when compared with no intervention or to any off-line intervention.[14] None of the internet-based interventions studied in the review were based on Web 2.0 technologies.[15] Nonetheless, the few studies published to date tend to show greatly positive effects of using collaborative Web 2.0 technologies like Google Docs[TM] to complement regular teaching methods.[4,16,17] For example, the first randomised study[16] to demonstrate the efficacy of an online collaborative writing technology in healthcare education showed a very positive effect on the quality of scientific manuscripts written collaboratively by students using Google Docs[TM] compared with manuscripts written by students not using Google Docs[TM]. Furthermore, a recent survey[7]

of British medical students, consultants, general practitioners and medical residents showed high interest for the use of Web 2.0 technologies such as instant messaging, blogs, wikis, social bookmarking, media sharing and social networking in medical education. Nonetheless, the survey showed that the actual use of these technologies in social and educational settings was low. Another example is Wikipedia[TM], where 50% of all contributions come from 0.1% of editors.[18,19] This skewed distribution in the frequency of individuals contributing to free and open source projects has been described as the 'long tail' distribution where a large number of people make small contributions.[20–22]

An initial evaluation in January 2011 of the Google Docs[TM] project revealed similar results. Although all 108 of 111 residents in Canada who had attended the exam preparation course accepted the invitation to access the slideshow, only 12% (13/108) contributed 2.5% (59/2280) of all revisions made to the slideshow since its creation. These revisions include changing the order of the slides, adding slides or modifying slides. Only 1.8% (2/108) of the residents actually added slides, none of which summarised new articles. This means that the principal author of this slideshow (PA) summarised all 142 articles and performed 97.5% (2221/2280) of all revisions. Considering the valuable opportunities Google Docs[TM] offers for sharing information, residents' low contribution rate is surprising.

Box 2 The National Review Course and the Google Docs slideshow collaborative

National Review Course in Emergency Medicine
- Created in 2003 to assist graduating residents in the preparation to their certification exam from the Royal College (see Box 1).
- Held each year at Queen's University, Kingston, Canada.
- Review course lasts 3.5 days in the autumn of each year.
- Didactic sessions cover the most important topics in emergency medicine.
- Simulated oral exams prepare participants for their RCPSC oral exam.
- Course faculty members are content experts from various departments of emergency medicine across Canada.

Google Docs slideshow entitled *Literature review for (...) exam*
- Created in 2008.
- Complements a 90-minute didactic literature review of the most important landmark articles to know in emergency medicine, held during the course.
- Course participants are encouraged at the end of the didactic session to contribute their own critical appraisal summaries of landmark articles to the online collaborative slideshow.
- The online slideshow remains freely available after the course.
- It has been available online since 2008 to all those having attended the course.
- In addition to course participants, other individuals, e.g. course faculty members, emergency physicians, family physicians, junior RCPSC emergency medicine residents, emergency medicine residents from other residency programmes [residents in family medicine (College of Family Physicians of Canada)], have asked to be given access to the online collaborative to consult and add to its content.
- As of September 2011, 305 individuals (108 having participated in the National Review Course) have access and can contribute to the presentation.

Thus, before any of these applications is implemented in healthcare education on a wide scale, more research is indicated to determine ways to increase users' sharing of knowledge using Web 2.0 technologies.

Explanation of low contribution rates

Sustaining high usage rates of internet-based interventions is a known problem in past studies, a phenomenon called the 'law of attrition'.[23] However, few studies have explored the reasons for low contribution rates. One study has surveyed radiology residents about their intention to use a wiki, another collaborative writing Web 2.0 technology, but did not explore the determinants of this intention.[13] Still other studies have reported on barriers to users contributing to wikis on medical education,[4,7] but none has reported barriers to users contributing to a Google Docs™ application. The studies on wikis report that a lack of training in the use of wikis, a preference for more personal face-to-face learning, a lack of time, institutional policies and a lack of confidence inhibit users from contributing to a collaborative document. While these barriers help us understand part of why students do not contribute, we do not know what elements could encourage users to share their knowledge using an online collaborative tool. Neither does this study use a validated behaviour change theory like the Theory of Planned Behaviour (TPB) to systematically explore all barriers within the context of a well-defined behaviour. Our use of a validated theoretical framework will help paint a more complete picture not only of the barriers and facilitators associated with this behaviour, but also of attitudinal and normative beliefs. In so doing, our study will inform a theory based intervention to increase users' employment of collaborative online writing technologies like Google Docs™ to share their knowledge.

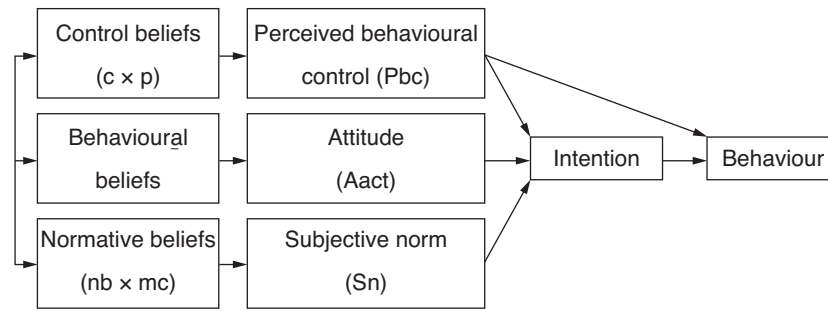## Conceptual underpinnings of the proposed study

This study will use the TPB to attempt to understand the factors that influence residents to contribute or not to contribute summaries of landmark articles to the online collaborative slideshow. The TPB[24] (Figure 1) is a well-known theory validated for the study of healthcare professionals' behaviour.[25–32] It provides a theoretical account of the ways that attitude, subjective norm and perceived behavioural control combine to predict behavioural intention.[33] It postulates that when an individual has some control over a situation, intention is the immediate determinant of behaviour. Perceived behavioural control can also be used to directly predict the behaviour if it reflects the actual control an individual has over the behaviour.[25] To apply the theory, academics employ methods and tools that have been replicated many times.[34–43]

According to the TPB, intention is influenced by three constructs: attitude, subjective norm and perceived behavioural control. Attitude ('Aact' in Figure 1) is defined as an actor's beliefs about the consequences (the advantages and disadvantages) of a behaviour. Attitude is assumed to have two interacting components termed the behavioural beliefs: beliefs about the consequences of a behaviour ('bc' in Figure 1), and judgements – positive or negative – about these consequences (outcome evaluation or 'e' in Figure 1). Subjective norm ('Sn' in Figure 1) refers to the perceived social pressure to engage or not to engage in a behaviour. Subjective norm is also assumed to have two interacting components named the normative beliefs, i.e. beliefs about how people who are in some way important to the actor would like the actor to behave (normative beliefs or 'nb' in Figure 1), and the actor's motivation to comply with these normative beliefs (motivation to comply or 'mc' in Figure 1). Finally, perceived behavioural control reflects the actor's perception of how difficult it is to perform a given behaviour. This perception is determined by control beliefs ('c') about the situational and internal factors that can inhibit or facilitate the actor's performance of the behaviour and the power of these factors (perceived power to influence, or 'p' in Figure 1). Different variables may be measured depending on the objectives of the research. Prediction of the behaviour may be obtained by measuring intention and perceived behavioural control. Understanding why certain individuals adopt the behaviour involves measuring attitude, subjective norm and perceived behavioural control. Finally, to obtain a more comprehensive understanding of the factors influencing the adoption of the behaviour, measuring attitude, subjective norm and perceived behavioural control and their associated beliefs (bc, e, nb, mc, c and p) is necessary.[25] However, research has demonstrated that simply measuring bc, nb and c is sufficient to obtain the information needed about the underlying factors influencing the behaviour.[44] This approach has the advantage of being shorter and more efficient because it leads to a reduction in the number of items presented to subjects. This helps reduce subjects' fatigue and boredom when answering repetitive questions. The information obtained is therefore more valid.

Objectives

The goal of this study is to identify residents' salient beliefs concerning attitude, subjective norm and perceived behavioural control that underlie their intention to contribute summaries of landmark articles in emergency medicine to an online Google Docs™ slideshow. The behaviour is described in detail in Box 3.

Equations

Intention = (β_1)Aact + (β_2)Pbc + (β_3)Sn

Aact ~ $\sum^n_{=i1}(bc_i \times e_i)$ Sn ~ $\sum^n_{=1}(nb_i \times mc_i)$ Pbc ~ $\sum^n_{=1}(c_i \times p_i)$ (44)

Legend

Behaviour: The behaviour under study

Intention: A person's readiness to perform the behaviour

Aact: Attitude toward the behaviour (the advantages and disadvantages)

bc: Beliefs about the consequences of a behaviour

e: Outcome evaluation (positive or negative judgements about these consequences)

Sn: Subjective norm (perceived social pressure to engage or not to engage in a behaviour)

nb: Normative beliefs (beliefs about how the referents would like the actor to behave)

mc: Motivation to comply (actor's motivation to comply with these normative beliefs)

Pbc: Perceived behavioural control (actor's perception of how difficult it is to perform a given behaviour)

c: Control beliefs (situational and internal factors that can inhibit or facilitate the behaviour)

p: Perceived power to influence (power of these factors)

Figure 1 Theoretical framework of the Theory of Planned Behaviour.[24]

Methods

Study design

A research professional will conduct semi-structured interviews of emergency medicine residents, either in person by telephone or by videoconference using the free Skype[TM] service. Interviews based on a vignette describing the behaviour of interest (see Appendix 1) will elicit participants' feedback concerning the following elements:

Box 3 Definition of the behaviour

- *Action*: to contribute
- *Target*: a Google Docs[TM] slide summarising an important article missing from the presentation
- *Context*: to prepare for the Royal College of Physicians and Surgeons of Canada certification exam in emergency medicine
- *Time*: in the next six months

- the advantages and disadvantages of adopting the defined behaviour (attitude)
- influential people who would approve or disapprove of the participant adopting the behaviour (subjective norm)
- barriers and facilitators of the behaviour (perceived behavioural control).

Even though a similar questionnaire has been validated in previous research projects,[34,45] a focus group of three residents having access to the Google Docs[TM] slideshow will validate the semi-structured questionnaire and clinical vignette. This focus group will confirm participants' general understanding of the questions and of the behaviour described in the vignette. If indicated, we will modify the questionnaire. After validating the questionnaire, we will interview 25 residents from all emergency medicine programmes across Canada in their last year of training. According to Godin and Kok,[35] a sample of 25 is sufficient to achieve data saturation when eliciting salient beliefs. These residents will have had access to the Google Docs[TM] slideshow over the preceding year as an aid to their preparation for the RCPSC exam. To avoid interfering with residents' preparation for their exam, they will be interviewed in the months following their exam (typically scheduled for late spring).

Participants

Eight months before the RCPSC exam, all emergency medicine residents graduating from Canada's 13 RCPSC training programmes will be invited to access and contribute to the Google Docs[TM] slideshow. One month after the exam, residents will be emailed an invitation to participate in the study. If the email does not generate adequate interest, a letter explaining the research project will be sent to all emergency medicine programme directors across Canada, asking them to recruit residents on our behalf. From those residents interested in participating in the study, up to 25 participants will be selected, making sure to have at least one resident from each training programme.

Data collection procedure

All survey participants will receive the consent form as well as the vignette and questionnaire by email. After verbal consent is obtained, participants will detail the following characteristics: age, gender, university diploma, any previous diplomas, year of training (to confirm that all respondents are indeed in their last year), previous consultation of or contribution to a wiki or another collaborative writing tool, previous consultation or editing of another Google Docs[TM]

application, previous consultation of the *Literature review for the RCPSC exam* Google Docs[TM] slideshow, frequency of consultation of the online presentation over the past year, previous contributions to the online slideshow, frequency of contribution to the online presentation in the last year, and changes brought to the slides of the online presentation. Participants' intention to contribute to the Google Docs[TM] slideshow in the future will be measured using a Likert scale. Participants will then read the clinical vignette, after which a research professional will interview them using a semi-structured questionnaire. The interviewer will note participants' answers on paper forms that correspond to the interview format. Interviews will also be digitally recorded, transferred to a password-protected computer and transcribed for analysis.

Content analysis

Two research professionals experienced with using the TPB to perform qualitative content analysis will independently analyse the transcripts of the recorded interviews to identify participants' beliefs about the three constructs (perceived behavioural control, attitude, subjective norm). After discussion, research professionals will group similar beliefs into themes. They will then assess the beliefs within each theme to remove duplicates and produce a list of unique beliefs for each construct. They will count the frequency of mention of each belief and rank the beliefs accordingly. The 75% most frequently cited beliefs will be labelled 'salient beliefs'. Any dissent between research professionals will be resolved by the principal investigator, who will make the final decision.

Ethical aspects

This study protocol has been approved by the Ethics Review Board at the Centre de santé et de services sociaux Alphonse-Desjardins, Quebec, Canada. Participation in the study will be voluntary and will depend on consent from the participant. All interviewees will remain anonymous and interviews will be conducted by a research professional (AB) who will not have met respondents prior to interviewing them. The principal author (PA) will not know the identity of the study participants. Answers will be recorded and numbered so that a belief cited by a participant can, if necessary, be anonymously linked to the interview in which the belief was cited. Voice recordings will only be audited by the research professionals and by the person who transcribes the interviews. (See online at www.radcliffe publishing.com/journals/J12_Informatics_in_Primary_ Care/Supplementary%papers.htm)

Discussion

Principal findings

To our knowledge, this study will be the first to identify medical residents' salient beliefs about their intention to contribute content to a collaborative online Google Docs[TM] slideshow.

Potential impact of this study

This study will use qualitative content analysis based on the TPB to identify medical residents' salient beliefs concerning their involvement in online collaborative writing technologies. As this study will be the first to explore the behaviour in question (residents' intention to add a summary of an article to an online presentation), the study will be limited to determining the salient beliefs underlying each of the three constructs of the TPB: attitudinal beliefs, normative beliefs and control beliefs. The next step in exploring the behaviour will be to use the findings to construct a validated questionnaire that measures the quantitative importance of the constructs. In addition to the present study, our research team is surveying healthcare professionals' intention to use wiki-based reminders in trauma care.[34] Furthermore, other studies using the TPB have identified the beliefs of healthcare professionals about their intention to complete an internet-based continuing medical education programme.[45] Together, these studies will generate results that will help develop interventions to increase healthcare professionals' contributions to internet-based collective writing projects, to be tested in a future trial. The present study is thus an essential step in the development of an intervention that we hope will increase residents' contributions to an online collaborative document. We are also confident that understanding how to encourage this particular behaviour will prove useful in developing online collaborative writing technology for use in medical education.

Another potential impact of this study concerns interprofessional collaboration. Teaching collaboration is becoming an important aspect of healthcare education.[46–48] For example, the Canadian Medical Education Directions for Specialists (CanMEDS) – a framework for medical education that sets high, clear standards for the essential competencies expected of Canada's medical specialists – requires specialty residency programmes in Canada to teach the collaborator role, one of the CanMEDS roles that residents must acquire during their residency.[49,50] In addition, the RCPSC[49] considers that all specialists should be able to: (1) consult effectively with other physicians and healthcare professionals and (2) contribute effectively to other interdisciplinary team activities. Thus, by informing the implementation of online collaborative writing technologies like Google Docs[TM], the results of this study will help teach the interprofessional collaboration required of Canada's specialists and indeed of other healthcare professionals.

Finally, the Web 2.0 revolution has changed how new generations of healthcare professionals communicate. A recent survey[7] reveals that medical students demonstrate high use of Web 2.0 technologies. The results of this study are thus particularly timely and useful – they will influence the next wave of interprofessional communication already taking place.

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AUTHORS' CONTRIBUTIONS

The principal investigator (PA) designed and wrote this protocol. DB, RMF, RF, FL, JP and AB reviewed and modified different versions of the protocol. All approved the final protocol. PA conceived the idea of the Google Docs[TM] slideshow. PA and AB will closely supervise and coordinate the conduct of this research project. AB will perform all the interviews and content analysis with another research professional. PA will take part in the content analysis and will serve as a judge if the research professionals do not reach con-

sensus in determining the salient beliefs. Once the results of the survey become available, all authors will take part in analysing them and in writing the manuscript.

CONFLICTS OF INTEREST

The principal author (PA) receives honoraria for his presentation at the national review course at Queen's University. None of the authors have a financial interest in the free online collaborative tool, and no patents are pending for this tool. All other authors declare that they have no competing interests.

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Appendix A

Vignette

You are a resident in emergency medicine studying for the Royal College of Physicians and Surgeons certification exam. This exam is scheduled in six months. You have access to the online Google Docs[TM] slideshow *Literature review for the FRCP exam* summarising the most important articles in the literature of emergency medicine. This slideshow is accessible to all residents who, like you, are studying for the same exam. While viewing the Google Docs[TM] presentation you notice that an article you believe is important for this exam is missing. You decide to add a summary of this article within the online slideshow