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**IMPLEMENTATION OF WORKPLACE HAZARDOUS
MATERIAL INFORMATION SYSTEM TRAINING IN
TEACHER EDUCATION: KEEPING OUR TEACHERS
AND STUDENTS SAFE**

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ABSTRACT

Workplace Hazardous Material Information System (WHMIS) training is a requirement and a right for practicing teachers in Canada, as it is part of federal legislation. WHMIS training can assist teachers with identifying hazardous material and achieving increased awareness of the dangers, potential hazards, and safety and protective measures, thus improving both teacher and student safety, and is of the utmost importance for science teachers. This article examines the implementation of different forms of WHMIS training within a pre-service teacher education program in Ontario, Canada, through the use of an action research design. Because pre-service teachers are “students” and not “workers,” and therefore not specifically covered in the legislation, there seems to be no clear direction concerning training for them. This research suggests that there is value in WHMIS training for pre-service teachers, and that universities should heed this.

INTRODUCTION

The purpose of any faculty of education is to assist those who want to become teachers in understanding all aspects of the profession and the responsibilities associated with the role of “teacher,” including the content knowledge, the pedagogy, and the pedagogical content knowledge (Etkina, 2005; Wenning, 2007). Pre-service teachers are required to take education courses that are designed to challenge the candidates and increase their basic knowledge of the learning strategies and pedagogical approaches that can be implemented within various classroom settings. After candidates graduate from their Bachelor of Education program and successfully find employment, one of the standard requirements of boards of education in Canada is for all new teachers and returning teachers to undergo Workplace Hazardous Material Information System (WHMIS) training (Ontario Ministry of Labour, 2008). This training is required by both provincial and territorial level governments and the federal government (Carleton University, 2013; Ontario Ministry of Labour, 2008). The focus of this training is for the individual to be informed about the hazardous materials in the workplace and the school setting, and to receive appropriate training to enable her or him to work safely in this environment (Carleton University, 2013; Ontario Ministry of Labour, 2008). Due to the fact that new teachers, once they are employed, are required to obtain WHMIS training, and that pre-service teachers should have this training as they will be going into schools for their teaching practice, the joint authors of this article, who are science education professors, have explored through action research the impact of different methods of delivering WHMIS training to pre-service teachers, including the following: the reaction from pre-service teachers as to their preference, the time commitment on the part of the professor and pre-service teachers, the engagement level of the pre-service teachers, and the organizational requirements of two WHMIS training packages.

This article gives an overview of WHMIS as well as of the WHMIS training offered at various universities in Canada in Bachelor of Education programs to help provide a context for this research. The action research design and the literature that support the design of the training packages utilized are discussed. An analysis of the quantitative and qualitative data from the project is given, with conclusions and recommendations for other faculties of education.

UNDERSTANDING THE IMPORTANCE OF WHMIS TRAINING

WHMIS was jointly developed in 1989 by labour, industry, and federal, provincial, and territorial governments (Ontario Ministry of Labour, 2008). In Canada, WHMIS applies to all workplaces covered by the Occupational Health and Safety Act, and universities fall under this umbrella (Ontario Ministry of Labour,

2008). Most universities offer sporadic WHMIS courses, but there is no consistently used WHMIS training package for university students or pre-service teachers. Further, WHMIS is not usually mentioned during orientation sessions for new faculty or new pre-service teachers. However, at some universities, specific faculty, staff, and students working in laboratories are required to undergo WHMIS training (Carleton University, 2013; Lakehead University, 2013; McGill University, 2013; University of Alberta, 2013; University of British Columbia Okanagan, 2013; University of Ottawa, 2013; University of Prince Edward Island, 2013; University of Waterloo, 2013). Universities, like all employers in charge of worksites where controlled products are used, have the duty under the law “to educate workers” (Ontario Ministry of Labour, 2008: 27).

Although pre-service teachers, during their practice teaching sessions in classrooms, are not “workers” (or employees) because they are not being paid, they are still teaching in schools and are expected to create and maintain a safe environment.

WHMIS training is important for science teachers and for those who are interested in becoming science teachers, as they will be working with potentially hazardous materials on a daily basis throughout their careers. Although some provinces have published lists of what schools should have within their chemical, biological, and physics inventories (Nova Scotia Department of Education, 2005), schools have a tendency to keep or to be unable to properly dispose of chemicals and other materials that are not on the approved list or that have been generated through the laboratory experiments. The chemicals and other materials that can be found in most Canadian elementary, middle, and secondary schools are similar to those found in schools across the United States, as was discussed by Becker and Elston (2004) in their evaluation of the chemical inventory practices of three New Jersey public schools. These schools did not have written or electronic chemical inventory lists, they did not show an understanding of proper chemical inventory management, labeling and proper disposal were issues, and the schools were in possession of materials that “far exceed[ed] any reasonable use schedule . . . and did not match the curriculum” (Becker & Elston, 2004: 22). Further, Becker and Elston commented that

While reactive and mildly toxic chemicals may have legitimate uses in secondary schools, safe handling and storage techniques, proper disposal programs and appropriate security must accompany their use. Teachers need to have proper training in chemical safety, including the use of laboratory hoods and personal protective equipment. . . . Improper storage and disposal is a source of liability to our health, safety and the environment. (Becker & Elston, 2004: 23)

Here, the call for proper training is clear and clearly warranted. Becker and Elston argue that “teachers and front-line education supervisors should develop a strong safety ethic. While that ethic should begin in secondary school, it must be

a part of a science teacher's education curriculum at the college level" (Becker & Elston, 2004: 23). The rationale for conducting the present research was to address the issues raised by Becker and Elston as well as by many other teachers in the field who have raised concerns over the need for pre-service teachers to receive WHMIS training prior to beginning their practice teaching sessions.

The question of the format of delivery of WHMIS training is also discussed in the literature (Gabriel & Longman, 2004). WHMIS training can be provided in various ways. Two of the most common are large lecture-style presentations where participants listen to the lecture, are allowed to ask questions, and may or may not have to complete an assessment at the end of the session. A second format, which is becoming popular, is the provision of online WHMIS modules that individuals work through, with an assessment to be completed at the end of each module. An article by Gabriel and Longman (2004) has examined staff perceptions of e-learning of WHMIS in a community health care organization. Gabriel and Longman's study "set out to specifically examine the range of perceptions, attitudes, and responses of learners to an e-learning mode of delivery for WHMIS training" (2004: 2). From the findings of this research, it is noted that

the online venture proved to be effective from the perspective of the learners, interactive components enhanced the understanding of the WHMIS concepts at an individualized pace for the learner. . . . the program included an evaluation that provided immediate feedback and an opportunity to review before proceeding to the next module . . . [but] it was industrial-based and not perceived as relevant to the workers . . . [and] the two hour session was long. (Gabriel & Longman, 2004: 5)

METHODOLOGY

Much has been written concerning the usefulness and methodology of action research (Carr & Kemmis, 1986; McMillan & Wergin, 2010; Somekh, 2006). What is important from the present authors' perspective is that "the study is undertaken by educational professionals in their own practice setting for the purpose of better understanding their work and how to improve it. What distinguishes action research is not how the study is done, but why" (McMillan & Wergin, 2010: 166). The desired result of action research, as discussed by McMillan and Wergin (2010), is that a change should occur in either practice or policy. It is hoped that this research will lead others to examine the feasibility of incorporating WHMIS training into their Bachelor of Education programs or indeed into all programs offered at the post-secondary level.

It is well known by teachers and researchers that students should be active participants during the learning process (Henderson, 1992). Henderson notes three key characteristics of reflective teachers that assist in bridging theory and practice. Of these characteristics, the most relevant to this particular study is the ethics of caring: if teachers care for their students then the teachers will make

every effort to understand where individual students are on their own personal learning journey and to keep them “safe” (Henderson, 1992). WHMIS training for the teacher can be viewed in light of the ethics of caring: if the teacher is aware of the possible hazards and risks and understands the safety precautions required in dealing with chemicals and laboratory equipment, then students can proceed on their science learning journey in a safe and controlled environment.

Context of the Study

This research took place at a primarily undergraduate university in Ontario, Canada. The authors, who both taught within the Faculty of Education, required their students (pre-service teachers in the Bachelor of Education program) to participate in WHMIS training. Both of the authors taught a science methods course. The authors required pre-service teachers to take the WHMIS training prior to their practicum, during which they would be teaching within a science classroom or laboratory setting. There was no formal evaluation of the WHMIS component for inclusion in students’ final grades for the course, but the pre-service teachers were observed by the professors to assess their ability to safely manage a laboratory, and individual correction was given when required.

Because safety in the science classroom is extremely important, and bearing in mind Becker and Elston’s (2004) research, incorporating WHMIS training into course content is logical. In addition to including WHMIS, the science methods courses taught by the authors used a team approach to course construction and teaching. The course was co-constructed by both authors and their assessment/evaluation items were brought into alignment. As Fullan (2001: 46) notes, the alignment of courses “along three dimensions—in materials, teaching approaches, and beliefs, in what people do and think” is “essential if the intended outcome is to be achieved.” The intended outcomes for the science methods courses were for pre-service teachers to be reminded of science concepts as well as learning science teaching pedagogy, all within a safe and controlled learning environment. WHMIS training was included in the course to ensure that pre-service teachers were made aware of the appropriate methods of handling various chemicals and disposing of them, using the appropriate safety procedures, and reminded of daily safety practices within the science laboratory.

Between them, the two professors taught approximately 450 pre-service teachers their required science methods course every year. This research was conducted over a two-year period. The participants in this study ranged in age from 24 to 50+ years of age and were a diverse group (in terms of culture, ethnicity, and the subjects they would be teaching). The science methods course specified a minimum of 24 hours in contact time. Of these contact hours, two hours were allocated for in-class WHMIS training; this constituted 8% of the contact hours for middle-school pre-service teachers. During this study, WHMIS

training was offered through different delivery modes to determine the best fit with the overall program.

Phase 1: Lecture-Style WHMIS Initiative

The first type of WHMIS training provided as part of this research used a lecture-style mode of delivery in which the training session featured a guest speaker in a large lecture theatre. The session lasted two hours and at the end of the session the pre-service teachers obtained general WHMIS certification. The pre-service teachers were required to attend and asked to listen and ask questions; however, there was no assessment at the end of the session. The professors judged that this training session would be in line with course content and in keeping with Fullan's (2001) three dimensions.

The training took place in a large lecture theatre with 100 to 150 pre-service teachers attending each session. Three sessions were held during one day of classes. A total of 400 pre-service teachers participated in the WHMIS training and received general certification from this process. One or both of the professors were present during each of the training sessions.

Numerous issues emerged during the lecture-style WHMIS delivery. Although useful in principle, the training method was not well received by the pre-service teachers. They were required to sign in for attendance purposes. As the lecture was delivered, it became very clear that the pre-service teachers were bored, unengaged, multitasking with their laptops open and working on material that was not WHMIS related, and eager to leave. This was perhaps not surprising, as the delivery of the WHMIS lecture was very transmissive in nature, with little or no interaction between the instructor and the students (see Miller & Seller, 1990). Opinions are divided in the literature on guest speakers. Some suggest that such speakers provide an excellent way to introduce specialized or controversial topics (Kumashiro, 2000; Lance, 1987), while others claim that lecture-style professional development is lacking in peer learning and is too teacher centred (Kelleher, 2003).

Later, during the regularly scheduled science methods classes and in the end-of-year course evaluations, pre-service teachers commented on their experience of the lecture-style WHMIS training. Their comments included the following:

Participant A: I don't feel as if I have learnt anything about WHMIS, but it is a nice piece of paper to have.

Participant B: It was as boring as watching paint dry!

Participant C: I got some homework done and got caught up—thanks for the free class.

Participant D: Please, find another way—that was the exact opposite of how you are suggesting we teach!

These are only a few of the many comments made, but they reflect the opinions of a very high percentage of the participants.

As can be seen in the comments, the pre-service teachers did not feel they had “learnt anything.” The training was seen as providing “a nice piece of paper,” but one participant admitted, “I have no idea what was taught.” Although these comments were disappointing to the professors, upon reflection they were not surprising. The WHMIS training had been provided; however, the method of delivery was not conducive to student engagement. Further, and as noted by many of the pre-service teachers, the method of delivery was contrary to the pedagogy of both the science methods course and the Bachelor of Education program in general.

Since this delivery mode was not conducive to active engagement and not consistent with the pedagogy of the education program, the next task was to find a more engaging WHMIS delivery method that would fit within the pre-determined class schedule of two hours, would give WHMIS certification, and would be much more in tune with the methodologies, teaching strategies, and pedagogy being taught within the education program.

Phase 2: Internet-Based Modular-Style WHMIS Initiative

At the beginning of the second year of this study, the professors decided that an up-to-date, online, Internet-based WHMIS certification program should be introduced to address the issues that had emerged from the large lecture-style WHMIS training of the previous year. The pre-service teachers would be WHMIS certified, as before, but now their training would be online and engaging, and they would be required to complete an assessment after the first section of the training in order to move to the next section. A further assessment at the end of the training was required for final certification. The assessments took the form of multiple choice summative evaluations designed to ensure understanding and the absorption of critical information.

After searching for online WHMIS providers and holding numerous discussions concerning costs and administration requirements, the professors found a suitable online provider. The online Internet-based program was logical and user friendly. The pre-service teachers were given a unique and individual username and password; they were to sign in and then complete the various modules of the training package. At the end of each module, there was a short assessment consisting of multiple choice questions: the candidates needed to score 100% in order to move to the next section. Once they had completed all of the modules, the pre-service teachers could print their own certificates. The administration of the program was very simple for the professors and they were given administration privileges allowing them easy access to the database to determine whether each individual student had successfully completed the course.

The pre-service teachers were given one class period in which to complete the online WHMIS training. During this training, the professor was present to assist with questions and a university computer technician was available if required. All of the pre-service teachers brought their own laptop computers and ear buds, as the program had both an audio and a visual component. All those taking the training were able to log onto the Internet and retrieve the appropriate Web site. All of them worked independently of each other, and once the training was completed, they were asked to complete a short (10-minute) online survey about the usefulness of the training package. In all, 320 pre-service teachers took part, with 264 participating in the follow-up online survey, that is, 82.5% of the population. Of the 264 who opened the survey, 202 completed it. This is a 76% completion rate for those who opened the survey and a 63% completion rate for those who took part in the training. All those who took part in the training completed the online WHMIS training package and received their WHMIS certification.

The data generated from the online survey showed that the population was 63.8% female and 36.1% male. The pre-service teachers varied in age between 20 years old and 50 years old, with the majority (91.2%) being between 20 and 30. The authors felt it was important to determine whether this was the first online tutorial that the participants had taken, as that could have an impact on their perception of the “usefulness” of the online WHMIS training. In fact, the participants were almost evenly split, with 45.7% recording that they were first time users of an online tutorial and 54.2% recording that they had completed online tutorials in the past. The slightly higher percentage of those who had previously experienced online tutorials meant that those who did not have previous experience would have a colleague close by who had experience—and this provided a form of peer tutoring/troubleshooting with the technology.

It was also useful to determine who had experienced WHMIS training previously and the mode of delivery of that training. By gaining an understanding of the previous experiences of the pre-service teachers with WHMIS training and their perception of the online training provided within the course, the professors could gauge the value and success of the online training they had provided. Further, a comparison between the online mode of delivery and the lecture-style format could be made.

The data indicate that 74% of the participants had had WHMIS training prior to beginning their Bachelor of Education program. This was well above what the authors expected and what would have been expected from Becker and Elston’s (2004) findings. Next, the participants were asked how long it had been since they had completed their previous WHMIS training. The responses to this question were more in tune with expectations in that only 34.5% stated that they had completed WHMIS training within the last year. Clearly, if the respondents had not been provided with WHMIS training as part of their Bachelor of Education program, there would have been a significant gap between their

WHMIS training and their entry into the science classroom. This observation highlights the importance of including the training in the education program.

With regard to previous WHMIS training, the authors were curious to determine the format that had been used. This would be useful in deciding whether the online format should be kept or whether another format would be more effective. The majority of the respondents stated that they had received WHMIS training in a classroom setting, using neither a "lecture" nor an "online" format, but rather an instructor going through the material, holding discussions, responding to questions, providing a workbook exercise, and so on, in a small group setting. A lecture-style format was experienced by 23.6% of those who had had previous WHMIS training, and an online format by 13.6%. Interestingly, 13% had experienced "other" formats, and when the authors probed more deeply, a workbook/correspondence type of instruction was described.

The participants were then asked about their perceptions concerning the best learning model for WHMIS training. The data indicated that 60.8% of the participants felt that the online tutorial method was the best, while 39.1% preferred other methods. Those who preferred other methods may well have included pre-service teachers who learn better with more discourse than the online tutorial provided and/or with more social interaction in general. This is in keeping with the findings of Gabriel and Longman (2004: 4): some participants in their study noted that "they disliked the online learning mode because it was not their preferred learning style."

Further, the participants were asked if they felt that they had learned worthwhile information about WHMIS during the online training. The majority (86.5%) of pre-service teachers felt that they had learned worthwhile information. This is similar to the findings of Gabriel and Longman (2004), in whose study the majority of the participants also felt that the online WHMIS training had been a positive experience. Those in the present authors' study who disagreed did not explain why, and so we are unsure whether their response was due to a lack of learning as a result of the mode of delivery or whether they were already well versed in WHMIS and therefore did not learn enough that was new to make this a worthwhile experience. Alternatively, their response may have been due to program length or technological issues, as discussed by Gabriel and Longman (2004).

The final question relating to perception asked by the present authors dealt with their feelings about the delivery of WHMIS training as part of their science methods course via an online tutorial. The responses were similar to those given to other questions, in that 86.6%, a large majority of the pre-service teachers, felt that the experience was worthwhile and should be kept. Those who disagreed, again, did not fully explain their response, but it can be assumed that they either did not enjoy the delivery method or they were already familiar with the content and did not require the training.

To conclude the survey, the pre-service teachers were asked to indicate how long it took them to complete the online WHMIS training. Most of the participants

(93.5%) were able to finish the training within 1.5 hours. This is a very positive result, in that the class length was two hours and so the majority of them were able to finish while in class with the help and support that was provided by the professors and the university technology department.

The participants were also asked what they felt were the advantages and the disadvantages of completing WHMIS in an online format. Their comments on the advantages included the following:

Participant E: You can go at your own pace.

Participant F: You have more than one chance to pass the test. So, if I didn't get it the first time – I get a second chance.

Participant G: I don't feel rushed.

Participant H: Online activities are flexible.

Participant I: I am a visual learner, so for me to actually read the information, I found that I learned more. Also I like how there were only a few questions after each section.

The comments focused on working at one's own pace, not feeling rushed, having flexibility, and being able to take the tests multiple times—all of which meant that test anxiety was reduced.

Comments on the disadvantages included the following:

Participant J: You can not ask any additional questions which you could if the training was completed in a classroom setting by an instructor.

Participant K: The test is too easy.

Participant L: You could guess at the answers of the test and not have to read the whole section—or listen to it.

Participant M: The test questions keep changing when you have to redo the test, I found that this makes it harder since there are so many questions. You need to know it to pass it.

When considering the disadvantages of WHMIS online training, participants noted the lack of “personal instruction”—yet in the lecture style, where there was personal instruction, they did not take advantage of it and ask questions. This notion of “personal instruction” was also noted as a disadvantage of the online WHMIS training completed in Gabriel and Longman's (2004) study. The level of difficulty of the test at the end of each section was another issue noted—some found the test too hard, some found it too easy, and some were annoyed when the questions changed if a score of 100% was not achieved. The other key point is that individuals could skip the bulk of the online tutorial and go directly to the test. Although this is not ideal, if the participant was aware of the WHMIS content and was successful in the tests, then the professors did not require the participants to go back and read the content.

When asked for any other comments at the end of the survey, participants commented that they found this approach to the training very engaging and useful. Their comments included the following:

Participant N: This is great—it is easy and I get the certification!

Participant O: I like that if I can't finish it here, I can do it from home.

Participant P: I'm happy I can print my certificate from home instead of spending more money here on campus to print it.

The administration of the online training was also kept under the control of the two professors, and as before, the pre-service teachers were encouraged to complete the training by the time their science education course was completed. Also, the professors were able to access the participants' certificates when they lost their username and password and required the certificate for employment.

AIMS AND NEXT STEPS

The aim of this initiative was to implement WHMIS training for all science pre-service teachers within the university's Faculty of Education and then to persuade the administration to consider the implementation of WHMIS training throughout the university. The "image" of WHMIS training, it was hoped, would include the acknowledgement and acceptance of the lessons learned from the smaller implementation attempts within the Faculty of Education, which would help to determine the best mode of training for the university as a whole (Miller & Seller, 1990). Since the online Internet-based approach was seen to be more useful and engaging than the lecture-based approach, the use of the online approach would promote the perpetuation of a safe working environment.

Online WHMIS training should fall under the umbrella of professional development. Zhao et al. (2002: 511) support this type of professional development. In their words, "We . . . encourage teacher education institutions and other teacher professional development programs to broaden their views of the kind of preparation and support preservice and in-service teachers need to thoughtfully and effectively integrate technology in their teaching."

EVALUATION

Determining adequate evaluation techniques for fundamental changes within any institution can be difficult, since those who are implementing a change want it to be successful yet not add to the stress of the individuals who are experiencing the change. As well, obtaining feedback from those who are "changing" can be complicated, since the questioning technique must ensure that data are obtained from a number of varying sources so as to avoid skewing.

The first group of pre-service teachers who completed the WHMIS training responded to the training in different ways. The first group responded through informal discussions and participant narratives. Although this is an acceptable form of data collection, the comments and narratives were not systematically collected. Therefore, in making the decision that a lecture-style format was not the best one to choose, the professors also examined course evaluations by the pre-service teachers and took into account the body language of those who took part in the workshops. All the data suggested that this type of delivery was not well received and that the pre-service teachers were bored.

The second round of evaluating WHMIS training was carried out via a more formal online survey, where questions were scored according to either a yes/no response or a Likert scale type of response and the participants were given an opportunity to provide open or narrative responses to open-ended questions. The participants also had the opportunity to provide comments at the end of the survey. The online mode of delivery was very favourably received.

CONCLUSIONS

Important changes within the university's Faculty of Education began with the development and implementation of WHMIS training for the science education pre-service teachers. This research clearly indicates that (a) WHMIS training can be inserted into the science methods courses taken within the Bachelor of Education program. It also clearly indicates that (b) lecture-style WHMIS training was not well received by the pre-service teachers. The data indicate that (c) online WHMIS training was perceived to be worthwhile in terms of the information learned, and also that (d) the participants valued the class time allocated to complete the WHMIS training—they felt it to be a worthwhile experience. Furthermore, (e) 60% of participants felt that the online learning mode of WHMIS was effective. This is of significance since many who had received prior WHMIS training had done so within a classroom setting. This indicates that completing WHMIS training online was a positive change in delivery, which, in some ways, is not surprising as the majority of the pre-service teachers were under 30 years of age and were familiar with laptop computers.

WHMIS training is not a requirement in many universities; nor is it a specific requirement of pre-service teachers as they are still considered “students” rather than “workers.” However, WHMIS training is a requirement and a right for practicing teachers in Canada, as part of federal legislation, with science teachers being no exception. Many provinces and territories offer online or other computer-based training to their teachers, with face-to-face training being phased out due to costs and questionable engagement as was echoed in the findings of this research. Many universities offer WHMIS training to their undergraduate and graduate students, yet few faculties of education offer the training or require their pre-service science teachers to complete it. It is this apparent gap that will

require further study and that this research addresses. This research suggests that there is value in online WHMIS. Its value is acknowledged by the pre-service teachers in this study, and the universities should pay heed to these findings. It is important for the educational community to consider the implementation of WHMIS training throughout all faculties of education. This would add to the education of our current students and future teachers, thereby preparing the workforce of tomorrow to accept their responsibility and accountability when it comes to keeping themselves and our children safe within our schools.

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