The Efficacy of Blended Versus Classroom Instruction with Older Adults Learning Social Networking and Computer Skills

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Abstract

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Madeleine Ward

Blended instruction, a combination of classroom and online instruction, is becoming increasingly popular today. Blended learning is beneficial, as it provides the flexibility of online learning with the social aspects of the classroom. For this blended learning study, two groups of older adults, ages 60-85, participated in social networking and computer skills training, either in a blended learning environment (*n* = 9) or in a traditional classroom (*n* =8). Two sessions of computer training took place, and the data from the two sessions were combined, as they were performed in an identical manner except for the duration of each session. For evaluation purposes, the effectiveness and satisfaction ratings of classroom versus blended instruction were assessed by weekly quizzes and pre- and post- course questionnaires. The results of this mixed methods study indicated that students' computer skills significantly increased after the training, as determined by self-ratings supplied by the participants. In addition, the increase was somewhat greater for the blended group than the classroom group, although this was not a statistically significant difference ($p>.05$). Participants also rated they were satisfied with the computer courses, regardless of instructional type. For the blended learning group only, a follow-up session in the form of a Focus Group interview was performed to obtain additional information on the blended course format. Six of the nine

participants indicated that they would be motivated to take additional courses in the blended learning environment. The results of this study can contribute to the literature as there is minimal research on older adults' effectiveness and satisfaction ratings on blended versus classroom instruction for computer skills training.

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Introduction

Older adults are one of the fastest growing Internet user groups today. A survey conducted in April of 2012 indicated that 53% of American adults' ages 65+ are using the Internet or e-mail, a significant increase compared to 40% in August 2011. Seniors on social networking sites have also increased significantly over the past few years, indicating by an increase of 150% from April 2009 (13%) to May 2011(33%). As of February 2012, one in three online seniors (34%) uses social networking sites such as Facebook, and 18% do so on a daily basis. By comparison, the favorite method of online communication for older adults is e-mail (Zickuhr & Madden, 2012).

Older adults can benefit greatly from acquiring social networking and computer related skills. Some of these benefits include: (a) improving their quality of life, feeling more independent and in control, (b) increasing their interpersonal interactions, (c) improving their mental health, by alleviating depression (d) meeting self-fulfillment needs, feeling empowered, and (e) promoting greater cognitive functioning. Kim (2008) states that Internet usage offers older adults lifelong learning opportunities, enhances their emotional relationships with families and friends, and helps them to remain actively engaged in society. Moreover, older adults with physical mobility difficulties can participate in online learning and use online communication tools, increasing their ability to take part in educational activities and social networks (Chaffin & Harlow, 2005; Swindell, 2002).

Therefore, learning computer skills can be very beneficial for older adults. Additionally, investigating which instructional method is most effective for teaching these skills is very important. The purpose of this mixed method study was to investigate whether older adults found blended learning as effective and satisfying as classroom learning when taking a series of eight computer courses. Additionally, the researcher investigated whether participants in the blended learning environment would be motivated to take additional blended or online courses.

The research problem is a lack of research on which instructional methods are most effective and satisfying to older adults learning computer skills. Therefore, I decided to perform a study that would investigate this phenomenon.

Therefore, my research questions were:

1. Would there be a difference between blended learning and classroom learning based on the results of the quiz scores?

2. Would students be more satisfied with the computer courses in the blended group or in the classroom group?

3. Would students in the blended group indicate that they were motivated to take additional blended courses in the future?

To answer these questions both quantitative and qualitative data were collected. Therefore, data were obtained from online quizzes, and pre-and post-

course questionnaires (containing both close-ended and open-ended questions), and a Focus Group Interview.

This study can contribute to the literature as currently there is minimal research on older adults' effectiveness scores and satisfaction ratings with blended (classroom/online) versus classroom instruction. Additionally, older adults participating in this study will have an opportunity to take courses in a blended or online environment, which may encourage and motivate them to take additional blended or online courses.

Literature Review

Peterson (1990) defines educational gerontology as 'the study and practice of instructional endeavors for and about the aged and aging' (p.3). According to Peterson, the two major areas of educational gerontology are (a) instructional techniques for older learners and (b) instruction for individuals who work with older adults. While andragogy refers to the educational theory and practice of adults in general, geragogy refers to the theories and practices of the older adult population (Battersby & Glendenning, 1992, Moody, 1985). Both andragogy and geragogy presume that adult learners are self-directed, have various life experiences conducive to learning, and have an interest in programs that improve their knowledge and skills, especially if they are associated with issues relevant to their personal lives (John, 1988). Therefore, it is essential that older adults' learning is learner-driven, and that they are involved in the planning and execution of educational programs (Brubaker & Roberto, 1993; Girton, 1995;

Hiemstra, 1980). According to Charness, Czaja & Sharit (2007) the 'learning-while-applying' approach is effective for late-career learners.

Erickson & Noonan (2010) examined late-career adults and online instructional methods. The study investigated both academic performance and instructional support needs of late-career adults (aged 50-65) in an online course as compared to early-career (aged 21-35) and mid-career (aged 36-49) adults. The results of the study showed that late-career adults were satisfied with the online delivery, and they found the experience to be more rewarding than their early- and mid-career peers, despite the differences in technical abilities. Late-career adults had high levels of success in the online course with all 51 participants successfully passing the course, and one-third of the students earning an A (90-100%) and two students earning a B (80-89%). The late-career adults also indicated that they were satisfied with the course because it was directly applicable to their work.

The results obtained by Erickson & Noonan (2010) are contrary to the results of a study by Lakin et al. (2008), in which older adults stated that they preferred traditional, face-to-face instruction, as compared with online instruction. The reasons cited for their preference were poor computer skills and loss of face-to-face connections. However, Erickson & Noonan (2010) found that even though the late-career adults required more technical assistance than the early- and mid-career peers, they performed just as good as or better than their younger counterparts after receiving the required technical support. In addition, late-

career adults were motivated to take more online courses as a result of their satisfaction with the course.

Morris and Ballard (2003) investigated older adult's preferences for instructional strategies and techniques in family life education programs. Their sample consisted of 250 older adults in four different age groups: 50-64, 65-74, 75-84, and 85 and over. Participants rated 15 teaching methods using a 4-point Likert-type scale, ranging from *very helpful to not at all helpful* (indicating a Kirkpatrick Level 1 evaluation). After exploratory factor analysis three methods remained: Group Instructional Strategies, Independent Use Strategies and Computers. The results indicated that instructional strategies using computers were rated the lowest of all the instructional strategies. However, they determined that group-oriented instructional strategies, such as blended learning (synchronous learning) could have many advantages for older adults, as it can help reduce social isolation and technophobia. Therefore, blended instruction can be beneficial to older adults, as it mixes the best aspects of online learning with the best aspects of classroom learning, providing older adults with the benefits of both instructional methods. According to Gutierrez (2006) users of the blended learning environment can take advantage of the benefits associated with both face-to-face and online methods. As technical difficulties can be a problem for online students of any age, especially for older adults or those less comfortable with computers, blended instruction provides students the benefit of becoming familiar with the required technology before attempting the online section of a

course. Swindell (2002) suggests providing older students with technical support and the use of well-known and stable technologies.

Blended learning is generally defined as the combination of face-to-face instruction with distance education delivery systems (Osguthorpe & Graham, 2003). Blended learning is commonly used today in many higher education organizations, particularly those which have incorporated distance education and various other forms of e-learning. In blended learning, the balance between online and face-to-face instruction can differ for each course. Some blended courses include more face-to face than online strategies, depending on the instructional goals, student attributes, instructor experience, and online resources. Some courses mix the two forms of instruction evenly and others use more online strategies, rarely using face-to-face contact (Gutierrez, 2006).

Blended learning can be beneficial as it provides the flexibility of online courses combined with the social aspects of classroom courses (Rovai & Jordan, 2004). Melton et al. (2009) used a blended learning course delivery compared to a traditional face-to-face class format to evaluate student achievement and satisfaction in a general health course. The results of the study indicated that students achieved higher final course grades and were significantly more satisfied in the blended course than in the face-to-face course. Moreover, a blended course design may contain active teaching as students are more responsible for learning content on their own, while time in the classroom is spent with the application of newly attained knowledge. In addition, active learning may explain the higher grades obtained by the blended group (Melton et al., 2009).

A number of meta-analyses of online and blended learning compared to classroom instruction have brought together many studies conducted in various settings in order to estimate the comparative learning effectiveness of these two patterns. Table 1 summarizes these studies. In a follow-up to a 2004 meta-analysis of distance education versus classroom instruction (Bernard et al., 2004), Bernard (2010) found that the sub-set of studies conducted with online courses produced an average effect size of 0.12 compared to classroom instruction. Other meta-analyses, such as those by Sitzman et al. (2006) and Cook et al. (2008) examined specialized populations (i.e., Web-based instruction in business contexts and e-learning for healthcare workers) and found essentially the same overall effect size.

The U.S. Department of Education commissioned a study of online and blended contexts. For online learning they found an overall effect size of 0.14, in line with the other studies, and a higher effect size (d = 0.35) for blended instructional contexts. In a study of postsecondary educational settings, Schmid et al. (2009) found an average effect size comparable to the Department of Education study for 114 effect sizes (d = 0.34).

This set of studies demonstrate a remarkable degree of consistency, so that the overall conclusion can be drawn that online benefits learners, compared to classroom instruction, but only modestly. However, blended instruction may combine the best of online and classroom environments to produce an average effect size approaching what is generally considered moderate and therefore may be worth investing resources, time and money, to achieve a more effective

form of instruction that is more effective than either classroom or online instruction alone.

Table 1

Meta-analyses comparing online learning and blended learning to classroom instruction.

Meta-Analyses	Inclusive Dates	Comparison	*k*	*ES*+	Sig. (*p*)
Bernard et al. (2010)	1990-2003	OL vs. CI	59	0.12	= .05
Sitzmann et al. (2006)	1996-2005	WBI vs. CI	71	0.15	≤ .05
Cook et al. (2008)	1990-2007	OL vs. CI	63	0.12	= .045
U.S. DOE (2009)	1996-2006	OL vs. CI	28	0.14	≤ .05
U.S. DOE (2009)	1996-2006	BL vs. CI	14	0.35	< .001
Schmid et al. (2009)	1990-2010	BL vs. CI	114	0.34	< .001

OL = Online; CI = Classroom Instruction; WBI = Web-Based Instruction; BL = Blended Learning

Blended courses may also be beneficial for older adult learners. Kim (2008) states that 'many studies have recommended a variety of instructional methods especially designed for older computer users' (p. 723) and 'older adults require additional time or self-paced practice to master learning content' (Baldi, 1997, Filipczak, 1998, Van Fleet & Antell, 2002; Jones & Bayen, 1998; Mayhorn et al., 2004). With blended instruction, older adults are more in charge of their learning, as they can take courses in their own time, and at their own pace. In addition, blended learning offers a mix of instructional methods, such as an

online section and a classroom section. Therefore, in the online section older adults can learn more independently, and at their own pace, while in the classroom section, they can have direct access to the instructor, and socialize with other students in the class.

Socialization is important as older adults do not easily learn computer skills individually; they interact with other learners, instructors, learning tools (computers) and classroom settings (Hansman, 2001; Wilson, 1993). According to Lave & Wenger (1991; 1998) 'situated cognition theories assert that learning is rooted into situations where learning occurs and learning is a social practice' (p. 729) and 'knowledge is fundamentally located in situations; therefore, the question of learning transfer is a major issue' (p.729). This means that where older adults learn their computer skills will affect their transfer of learning, such as, if they are engaged in classroom courses only, at a community center or local library, they may have difficulties transferring the knowledge they acquired when using their computer at home. As a result, using blended instruction to teach computer skills could be very beneficial to older adults as some of the courses would be performed online, on their computers at home, and some in the classroom, thereby allowing for greater transfer of learning.

It appears that older adults are increasingly embracing online learning. As this concept is relatively new, the research on this topic is limited. Therefore, the purpose of this mixed methods study was to investigate the impact of instructional methods on students' quiz scores, and students' satisfaction scores. Additionally, students' motivation to take additional blended courses was

examined. To measure this, I collected quantitative and qualitative data from seventeen older adults (aged 60+) using quizzes and questionnaires. For the blended group only, a Focus Group interview was performed. This study is important as training older adults in basic computer skills can result in more positive attitudes, increased motivation to learn and decreased levels of anxiety (Baack et al., Dyck & Smither, 1996; Morris, 1994).

Hypotheses

The hypotheses for this study were as follows:

H_0: There will be no difference in the quiz scores between the classroom group and blended group with the computer training. H_1: Older adults will score higher on the quizzes in the blended group than the traditional classroom group with the computer training. H_2: Older adults will be more satisfied with the blended courses than with the traditional classroom courses.

Pilot Test

Course Materials Design and Development

A pilot test was conducted from September 13, 2012 to November 29, 2012. Four older adults participated in twelve classroom computer courses, for one and half hours per week, at the CCS in Pierrefonds, Quebec. The courses included Advanced e-mail functions, Skype, Facebook, Microsoft Word and Excel, Twitter, Web Safety, and Google. The purpose of the pilot test was to obtain information and feedback from the participants on the computer courses,

the instructor, and to determine whether participants' computer usage increased over the twelve week period. To assess this, participants completed pre- course and post-course questionnaire. The completed questionnaires were collected by the researcher at the end of the first and last course. The result of the pilot study was to assist with the designing of more effective computer courses for the next twelve week session.

The results of the pilot study indicated that participants were very satisfied with the computer courses, as they rated 'strongly agree' to most of the questions on course satisfaction. Additionally, Figure 1 shows that two participants rated 'strongly agree' and two rated 'agree' to question 22 asking if their interest in this subject matter had increased as a result of taking the courses. Therefore, participants' indicated that they were very satisfied with the courses and taking part in the courses increased their interest in using computers in their daily lives.

Participants' self-ratings on their use of the applications from pre-course to post-course indicated an increased use of Skype, Twitter and Word. Overall, the courses were effective as determined by the participants' self-ratings and positive comments. Therefore, for the next session of courses, all courses will be given in the same manner. The only course omitted from the list of courses was Microsoft Excel, as participants stated it was not useful to them.

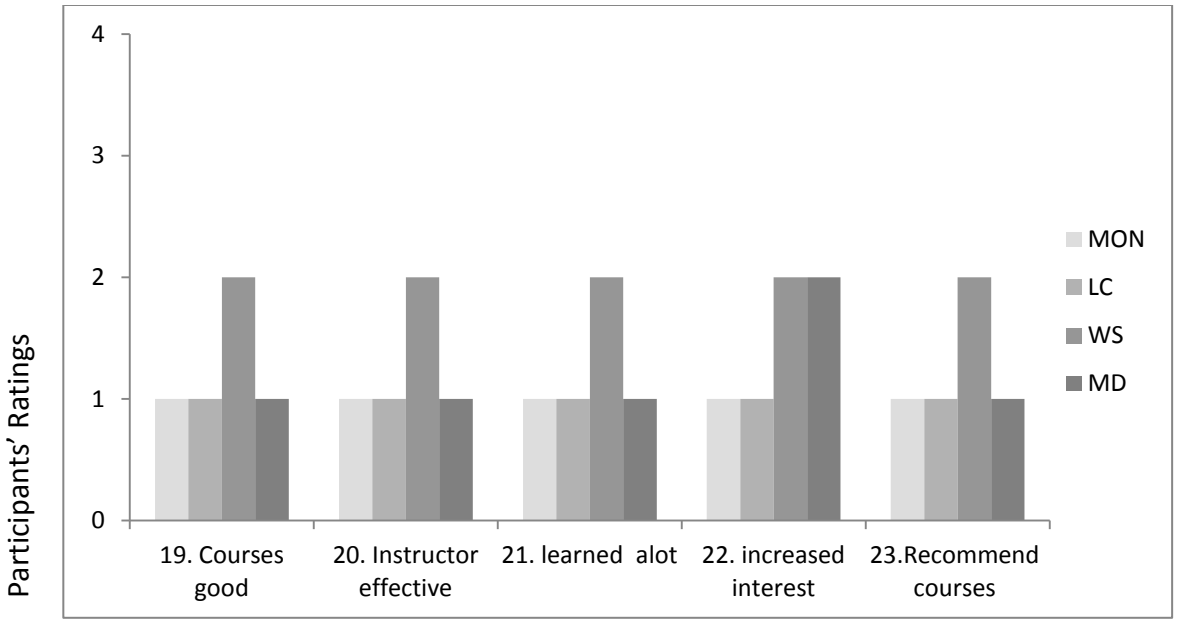

Figure 1: Participants' satisfaction ratings of the courses. Ratings are indicated as: 1: Strongly Agree, 2: Agree, 3: Disagree and 4: Strongly Disagree. Participant's initials are indicated as: MON, LC, WS, & MD.

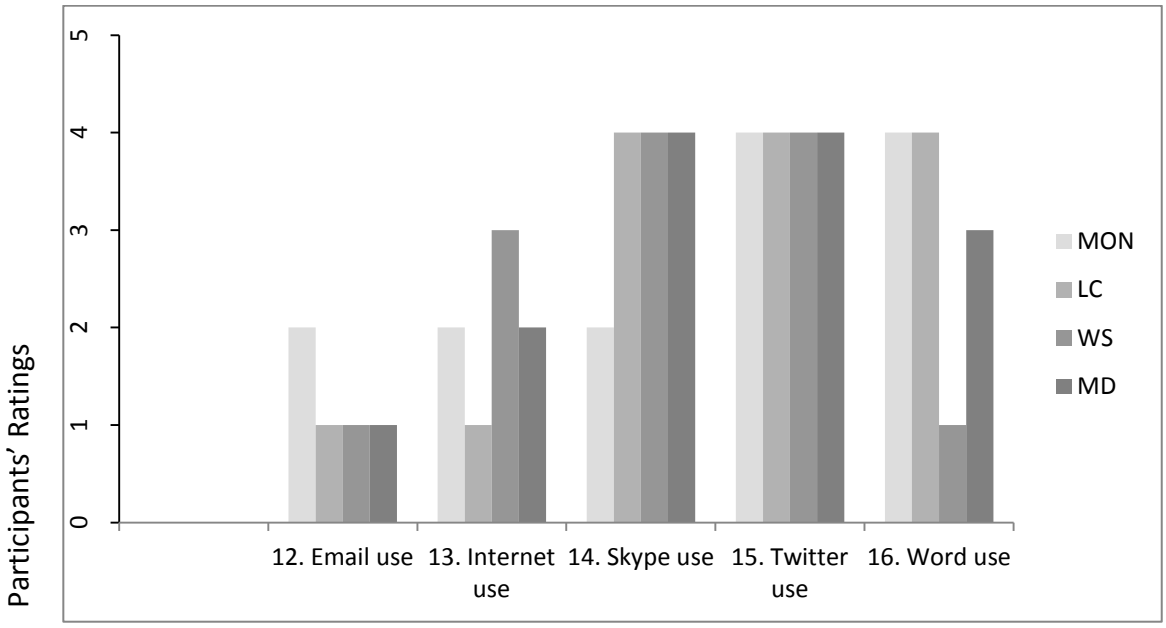

Figure 2: Participants self-ratings of their use of the applications pre- courses. Ratings are indicated as: 1: Very Often, 2: Often, 3: Sometimes, 4: Never. Participant's initials are indicated as: MON, LC, WS, & MD.

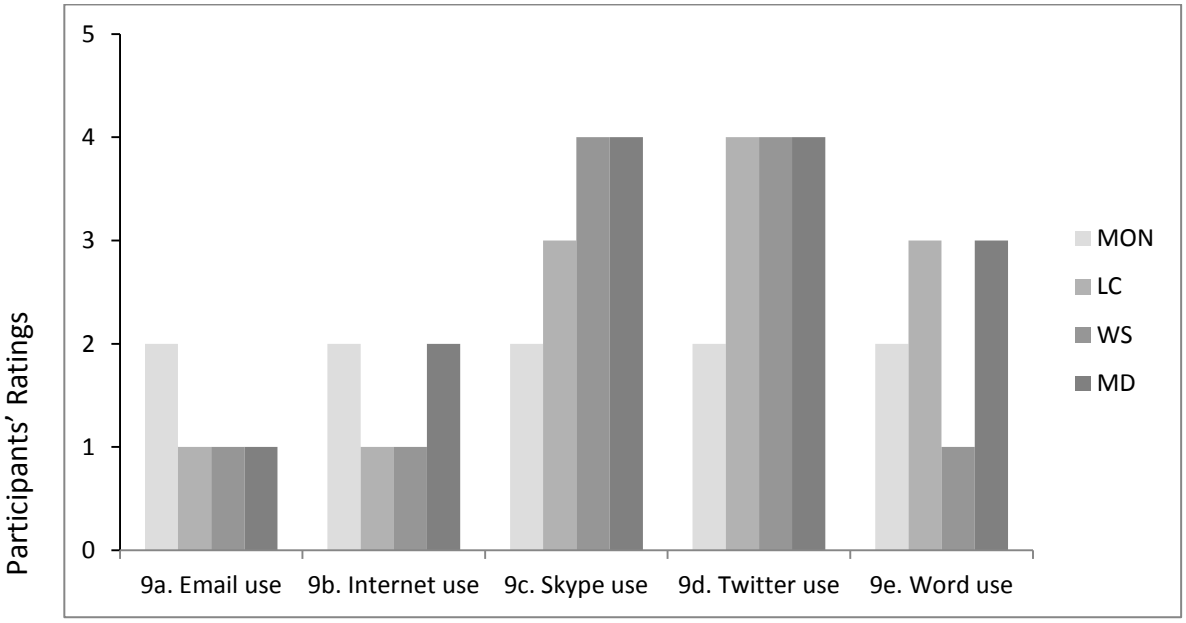

Figure 3: Participants self-ratings of their use of the applications post- courses. Ratings are indicated as: 1: Very Often, 2: Often, 3: Sometimes, 4: Never. Participant's initials are indicated as: MON, LC, WS, & MD.

The Present Study

The present study investigated the differences between blended learning and classroom learning based on the results of older adults' quiz scores and satisfaction ratings. Therefore, the same series of computer courses pilot tested in the previous session were taught to two groups of older adults, with the exception of Microsoft Excel, in either in a blended or classroom environment.

The computer courses included Social Networking courses, Advanced e-mail, Google, Skype or Adobe Connect (depending on the section), Web Safety, Microsoft Word and Computer Brain Training games (see Table 2). The format of the blended courses was five in-class courses, Facebook, Twitter, Google, Adobe Connect and Brain Training games, and three online courses: Web Safety, Advanced e-mail, Microsoft Word. The classroom only section was in the exact same order, except that participants learned Skype instead of Adobe Connect. The students benefited from the courses as they learned social networking skills, e-mail skills, and how to safely navigate the Web. The blended class also learned to use the technology required to take online courses, and acquired some experience with performing courses online.

Table 2

Courses and Course Descriptions

Facebook	**Google**	**Skype**	**Twitter**	**Advanced e-mail functions**	**Web Safety**	**Microsoft Word**
Set-up profile & picture	Search	Create an account	Set-up an account & picture	Sending attachments in e-mail	Social Networking & computer safety	Open a new document
Set-up privacy settings	Maps	Add/Import contacts	Following people	Download /Save attachments	Phishing defined	Open an existing document
Find friends	G-mail	Manage contacts	Send/ Receive tweets	Set-up folders	Keep my computer safe	Save/Save As/Print documents

Compose & post messages	Image	Use Call function	Retrieve e-mail from folders	Reviewing Privacy settings	Insert Header/ Page number
Upload photos	You Tube	Use Video function	E-mail search		Insert Table
		Instant Messaging	Add signature to e-mail		Mail/Labels

Method

The purpose of this mixed methods study was to examine the effectiveness scores and satisfaction ratings of classroom versus blended instruction with a series of eight, one and a half hour computer courses to an older adult population.

Research Design

The design of this study was quasi-experimental as the researcher had access to the participants through the CCS; therefore, all participants were active members of the CCS. The researcher could not randomly assign the participants to the two groups (classroom and blended) as assignment depended on specific criteria. Additionally, as the participants chose to take the courses on their own accord; they ultimately decided which group they participated in.

Therefore, participants were asked to join either the classroom or blended section depending on whether they met certain criteria. To take part in the

blended section, participants were required to have a laptop computer with a camera and microphone, and high-speed internet. They were also required to attend five classroom courses. Participants who did not meet the computer requirements were asked to attend the classroom only courses, as the CCS has five in-house desktop computers available for their members. If all participants met the computer criteria, they would have been randomly assigned to the two groups.

A mixed method design was chosen for this study. This design allowed for the collection of both quantitative and qualitative data, which provided a better understanding of the research problem than would one type of data alone (Creswell, 2012). Additionally, a mixed method design was chosen as there were a small number of participants in the study and collecting both quantitative (quiz scores and close-ended questions) and qualitative (focus group interview and open-ended questions) data allowed for a more in-depth understanding of the participants' ratings on the questionnaires. Participants' comments in the focus group interview and on the open-ended questions provided rich details about their experiences in the computer classes. For example, as there is little research on older adults learning computer skills in a blended learning environment, the comments and feedback from the participants in this group was very important.

For data collection purposes, participants completed quantitative standardized measures, such as online quizzes, and completed pre-and post-course questionnaires containing both close-ended and open-ended questions.

The weekly online quizzes were performed by all participants in Survey Monkey, to allow for the collection of quantitative performance data.

As a follow-up to the open-ended questions on the questionnaires, a focus group interview was performed. The interview provided rich and detailed qualitative data. My role as interviewer was to guide the discussion, but ultimately the goal was to encourage participants to discuss their experiences in the blended learning environment. We utilized the method of triangulation, the concurrent collection of qualitative and quantitative data, to examine these qualitative and quantitative measures. In triangulation, qualitative and quantitative data are usually assigned equal value. These different forms of qualitative and quantitative data were compared and contracted to determine if they generated comparable results or themes (Creswell, 2012).

Setting and Recruitment

All participants were recruited from the Catholic Community Services (CCS), a not-for-profit organization that supplies support services for families and individuals. The CCS provides reliable, highly successful programs and services, to the marginalized and economically disadvantaged, mainly within the Anglophone community of greater Montreal. Since the researcher (Madeleine Ward, who was both the researcher and instructor) had previously volunteered at the CCS LaSalle, QC group, she knew the program coordinator and contacted her about the current study.

A proposal was sent to the program coordinator at the CCS (Appendix J). The proposal outlined the study, the format of the computer courses (classroom, blended) and the desired number of older adults participants required for the study. The coordinator sent the proposal to all the CCS groups in the Montreal, QC area. As the manager at the CCS in Lachine, QC was very interested in having computer courses for her members, she contacted the researcher for more information. Therefore, the older adults who participated in this study were all members of the CCS Lachine, QC group.

In the initial recruiting phase, participants were asked a series of questions to determine their level of computer knowledge. According to the inclusion criteria, participants in the blended group were required to own a laptop computer with a microphone and camera, and high speed internet at home. Participants in the classroom group had access to desktop computers provided by the CCS.

All classroom computer courses were held at the Lachine, QC center. The computer room at the center contained five desktop computers, a projector and a large, white screen. The participants who did not own a laptop computer had access to the desktop computers, and participants with laptops sat at a large table opposite the instructor. The PowerPoint slides were projected onto a large screen and the instructor ensured that all participants could clearly view the screen.

Participants

Table 3 provides detailed demographic information for all participants. Overall, a convenience sample of seventeen older adults from Lachine, QC was studied. Convenience samples are those in which participants are selected because they are willing and available to be studied (Creswell, 2012). For this study, the participants were available as they were members of the CCS and willing to take the computer courses. All participants who took part in this study were retired and aged 60 years and older. More specifically, the majority of participants were female and ranged in age from 71-75 years old. In addition, the educational level of most participants was High School, and their computer usage time was approximately 6.5 hours per week. Participants indicated that they used the computer mostly for communication, information seeking and shopping. All participants possessed good reading skills, and intermediate computer skills.

Table 3

Participants' Demographic Information

Initials	Age Group	Gender	Education Level	Weekly Computer Usage (Hrs.)
DS,SD,ILP	61-65	3 F	HS,C	.50-14
SL, MC, AMB	66-70	3 F	U,C	1-12
VV, ML, FP, MB,HS,OP,BS	71-75	6 F,1 M	HS, C,U	2-21
SG, AS	76-80	1F, 1M	HS,U	1- 8
HD, MM	81-85	2F	HS,C	3-7

Note. F= Female, M= Male. Weekly Computer Usage is indicated in hours.

Education Level: HS= High School, C= Cegep, U= University.

Instruments

A modified version of the PedTech Student Survey downloaded from The Center for the Study of Learning and Performance (Concordia University) was administered pre- and post-courses to both the blended and classroom participants. This measure was chosen as it contained many questions pertaining to learning with technology, the perceived effectiveness of computer use, the courses and the instructor. Questions on the survey that were not pertinent to the audience of the study were removed, with approximately 80% of the questionnaire remaining intact. The PedTech Student Survey has reliability and validity as it was developed by the researchers at Concordia University, and has been used extensively in their research.

The pre-course questionnaire contained questions such as the demographics of the participants, and their computer knowledge and skill level (Appendix A). There were two versions of the post-course questionnaire, one for the classroom section (Appendix B), and another for the blended section (Appendix C). The post-course questionnaire for the classroom section contained questions pertaining to the students' reactions to the courses and the instructor. The post-course questionnaire for the blended section was similar to the classroom section questionnaire, but contained an additional section with questions on the students' reactions to the blended learning courses.

A modification of the Blended Learning Survey for Students was used for the additional section of the blended learning questionnaire (Owston, 2012). This measure was chosen as it contained many questions that compare the blended course format with other face-to-face courses participants may have taken

previously, and questions on whether participants would take additional courses in the blended format. Questions on the survey that did not meet the needs of the study were removed, with approximately 70% of the questionnaire remaining intact. The Blended Learning Survey for Students is a modification of several existing instruments such as: *the Classroom Survey of Student Engagement* (CLASSE), which is an adaptation of the National Survey of Student Engagement; the surveys in the appendices of Garrison and Vaughan's book *Blended Learning In Higher Education*; the *Blended Learning Toolkit* developed at the University of Central Florida; and student surveys from Cook, Owston, and Garrison's COHERE study (Cook, et al. 2004). The Blended Learning Survey for Students (Appendix D) has been used extensively and successfully by York University for their undergraduate blended learning courses (Owston, 2012).

Quizzes of the previous class material were performed weekly by the participants through Survey Monkey. The quizzes contain five multiple choice questions (Appendix E) that evaluated whether participants were able to meet the course objectives and transfer what they learned in the courses at home. The questions on the quizzes were developed by the instructor or were a modified version of the Microsoft Word 2007 exam. Therefore, a quiz was developed for each of the seven segments of the courses: Word, Skype, Facebook, Google, Web Safety, Advanced e-mail and Twitter. To ensure for the validity and reliability of the quizzes, they were evaluated by two subject matter experts who teach statistics at Concordia University, Montreal, QC, and an older adult from the same demographic as the older adults in the study.

To evaluate whether the participants were able to meet the course objectives and transfer what they learned in the courses at home, Kirkpatrick's (1998) four level model was utilized. Kirkpatrick's model was designed as a sequence of ways to evaluate training courses. The four levels of evaluation are: Reaction, Learning, Behavior and Results. A Level 1 analysis evaluates Reaction, or what students felt and thought about the training, a Level 2 evaluates Learning, or the increase in knowledge or skills as a result of the training, a Level 3 analysis evaluated Behavior, or the transfer of knowledge, skills or attitudes from the classroom to the job or home, and a Level 4 analysis evaluates Results, or the final results that occurred due to student participation in a training program.

For this study, three of the four levels of evaluation were examined. The post-course questionnaires contained questions pertaining to the students' reactions to the courses and the instructor (Level 1), the weekly quizzes tested participant's learning of the course objectives (Level 2), and determined if they were able to transfer their knowledge when using their computers at home (Level 3).

Procedure

Two sessions of eight computer classes were taught to an older adult population. The first session occurred from January 14, 2013 to March 4, 2013 and the second session from April 22, 2013- May 15, 2013. The instructor, schedule, and location of the computer courses were identical with the exception

of the course duration. The duration of the first session was eight weeks and the duration of the second session was four weeks. Each session contained two groups of participants (blended group, classroom group) with different participants in each group for each session.

All participants were asked to sign the consent form at the beginning of the first computer class. There was one consent form for the classroom group (Appendix F) and one for the blended group (Appendix G), as the blended group also participated in a focus group discussion at the end of the eight courses. Participants who were not willing to sign the consent form did not participate in the study, but still participated in the computer courses.

On the first day of courses, pre-course questionnaires were administered to all participants to determine why they were interested in taking the computer courses, their expectations of the courses and the instructor, and how often they currently used a computer at home. On the last day of courses, post-course questionnaires were administered to all participants to determine if they were satisfied with the computer courses, instructional method, usability of the course website, and the instructor.

Additionally, for the blended group only, five older adults participated in a focus group discussion. The purpose of the focus group was to determine 1) if the participants enjoyed the blended course format, 2) what participants' felt were the advantages or disadvantages of taking part in a blended course versus a

traditional classroom course, and 3) if they would consider taking additional courses in the blended format.

All eight classroom courses took place at the CCS Community Center, in Lachine, Quebec. For the blended courses, five of the courses took place in the classroom at the same location in Lachine, and three were performed online. Students participated in the online courses from their respective homes. The budget for this project was minimal as the CCS Lachine center offered the computer courses to the participants for a total fee of $ 5.00, to cover the cost of the internet. Participants used their own laptops, or the computers provided by the center. The instructor volunteered to teach the courses, and was not paid. The researcher paid approximately $ 10.00 for the copying of the consent forms and questionnaires.

All computer courses were one and a half hour in length, and were developed by the instructor in PowerPoint 2007. For the classroom courses, the slides were displayed on a large screen by a projector. For the online courses, the PowerPoint slides were uploaded into Adobe Connect, web-conferencing software, and shared with the participants in the Adobe Connect environment.

At the beginning of each course, participants performed a short, online, five item quiz of the material covered in the previous class. After the completion of the quiz, the scheduled course began.

For each course, the instructor began the course by outlining the course objectives. After the objectives were identified, the instructor went through the

PowerPoint slides developed for the course. The participants followed along on their computer with the instructor, in a step-by-step, 'learning-while-applying' style (Charness, Czaja & Sharit, 2007). The instructor occasionally switched from the slides to the actual software the participants were learning for that course. For example, if the subject of the course was Skype, the instructor would sign in to a Skype account she created for the course and demonstrate how to perform certain functions in Skype. The participants were encouraged to sign up for a Skype account of their own and to add each other and the instructor as Contacts. This proved to be a challenge for many of the participants as they were not accustomed to setting up a username and password.

As the course progressed, the participants were able to practice the main features of the software, such as the Call and Video call functions. Throughout the course the instructor ensured that the participants were performing the required operations by asking them if they understood what they are suppose to do and occasionally verifying their computer screens. Participants who appeared confused or lost were assisted immediately, as everyone in the group was expected to follow along at the same pace. At the end of each course, the instructor reminded all participants to refer to the course website if they wanted to practice what they learned in the course at home.

The online courses were performed in the same manner as the classroom courses, except that the students were in the Adobe Connect environment as opposed to the classroom. After the instructor and participants signed into Adobe Connect, they were able to see and hear each other, as the instructor enabled

webcam and microphone rights to all participants. However, due to loud feedback noise and participants talking at the same time, the instructor decided that communicating through the chat function, or allowing microphone rights to one participant at a time, would be more effective. Therefore, only the instructor's microphone was active, and the participants' listened to the instructor while the PowerPoint slides were displayed on the screen.

The instructor engaged participants in the course by asking questions, ensuring that they were following along and understood the course materials, and replying to participants' questions and comments in the chat. Similar to the classroom courses, the instructor occasionally switched from the slides to the actual software the participants were learning for that course. However, in the online environment, when the instructor changed the view in Adobe Connect from the PowerPoint slides to the to the software the class was learning, the participants could no longer see the instructor, they could only hear the instructor's voice and see the software displayed on the screen. For example, in the Microsoft Word course, when the instructor changed the view in Adobe Connect from the PowerPoint slides to Word, the participants could only hear the instructor and see the Word document on the screen.

Moreover, in the online environment, the instructor was not able to see the participants' computer screens to ensure that they were following along on their computers. The instructor had to continually monitor that participants saw and understood what was being taught in the course. The course ended in the same way as the classroom course, with the instructor reminding participants to

refer to the course website if they wanted to practice what they learned in the course.

Finally, on the last day of courses, both groups attended a classroom course. The course for both sections was 'Brain Training Games'. The games were downloaded from two different websites, www.lumosity.com (Figure 11) and www.positscience.com (Figure 12). The instructor and participants accessed the websites on their computers, registered and played the games. The instructor was also available to answer questions and review any of the course materials taught in the previous weeks. Finally, in the last fifteen minutes of the course, participants filled in the post-course questionnaire.

Course Schedule for the Classroom and Blended Groups

Table 4 demonstrates the course schedule that the instructor distributed to the participants at the beginning of the courses. The purpose of the course schedule was to advise the participants of the upcoming courses, and to indicate to the blended group which courses would be performed in the classroom and which courses would be performed online. The week before the scheduled online course, the instructor would remind the participants in the blended group that the next course would be performed online.

The instructor set up the course schedule so that an online course would be performed every second week as opposed to every week. This was to ensure that the participants had a chance to experience the online format, but not the social isolation that could occur with online courses. Therefore, the instructor's

goal was for participants to experience the best mix of the two types of instruction.

Table 4

Weekly Course Schedule

Week	Date	Course	Blended Group Location
1	January 14, 2013	Google	Classroom
2	January 21, 2013	Skype/Adobe Connect	Classroom
3	January 28, 2013	Web Safety	Online
4	February 4, 2013	Advanced e-mail	Classroom
5	February 11, 2013	Microsoft Word	Online
6	February 18, 2013	Twitter	Classroom
7	February 25, 2013	Facebook	Online
8	March 4, 2013	Brain Training	Classroom

Quantitative Results

The purpose of this mixed methods study was to investigate the impact of instructional method on students' quiz scores, and students' satisfaction scores, and the impact of the blended instruction on students rating of motivation.

In this study, two sessions of computer courses were conducted in the same format, with the same course materials, procedures and in the same location. The only difference in the sessions was the duration of the courses, eight weeks in the first session and four weeks in the second session. As the sample size in the groups for both sessions was very small, combining the data from the two sessions was a way to obtain a larger overall sample size. To ensure that there was no statistically significant difference between the two sessions, a one-way repeated measure *ANOVA* was performed with the student self-ratings data obtained from Session 1 and 2. The analysis confirmed that the

two sessions were not statistically different, $F(1, 10) = 1.63$, $p=.23$. Therefore, for the results of this study the data obtained from the two sessions of computer courses were combined.

Quantitative Data Analysis

The purpose of the quantitative analysis was largely to determine if instructional type had an effect on participants quiz scores and satisfaction ratings. The quantitative results will be compared to the qualitative analysis in an attempt to triangulate the data collected. Descriptive statistics (means and standard deviations) and frequencies were analysed with the *IBM Statistical Package for Social Sciences* (SPSS; version 21). For the following data analyses, there was a small sample size for each group, eight in the classroom group and nine in the blended group. It is well known that a small sample size has less power to detect differences or relationships.

To address the research question related to the differences between blended and classroom instruction based on the results of the quiz scores, an Independent Samples Chi-Square test was performed. To investigate whether Instructional Type (classroom, blended) and Time (pre-course and post-course) had an impact on participants' learning of the course materials, the self-ratings of participants in the blended and classroom groups were analyzed using a 2 x 2 repeated-measures *ANOVA*. Additionally, to determine if students were more satisfied with the courses in the blended group or in the classroom group, an

Independent Samples *t*-test analysis was performed. The results of the analyses are outlined below.

Independent Samples Chi-Square

To determine the impact of the instructional type on students' quiz scores, participants performed weekly quizzes via Survey Monkey, on the material covered in the previous course session. The quizzes comprised five multiple-choice questions, with three possible answers, A, B, or C. The table in Appendix I lists the five questions with the participants' response, either A, B, or C. An asterisk is placed beside the correct answer for each question. This raw data was summed across sessions to calculate Chi-Square.

The quizzes were scored in Survey Monkey as the software calculates a response count. Therefore, for each question on the quiz, Survey Monkey provided a count of the number of participants who answered A, B, or C. The researcher compared the results of each question with the correct answer and created tables in Excel to analyse the data. For the Advanced e-mail functions course, in the blended learning group, one participant erroneously completed the questionnaire twice. As Survey Monkey calculates the frequency counts for each question, the researcher noticed that there was an additional reply for each question. As all the questions were answered correctly on the quiz, it was not difficult to remove one response for each question.

For each course (Facebook, Google, Skype, Web Safety, Word, Advanced E-mail and Twitter) the number of right and wrong answers obtained by the

participants was counted (frequencies) and entered into individual tables in Microsoft Excel. From the data in the individual tables, a table with the total number of right and wrong answers (frequencies) was prepared and used to calculate Chi-Square. In this study, the total frequencies were used to calculate Chi-Square due to the small sample size, not having individual responses to the quizzes and the fact that nominal data (classroom/blended, right/wrong) was analysed.

Table 5 contains the observed frequencies, which is the total numbers of frequencies entered into Excel. The observed frequencies were compared with the expected frequencies, which are the frequencies one would expect to get in each cell by chance alone (Urdan, 2010). Therefore, this test allowed us to determine whether the observed frequencies were significantly different than the expected frequencies.

The results of the Chi-Square analysis indicated no significant difference between type of instruction and right and wrong answers, x^2 (1, N = 524) = 2.01, p=.16. Therefore, the results indicated no significant difference between blended learning and classroom learning based on the results of the quiz scores. However, the results did show that the blended learning group had a slightly greater proportion of right versus wrong answers compared to the classroom group.

There is a second way to analyze a 2 x 2 frequency distribution (i.e., cross tabulation) where one factor is a distinction between a treatment and control

group and the other factor is a dichotomous dependant variable (e.g., right-wrong). A *d*-type effect size can be converted from a log odds ratio (LOR) derived from an odds ratio (OR = A x D/B x C). The statistical method follows and the results of this analysis are shown in Tables 5 and 6.

$$OR = \frac{AD}{BC}$$

$$LOR = \log N(oddsratio)$$

$$d = \frac{LOR}{1.8138}$$

Table 5
Frequencies of Right and Wrong Answers by Instructional Type

	Right	Wrong	Frequency
Blended	265	39	304
Classroom	182	38	220
Frequency	447	77	524

Table 6
Effect Size Calculation

Odds Ratio	Log Odds Ratio	*d*
1.42	0.35	0.19

The effect size was also calculated to determine if there were differences between the blended group and the classroom group on achievement of right and wrong answers. The results of the effect size calculation (*d*=0.19) indicated a small difference between the groups on achievement of right versus wrong answers. The results showed that the blended group scored slightly higher on the quizzes, as compared to the classroom group.

In addition to performing the quizzes, participants completed both pre-course and post- course questionnaires. The questionnaires contained both Likert-type questions (close-ended) and open-ended questions. This allowed for the collection of both quantitative and qualitative data.

Repeated-Measures ANOVA

To investigate whether Instructional Type (classroom, blended) and Time (pre-course and post-course) had an impact on participants' learning of the course materials, participants were asked to self-rate their knowledge of the applications (Internet, E-mail, Skype, Twitter and Word) pre- and post-courses, on a scale of 1(none) to 5 (excellent), using a Likert-type scale. For example, if a participant rated themselves (pre-test) as having no or little knowledge of Skype (1/5), and after the course rated themselves as having excellent knowledge of Skype (4/5), then it could be determined that the participant became proficient in Skype from the course.

To investigate whether there was an interaction between Instructional type and Time, a one-way repeated-measures *ANOVA* was performed in SPSS (version 21). I performed a 2 x 2 repeated-measures *ANOVA* with Time (pre, post) as the *within-subjects* factor, and Type of Instruction (classroom, blended) as the *between-subjects* factor. This analysis revealed a statistically significant result for the main effect of Time, F (1, 12) = 56.2, p=*.000* and Instructional Type, F (1, 12) = 5.7, p=.03.

Table 7

Descriptive Statistics for Time by Instruction on Students Self-rating Scores

Test	Type of Instruction	*M*	*SD*	N
Pre-total	Blended	12.6	2.8	7
	Classroom	9.0	2.2	7
	Total	10.8	3.0	14
Post-total	Blended	18.1	2.8	7
	Classroom	14.7	4.2	7
	Total	16.4	3.9	14

Table 8

Repeated Measures Analysis of Variance for Self-Ratings

Source	*SS*	*df*	*MS*	*F*	*p*
Group	85.8	1	85.8	5.7	.03
Error	180.4	12	15.0		
		Within Subjects			
Time	222.9	1	222.9	56.2	.00
Time *Group	0.04	1	0.04	0.00	.93
Error (factor 1)	47.6	12	3.96		

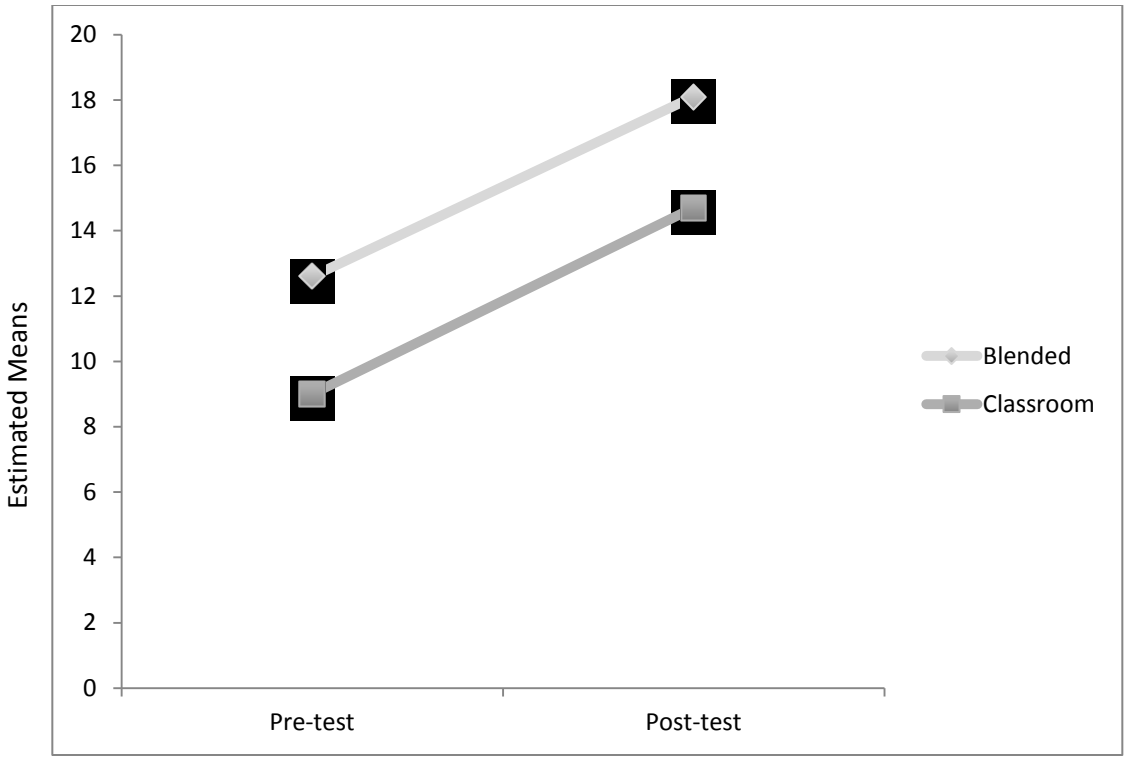

Figure 4. Type of Instruction (classroom, blended) by Time (pre-test, post-test).

The results indicated that the main effect of Type of Instruction (blended, classroom) and Time (pre, post) were statistically significant. This indicates that the blended group learned significantly more than the classroom group post-courses. However, Figure 4 illustrates that the two groups' pre-test self-ratings were different from the outset, as the mean for the blended group was 12.6 and the mean for the classroom group was 9. Therefore, the blended group's self-ratings were already higher on the pre-test, implying that the pre-test differences could have caused the post-test differences or results obtained. Nonetheless, Figure 4 does show that all students rated that they had greater knowledge of the applications on the post-test questionnaire than they did on the pre-course questionnaire, regardless of instructional type.

Independent Samples *t*-test

To investigate students' satisfaction scores, data from the post-course questionnaire was used. Participants rated whether they were satisfied with the course, the instructor, and if they would recommend the courses to others. The post-test questionnaire contained both Likert-type (close-ended) questions and open-ended questions. This allowed for the collection of both quantitative and qualitative data. The quantitative data collected was scored on an interval scale, using a 1 to 4 numbering system. Therefore, to analyse the data from the Likert-type questions, scores were assigned as follows: A = 1, B= 2, C= 3, D=4. The letter A always represented *strongly agree* or *very often* and was scored as the number 1. The letter D always represented *strongly disagree* or *never*, and was scored as the number 4. The satisfaction ratings were assessed from questions 19-23 of the post-course questionnaire, which consisted of five close-ended questions followed by one open-ended question. An Excel spreadsheet was created to record the scoring responses from the questionnaires.

To measure the satisfaction scores data analysis was performed in SPSS (version 21) an independent samples t-test was performed. A two-tailed independent samples *t*-test with Instructional Type (blended, *n*=9; classroom, *n*=8) as the independent variable and Satisfaction Ratings as the dependant variable. This analysis produced a non- significant *t*-value, $t\ (15) = 1.01$ $p= .33$. See Table 9.

An independent samples *t*-test was used to analyse the data as there were two groups, one independent variable, Instruction, with 2 levels (classroom, blended) and one dependant variable, Satisfaction Ratings.

Table 9

Type of Instruction and Satisfaction Ratings

Source	Type	N	Mean	SD	*t*	df	p	Mean diff.
Satisfaction	Blended	9	6.8	1.7	1.01	15	.33	0.78
	Classroom	8	6.0	1.4				

This analysis investigated whether students would be more satisfied with the computer courses in the blended or classroom group. The results showed that students were satisfied with the computer courses, regardless of instructional type.

Figures 5 and 6 indicate that overall participants were very satisfied with the courses, as they rated *strongly agree* to most of the questions on course satisfaction. Additionally, for the classroom group, Figure 5 shows that five participants rated *strongly agree* and three rated *agree* to question 22, which asked if their interest in the subject matter increased as a result of taking the courses. Only one participant rated *strongly disagree* for this question, as she did not want to have an online presence for personal reasons.

For the blended group, Figure 6 shows that four participants rated *strongly agree* and five rated *agree* to question 22, which asked if their interest in the subject matter increased as a result of taking the courses. Overall, participants from both groups were very satisfied with the courses, and taking part in the courses increased their interest in social networking and computer skills training.

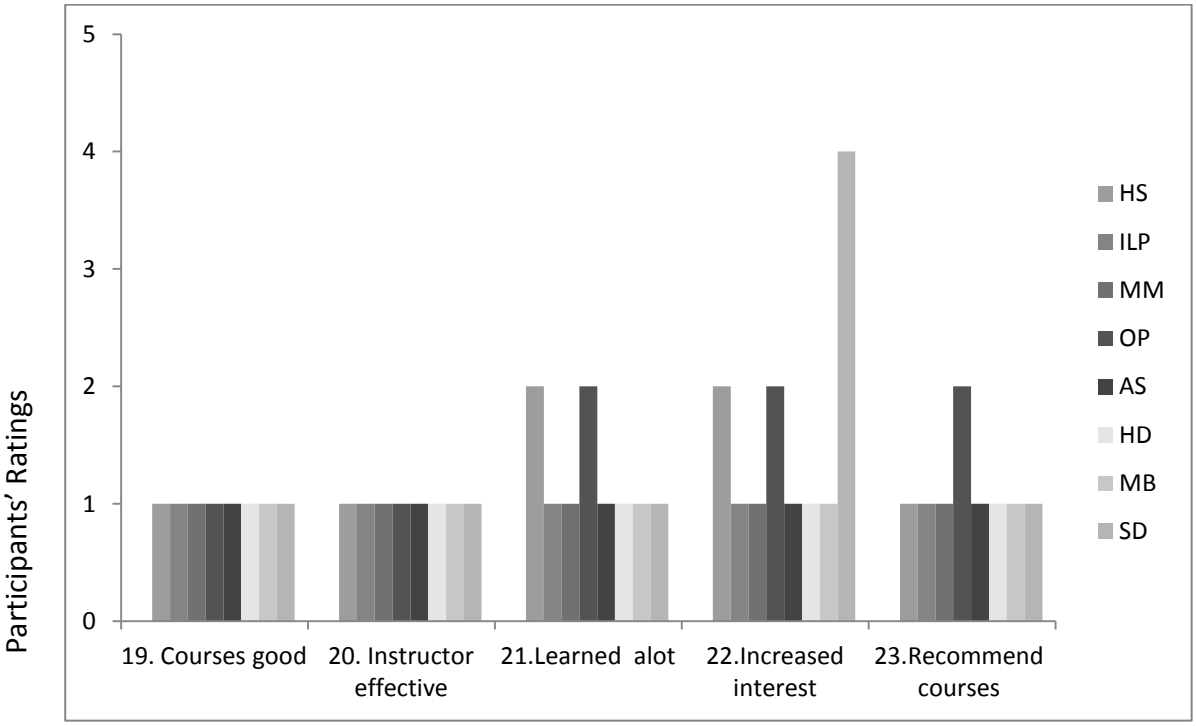

Figure 5: Classroom group participants' satisfaction ratings of the courses. Ratings are indicated as: 1: Strongly Agree, 2: Agree, 3: Disagree and 4: Strongly Disagree**.** Participant's initials are indicated as: HS, ILP, MM, OP, AS, HD, MB, & SD.

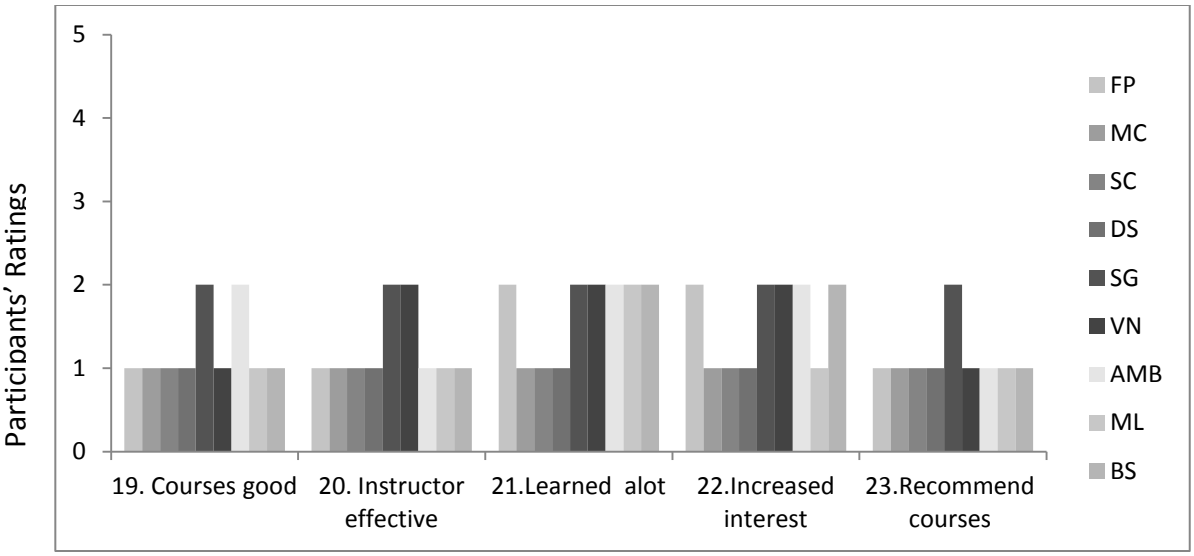

Figure 6: Blended group participants' satisfaction ratings of the courses. Ratings are indicated as: 1: Strongly Agree, 2: Agree, 3: Disagree and 4: Strongly Disagree**.** Participant's initials are indicated as: FP, MC, SC, DS, SG, VN, AMB, ML, & BS.

Qualitative Results

Overall, the comments from the participants were very positive concerning the courses and the instructor. Common themes in the participant's comments were: 'The instructor was very helpful and had lots of patience', 'Very satisfying in explaining all components of the classes', 'Excellent courses', 'I loved the instructor's method of teaching' and 'Instructor was always there to answer all our questions'.

Qualitative Data Analysis

Participants' comments on the post-course questionnaire for both groups reflected the obtained quantitative results. Participants indicated that their

computer knowledge and skills increased as a result of taking the courses. For example, participants' commented that they: 'learned a lot', 'understood computers better', 'learned several new applications', 'improved my skills', and 'felt more comfortable with the applications'.

Blended Instruction and Students Ratings of Motivation

To investigate the impact of blended instruction on students' ratings of motivation, participants in the blended group filled out additional questions on the post-course questionnaire. Participants were asked about their motivation to take additional blended courses, and if they preferred taking an online course to a classroom course. Table 10 contains the questions, ratings and comments from the nine participants.

Table 10
Motivation Questions and Ratings

Questions	Student Ratings
1. Given the opportunity I would take another course in the future that has both online & face-to-face components?	Seven: strongly agree, two: agree. Comments included 'To keep up-to-date with new technology', 'Enjoying both the online and face-to-face courses'
2. The online and face-to-face course components enhanced each other.	Five: strongly agree, four: agree. Comments included: 'Online is great due to not everyone talking at the same time, and hands-on with the teacher is great.' 'Yes, but easier to communicate face-to-face'. 'Online

	doesn't always work well, but fun to learn'.
3. If the same course is being offered in different formats, which course format would you prefer?	Six: blended course format (online & face-to-face), while three rated: entirely face-to-face courses.

The results indicated that almost all participants in the blended group rated that they enjoyed the blended format of the course and would be interested in taking blended courses in the future. Additionally, is it interesting to note that more than half the participants were not only motivated to take additional blended courses; they would in fact prefer it to traditional classroom courses.

Various comments from the participants concerning their motivation to take additional blended courses in the future included 'To keep up-to-date with new technology', 'I would take another because I am always willing to learn new things', and 'To see if familiarity to online part gets easier'.

Focus Group Interview

As a follow-up to the open-ended questions, a focus group interview was performed on March 4, 2013, with five participants (FP, MC, ML, DS, and VV) from the blended learning group. The interview was held on week eight, at the CCS in Lachine, QC. The duration of the interview was approximately 20 minutes. The four questions discussed in the interview are outlined below.

1. What do you feel were the advantages and disadvantages of participating in a blended course versus a classroom course?

2. What did you enjoy about the blended course format? Was there something you did not enjoy?

3. What do you think can be done to improve the blended course format?

4. Would you consider taking other courses in the blended format?

This follow-up analysis was conducted to capture the experiences of the participants in the blended group. Participants were asked to respond to four general questions pertaining to their individual or shared experiences. The interview was audio recorded and later transcribed using Microsoft Word. The interview was subsequently coded, using Microsoft Word, through Glaser and Strauss' (1967) constant comparative method. Through this inductive and comparative method, data is categorized with open coding, where researchers' initial notations of the data are recorded. Next, through a method called axial coding, these codes are grouped into smaller categories. This phase is characterized by contemplation and understanding. Ultimately, these groupings are refined to obtain broad categories or themes. These categories or themes, emerging from the data, are emphasized and discussed (Merriam, 2009). The emergent themes obtained from the data are outlined below.

Findings

The following three themes emerged from the data analysis: (a) participants' satisfaction/dissatisfaction with the blended learning environment, as opposed to the classroom only environment (b) situated learning: participants' experiences of learning in the blended environment, and (c) participants' motivation to take additional blended courses in the future.

Satisfaction/dissatisfaction with the blended learning environment. In this study, the blended learning environment combined both online and classroom learning. One of the themes that emerged from the data was the participants' dissatisfaction with the restrictions associated with learning in an online environment, such as, difficulties reading the instructor's social cues. In addition, compared to the classroom environment, some participants felt it was difficult to engage in an open discussion in the online environment. Comments made by FP and DS:

> ***FP*:** I prefer the classroom course over the blended (online) courses. In the online course, I felt I was sitting back, rather than getting my question in, you may have noticed I did not have many questions, I had questions to ask but I didn't get them in. And: You are more confined in that format, I guess, so personally I prefer the classroom, one on one, it is easier to get your attention, and I can get my questions in.

Another participant commented:

> ***DS***: The only thing I didn't like it that we couldn't all speak at the same time, we were restricted. That made it difficult because we had to write

what we wanted to say, as a group there must be a way for everyone to talk.

The comments expressed by the participants reflect what is commonly expressed by students who chose to learn in an online environment, regardless of age group. Although there are many advantages associated with online learning, such as students learning in their own pace and at their own time, there are also disadvantages, such as minimal social interaction.

In general, most participants said they were satisfied with the blended courses. Comments from ML, DS and VV:

ML: I don't mind the blended, but I am used to being in classroom I think it is whatever you get used to. The course was very informative. I was not used to this format, but it was good for me.

DS: I enjoyed it because I don't have a laptop I have a desktop, I am used to my desktop and the speed it goes, and I really enjoyed the online course. It gave me a chance to try out my new webcam, so I thoroughly enjoyed the online classes.

VV: What I enjoyed online was the fact that I was able to chat, and not interrupt, if there was something to say I just typed it right into the chat, and eventually you (the instructor) would respond to it.

These results reflect the results obtained from the quantitative data analyses. For the quantitative data analyses, students in the blended group rated

that they were satisfied with the blended courses, but not to a greater degree than students in the classroom only group. Therefore, the results of the quantitative and qualitative analyses both indicated that some of the participants in the blended group were more satisfied with the blended learning environment, while other participants, such as FP, stated that they preferred learning in the traditional classroom environment.

Situated learning: participants learning in the blended environment.

Another salient theme that emerged from the data was the importance of situated learning. Lave and Wenger (1991) define situated learning as learning that occurs in the same framework in which it is applied, and that learning is a social process. This kind of learning enables students to learn by socialization, visualization and imitation. This type of learning was apparent in the blended learning environment, as participants stated that they learned from each other. They also stated that they helped each other and felt proud when they were able to help someone else. This in turn made them feel braver and more inclined to try new things on the computer. Additionally, they became the experts as other members at the center who did not take part in the computer courses asked them for help. Comments from the learners include:

> ***FP****:* Even Monica on Friday was asking me questions! We are drawing from each other.
>
> ***MC***: Being here with my computer I feel more secure, I tried something I didn't know how to do and I did it! I set up a folder in my email, I did it!

MC: I taught Frank, but when I get home I am chicken to click I don't know why, I am afraid to get somewhere and it is a mess.

ML: You have to try it on your computer! If someone else does it, you don't learn.

The quantitative data analyses demonstrated that the blended learners self-rated that they were more knowledgeable of the applications after the computer courses. Additionally, for the Chi-Square analysis, the blended learners scored slightly higher on the quizzes, as compared to the classroom group. One of the reasons may be that for the blended group, most participants brought their own laptops to the courses. As the qualitative data suggests, using their own laptops enabled participants to feel braver and more inclined to try new things on the computer, and possibly to feel more comfortable helping others.

Participants' motivation to take additional blended courses. Two additional themes that emerged from the data were related to the course format, and participants' motivation to take additional blended courses in the future.

Currently, there are minimal guidelines in the literature on the most effective format for blended courses with an older adult population. For this study, the researcher determined that the best course format for older adult learners would be five classroom and three online courses. This format appeared to be successful with the learners, as when asked if they enjoyed the course format, all participants in the blended group agreed that it was nice to meet in the classroom, but to also have the online classes. Two participants commented:

ML: I think the format of five classroom and three online courses was a good idea. It worked out well because it was every second class that we were online. I think that it was a good format.

FP*:* It made a lot of sense. It was fine.

Additionally, participants' motivation to take additional blended courses in the future was discussed. Comments from some of the participants include:

DS: Yes I would like it. I enjoy the courses here too; I met a lot of nice people. It went very well. I like both (formats).

FP*:* Yes. We found out what we know and what we don't know.

MC: Yes. I found that coming to class we were able to help each other, you were busy, we helped each other, the other person said click there it is ok, we felt better!

For the quantitative analysis, we investigated the impact of blended instruction on students' ratings of motivation. Students rated whether they would be motivated to take additional blended courses in the future. The results of the analysis indicated that six of the nine participants in the blended group rated that they enjoyed the blended format of the course and would take additional blended courses in the future. These results are consistent with the qualitative data collected from the open-ended questions on the questionnaires. For the results of the focus group interview, most participants in the blended group stated that they would be motivated to take additional blended courses in the future.

Course Website

The course website was created as a learning aid for students to refer to at home. The website was created in Google Sites, and contains copies of the PowerPoint slides in PDF format, for each of the in-class computer courses. At the beginning of the computer courses, the instructor sent the website link to the participants by email. At the end of the first computer course, the instructor demonstrated how to access the link in the email, click on the link to access the website and how to navigate within the website. Students were also shown how to print the PDF files if they so desired. The website allows for asynchronous online learning, as students can access the website at any time (Figure 6).

It is interesting to note that only two students (from the blended group) out of seventeen indicated that they did not use the website. One participant commented the website was 'Very informative to check information'. Also, when asked in class if they used the website, students commented that they did, and it was very helpful.

Discussion

Broadly speaking, the purpose of this mixed methods study was to investigate the impact of instructional method on students' quiz scores, and students' satisfaction scores. According to Peterson (1990) the two major areas of educational gerontology are a) instructional techniques for older learners and b) instruction for individuals who work with older adults. This study compared two instructional techniques (classroom and blended) with social networking and

computer skills training. For this study, participants in both the blended and classroom groups performed weekly quizzes, and completed pre-and post-course questionnaires.

Hypothesis 1 predicted that older adults would score higher on the quizzes in the blended group than the traditional classroom group with the computer training. The performance data indicated that there was no significant difference between blended learning and classroom learning based on the results of the quiz scores. However, the results did show that the blended learning group had a slightly greater proportion of right versus wrong answers compared to the classroom group. Additionally, the effect size analysis (d= 0.19) indicated a small difference between the groups on achievement of right versus wrong answers. The results showed that the blended group scored slightly higher on the quizzes, as compared to the classroom group.

These results were not as expected as the blended group learned the course materials on their own laptop computers. This would suggest that the transfer rate would be higher than the participants who learned the course materials on a computer at the center. According to Lave & Wenger (1991; 1998) 'knowledge is fundamentally located in situations', therefore, transfer is greater when students learn in their own environment, or in their own homes. For this study, the blended learning group performed three of the eight courses on their computers at home. Additionally, when they attended the courses at the center, they were learning on their own computers, and they didn't have to transfer what they learned on the computers at the center to their computers at home.

Therefore, it may be that other factors, such as, the level of difficulty of the quizzes that was an issue. Perhaps the multiple choice questions on the quizzes were too easy, as both groups scored highly on the quizzes. As the quizzes were designed for an older adult population (aged 60+), the researcher did not want them to be too difficult. If the quizzes were too difficult, the participants could have chosen not to do the quizzes. The older adults were not required to attend the computer courses or to perform the quizzes; they did it simply as a recreational activity.

Participants in both groups also rated their level of knowledge of the applications before and after the computer courses. The result indicated a statistically significant main effect of Instructional Type (blended, classroom) and Time (pre- and post- courses). However, both groups were different from the start, with the blended group self-rating their computer skills to be greater than the classroom group. As both groups were not equal to begin with, it is difficult to determine whether the blended group did indeed learn more than the classroom group. However, the results do show that all students rated that they had greater knowledge of the applications on the post-course questionnaire than they did on the pre-course questionnaire.

Generally, one would expect students to know more about a subject they are learning after taking courses, or pre-course to post-course. However, due to the fact that the computer courses were taught to older adults aged 60+, with two older adults in the 80+ age range, and that most participants had little experience using social media, such as Skype, makes the results very interesting. This

cohort of individuals is called ‘digital immigrants’, as they were not born into the digital world, like the ‘digital natives’ of today. To adapt to today’s environment, digital immigrants have to learn a new way of communicating, and functioning in the world. This can be difficult for most and more so for older adults of this age group, who are fascinated by yet terrified of using computers. The fact that they indicated (by self-ratings and comments on the questionnaire) that they had greater knowledge and skill of the applications post-courses, regardless of instructional type, suggests that either type of instruction can be used successfully to teach older adults social media and computer skills.

Hypothesis 2 predicted that older adults would be more satisfied with the blended courses than with the traditional classroom courses. The results of the student satisfaction analysis indicated no significant difference between the blended and classroom groups on their satisfaction ratings, however, the results did show that students were satisfied with the computer courses, regardless of instructional type.

For this study, the blended group participated in five classroom courses and three online courses. The online courses were performed in their respective homes. One of the benefits of online learning is that students can take the courses where and when it is convenient for them. However, for this study, the online courses were performed synchronously, with the instructor and participants meeting online on a specific day and time. Perhaps the participants in the blended group did not rate that they were more satisfied than they did because they did not experience the full benefits associated with online learning,

such as taking the courses at their own convenience. Additionally, retired older adults usually join groups or clubs as they enjoy the socialization that occurs at these outings. The online courses were performed from their homes, so they may have missed going to the center and meeting with the other participants. For example, most participants were at the center at least one hour before the courses began, so they could socialize with the other members. Therefore, these factors could have affected the blended group's satisfaction ratings of the courses.

As this was a mixed method study, qualitative data analysis was also performed. Qualitative data was collected by open-ended questions on the questionnaires and by a focus group interview. Three main themes emerged from the focus group interview. The themes were (a) participants' satisfaction/dissatisfaction with the blended learning environment, as opposed to the classroom only (b) situated learning: participants' experiences of learning in the blended environment, and (c) participants' motivation to take additional blended courses in the future.

For students' satisfaction/dissatisfaction with the blended learning environment, students indicated that they were dissatisfied with the restrictions associated with learning in an online environment, such as, difficulties reading the instructor's social cues. In addition, compared to the classroom environment, some participants felt it was difficult to engage in an open discussion in the online environment. These results reflect the results obtained from the quantitative data analyses, where students indicated that they were satisfied with the blended

courses, but not to a greater degree than students in the classroom only group. Lakin et al. (2008) found that older adults preferred traditional classroom courses, as compared to online instruction. The reasons cited for their preference were poor computer skills and loss of face-to-face connections. In this study, the older adults had intermediate computer skills, and had a classroom course on Adobe Connect before taking the online courses. Therefore, they experienced little difficulty with the technology required to take online courses. However, as this age group is accustomed to taking course in a traditional classroom environment, some of the participants preferred it to the online environment.

For participants' experiences of learning in the blended environment, participants stated that they learned from each other, and that they helped each other and felt proud when they were able to help someone else. This in turn made them feel braver and more inclined to try new things on the computer. However, this was demonstrated more in the classroom environment than the online environment. According to Hansman et al. (2001; 1993) socialization is important as older adults do not easily learn computer skills individually; they interact with other learners, instructor and learning tools. In the online environment the participants found the social learning aspect difficult. In the online environment they could see each other but not hear each other speak, and they could see and hear the instructor, as their webcams were on, but their microphones were disabled. Therefore, participants communicated through the chat. As this older demographic is not accustomed to this type of communication, some found it difficult. The instructor had to encourage them to

use the chat, as they tended to perform physical gestures like shaking their head yes or no instead of typing into the chat.

The final theme that emerged from the dataset was participants' motivation to take additional blended courses in the future. Although the participants' only experience with blended courses were the courses taken as a part of this study, most participants (six of the nine) stated that enjoyed the blended format and they would take other blended courses in the future. This is encouraging as blended instruction can be beneficial to older adult learners, as it mixes the best aspects of classroom learning with the best aspects of online learning.

A number of meta-analyses of online and blended learning compared to classroom instruction have brought together many studies (Bernard et al., 2004, Bernard, 2010, Schmid et al., 2009, Sitzman et al., 2006 and Cook et al., 2008) conducted in various settings in order to estimate the comparative learning effectiveness of these two patterns. This set of studies demonstrated a remarkable degree of consistency, so that the overall conclusion can be drawn that online benefits learners, compared to classroom instruction, but only modestly. However, blended instruction may combine the best of online and classroom environments and therefore may be worth investing resources, time and money, to achieve a more effective form of instruction that is more effective than either classroom or online instruction alone.

Adult Learning Theory

According to Knowles (1980) adult learners need to feel actively engaged in their learning, and course materials need to be meaningful and relevant to their personal lives. The results of this study show that the majority of participants in both groups rated that they felt actively engaged in their learning. In addition, they rated that the course material was meaningful and relevant to their lives. According to the students' self-ratings and comments, their knowledge, interest of the applications, and computer skills increased as a result of participating in the computer courses, regardless of which group they were in.

John (1988) found that adult learners are self-directed, have various life experiences conducive to learning, and have an interest in programs that improve their knowledge and skills, especially if they are associated with issues relevant to their personal lives**.** Similarly, the older adults in this study may have been self-directed, as they were all retired and not required to take the computers courses for employment prospects. The older adults indicated on the pre-course questionnaire that they were interested in acquiring social networking and computers skills for personal reasons, such as to stay in contact with their children and grandchildren living in other parts of the world. In response to the open-ended question 'Why did you sign up for the computer courses?' most participants commented' It is important to know the new technology for communication', and 'to learn more computer skills'. Interestingly, one participant commented that she took the computer courses as 'knowledge for the future'.

Post-course Questions Specific to the Blended Learning Group

In this study, the blended group received additional questions on the post-course questionnaires. The researcher was interested in whether the participants had difficulty using the technology required for the course, in this case Adobe Connect, and if they felt isolated, engaged or anxious when participating in the three online courses as compared with the five classroom courses. The results from the questionnaires showed that participants in general had little trouble with the technology in the courses, and they did not feel anxious or isolated.

Some of the comments from the participants were that they 'felt engaged because I was able to understand the profs info and was able to execute the functions', 'Having others with less or more knowledge, I am able to draw from their questions and the instructors answers', and ‘Getting around onscreen makes me anxious until I get used to the site. This course encourages me to be a bit more daring, and allows me to ask questions off screen'.

Both the quantitative and qualitative data collected showed that most of the participants felt engaged in the courses and more than half stated that not only would they take additional online courses in the future, they would actually prefer it to classroom courses. However, it is important to note that participants did receive additional training in Adobe Connect, and the online courses were synchronous, so the instructor was present and available to assist the participants in the online environment. Consequently, the results of this study may not transfer to courses that are performed asynchronously or in settings where learners interact with content by way of a stand-alone Web-based instructional environment.

Blended Course Design

Currently, there are minimal guidelines in the literature on the most effective format for blended courses with an older adult population. According to Gutierrez (2006) some courses mix the two forms of instruction evenly, while others use more online strategies, rarely using face-to-face contact. For this study, the blended group participated in five classroom courses and three online courses. The researcher decided on this mix so as not to overwhelm the older adult learners. Given the positive ratings and comments of the blended group, this mix may be ideal for an older adult population, as they were able to enjoy the social contact of the classroom courses, but also try something new and exciting with the online courses. This is also reflected in the results of the post-course questionnaire, as more than half the participants in the blended group indicated that the online and classroom courses enhanced each other.

Mixed-Method Analysis

In a convergent mixed-methods design, the researcher compares both the quantitative and qualitative data collected to determine if they yield similar results (Creswell, 2012). In this type of design, the quantitative data provides a general overview of the phenomenon, while the qualitative data offers information about the context and setting. For the results of this study, a comparison of the quantitative and qualitative data showed that the two types of data collected yielded similar results. The participants' ratings (Strongly Agree, Agree, Disagree, Strongly Disagree) and comments on the questions for both the blended and

classroom questionnaires were very similar, with the comments providing context and a deeper understanding of the participants' experiences.

Limitations

Although this study shed some light on older adults' satisfaction ratings and effectiveness scores with blended (classroom/online) versus classroom instruction, certain methodological limitations need to be addressed.

One of the limitations of this study is the small sample size. A small sample size has less power to detect differences or relationships. However, the small sample size did allow for a more in-depth analysis of the participants experiences in the two groups of computer courses.

There were also limitations of the software used to perform the quizzes, Survey Monkey. This software does not allow for the collection of individual quiz scores. Therefore, all the quizzes were performed anonymously in Survey Monkey, and participants' individual scores on the quizzes were not provided.

Moreover, the design of this study was quasi-experimental. This design can introduce significantly more threats to internal validity than a true experiment (Creswell, 2012). One threat to internal validity could be selection, as participants in the blended group may have had more advanced computer skills than the classroom group, thereby affecting the outcome of the study. Other threats to internal validity could be convenience sampling and non-random assignment, as the researcher had access to the participants because they were available and willing to take the courses (Campbell & Stanley, 1963). Finally, another threat

may be mortality, as a participant who signed up for the computer courses felt the courses were too advanced and dropped out after the first course.

Another limitation of the study could be the different durations of the two sessions of computer training. For this study two sessions of computer courses were performed. The duration of the first session was eight weeks, and the duration of the second session was four weeks. Therefore, for the second session, the courses were performed twice a week, as opposed to once a week with session one. The shorter duration of the second session of courses could be a limitation as the participants had less time between courses, and had to learn the course materials at a faster pace than participants in the first session. This may have had an effect on their quiz scores and their ratings of the courses on the post-course questionnaires.

Another limitation is that the results of this study can only be attributed to the two sessions of computer courses taught for this study, and not all computer courses in general. Even though most participants in the blended group stated that they would be motivated to take additional blended courses in the future, they can only base their experiences on the blended courses taught for this study.

Future Research

Some suggestions for future research would be to obtain a larger sample size, preferably with participants who have similar levels of computer skills at the start of the courses. This would ensure that if either of the two groups

(classroom, blended) showed an increase of knowledge and skills post-courses, it would most likely be due to the knowledge they attained from the courses and not that they were different from the onset.

Also, there were some problems with the older adults filling in the quizzes online in Survey Monkey, such as some participants did not frequent their email often, so they did not get the link to perform the quizzes. Therefore, the instructor had to continually remind them to perform the quizzes. A more efficient method may have been to ask participants to fill in a paper and pencil version of the quiz. The researcher would then have the participants' individual ratings on the quizzes, which would have been better for analyzing the quiz data.

Another suggestion for future research would be to perform an item analysis on the quizzes. For the results of this study, there was no significant difference between the two groups on the quiz scores. This may be due to the fact that the multiple choice questions on the quizzes were too easy. Performing an item analysis on the instrument could determine if the questions were sufficiently distracting, and if additional distracters should be used. An item analysis of the quiz questions was not performed for this study; however, if the quizzes were to be reused for a larger scale study, it would be advantageous to perform this analysis.

Additionally, the participants had access to the course website to use as a learning aid. The website contained the PowerPoint slides of all the courses in pdf format. This allowed for asynchronous online learning of the course materials,

as the participants could access the website at any time. The post-course questionnaire contained only two questions pertaining to the course website, such as, if the participants used the website and if they found it helpful. All but two participants indicated that they used the website and that they did indeed found it useful. Moreover, one participant in the blended learning group printed out the all PowerPoint slides and brought them to class to use class notes.

This added element was not fully investigated in this study. Future research could examine how the website helped participants learn the course materials, how often they used the website, and if the website had an impact on the results. Additionally, it could examine if participants enjoyed the online format of the learning aid, or if they would prefer a different format, such as written handouts.

Future research on this topic is important as the number of older adult learners or lifelong learners is on the rise, especially with online learning, as they are becoming more comfortable using technology. Additionally, there are many benefits associated with teaching computer skills to older adults. A recent study found that older adults who frequently use the Internet feel a sense of belonging, and are up to 28 per cent less likely to become depressed. This was reflected in one of the comments from the participants who stated that ‘learning with technology is challenging, but once it is mastered I don’t feel disconnected from the rest of the people who use it’. In other words, it is important for older adults to learn the new technologies so as to stay connected in today’s society. Therefore,

future research that identifies effective instructional strategies for older adults' learning of social networking and computer skills is very important.

Conclusion

Research indicates that a variety of instructional methods are recommended when teaching computer skills to older adults. Blended instruction, which combines synchronous, online learning with classroom instruction, can be an ideal instructional method for older adults. In addition, the problems and inexperience they have with technology use can be addressed and successfully resolved with extra support and technical assistance.

Moreover, the results of this study indicated (by students' quiz scores and satisfaction ratings) that both instructional types, blended (synchronous online and classroom) and traditional classroom instruction, are equally effective for teaching older adults' social networking and computer skills.

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Appendix A

Instruments

- **Questionnaire 1: Pre-course Technology Survey (for all students)**

Please tell us about yourself:

1. Why did you sign up for the computer courses?

_____

_____

2. How would you rate your computer skills? (Please check √)

_____ Beginner _____Intermediate _____ Expert

3. How much time do you spend on the computer per week (e-mail, Internet, etc.)

_____Hours _____Minutes

4. What do you use the computer for? (Please check √ all that apply)

___Communication____ Information Seeking _____Shopping ____Leisure activities

___Other? Please explain_____

5. What do you expect to learn in the eight weeks of computer courses?_____

_____

6. What are your expectations of the Instructor?_____

_____

7.What age group do you fall into:

___ 55-60 ___61-65 ____66-70 ____71-75 ____76-80 ___81-85

8. Are you _____male _____female?

9. What is your education level? High School ____ Cegep _____University____ Other_____

Section I: Learning with Technology. Using the scale provided, please indicate how often you used the following applications as part of this course both inside and outside of class time.

A	**B**	**C**	**D**
Very Often	Often	Sometimes	Never

Frequency of use:

10. Overall, how often will you use a computer during class time?____

11. Overall, how often do you use a computer outside of class time?_____

Please rate your knowledge of these applications:

1	**2**	**3**	**4**	**5**
None	Weak	Average	Good	Excellent

12. E-mail____

13. The Internet (e.g., Search engines such as Google, etc.)___

14. Skype___

15. Twitter____

16. Word processing (i.e., Microsoft Word)____

Section II: Perceived Effectiveness of Computer Use: In and Outside of Class. Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	**B**	**C**	**D**
Strongly Agree	Agree	Disagree	Strongly Disagree

Using a computer for this course …

17. Will help me to be more actively engaged in my learning.___

18. Will make it easier for me to review material that I did not understand in class.___

19. Will help me set realistic learning goals.____

20. Will increase my confidence that I could learn the material._____

21. Will increase my interest in the subject matter in this course._____

22. Will make the course content more personally relevant.____

23. Will increase my interactions with other students and/or the instructor.____

24. Will make it easier for me to express opinions and engage in discussion.____

25. Will increase my confidence in my computer skills _____

Any additional comments?_____

_____

Thank- you for taking the time to fill out our survey!

(Revised from PedTech - Pedagogy-Technology Survey)

Appendix B

- **Questionnaire 2: Post-course Technology Survey** (for classroom section only)

Please provide as much information as possible.

1. What prompted you to sign up for the computer courses?

_____

Section I: Course Structure

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	**B**	**C**	**D**
Strongly Agree	Agree	Disagree	Strongly Disagree

2. The material in the courses was meaningful and relevant. ____

3. The instructor was supportive of individual differences and ways of learning.____

4. This course provided appropriate learning challenges.____

In the courses:

5. I felt that I was actively involved in my own learning.____

6. I was able to set personal learning goals._____

7. I used learning strategies such as notes to keep track of my learning goals._____

Any comments on the course structure?_____

_____

Section II: Learning with Technology

Using the scale provided, please indicate how often you used the following applications as part of this course both inside and outside of class time.

A	**B**	**C**	**D**
Very Often	Often	Sometimes	Never

Frequency of use:

8. Overall, how often did you use your computer during class time?_____

9. Overall, how often do you use the following applications outside of class time?

A	**B**	**C**	**D**
Very Often	Often	Sometimes	Never

E-mail____

The Internet (e.g., Search engines such as Google, etc.)____

Skype_____

Twitter_____

Word processor (i.e., Word)_____

Any comments on learning with technology?_____

_____

Section III: Perceived Effectiveness of Computer Use: In and Outside of Class

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	**B**	**C**	**D**
Strongly Agree	Agree	Disagree	Strongly Disagree

Using a computer for this course …

10. Helped me to be more actively engaged in my learning._____

11. Made it easier for me to review material that I did not understand in class._____

12. Helped me set realistic learning goals._____

13. Increased my confidence that I could learn the material._____

14. Increased my interest in the subject matter in this course._____

15. Made course content more personally relevant._____

16. Was appropriate to my needs and level of understanding._____

17. Increased my interactions with other students and/or the instructor._____

18. Was flexible enough to allow for individual differences in learning._____

Any comments on using the computer for this class?_____

_____

Section IV: Perceived Effectiveness

Please rate your knowledge of these applications after taking the courses:

1	**2**	**3**	**4**	**5**
None	Weak	Average	Good	Excellent

12. E-mail____

13. The Internet (e.g. Search engines such as Google) _____

14. Skype___

15. Twitter____

16. Word processing (i.e., Microsoft Word) ____

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	**B**	**C**	**D**
Strongly Agree	Agree	Disagree	Strongly Disagree

19. Overall, the computer courses were good._____

20. Overall, the instructor was an effective teacher._____

21. Overall, I learned a lot in these courses._____

22. My interest in this subject area has increased as a result of taking these courses._____

23. I would recommend these courses to others._____

Any comments on the effectiveness of the course or Instructor?_____

_____

Section V: The Computer Course Website

24. Did you use the Website as supplementary aid? ___Yes ___No

25. If so, did you find the website helpful? ___Yes ___No

If no, why?_____

Additional Comments:

If there are any questions, comments or suggestions that you would like to add please add them on the sheet below. We would love to hear from you! All comments welcome.

_____

Thank- you for taking the time to fill out our survey!

(Revised from PedTech - Pedagogy-Technology Survey)

Appendix C

- **<u>Questionnaire 3: Post-Course Technology Survey</u>** (for blended section only)

Section I: Blended Learning Survey

Using the scale provided, please rate the extent to which you agree or disagree with the following statements**.**

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

1. Overall, I am satisfied with this course _____

Please indicate reasons for satisfaction or dissatisfaction_____
_____

2. Given the opportunity I would take another course in the future that has both online and face-to-face components._____

Please indicate reasons for taking or not taking another course with both components

_____
_____

3. The online and face-to-face course components enhanced each other.

_____

If not, why?_____

Compared to other face-to-face courses I have taken:

4. This course offered the convenience of not having to go to the center as often

5. This course allowed me to reduce my travel time each week and related expenses_____

6. I am more engaged in this course_____

7. I am likely to ask questions in this course_____

8. I feel the amount of my interaction with other students in this course increased_____

9. I feel connected to other students in this course_____

10. I feel isolated in this course_____

11. I feel the amount of my interaction with the instructor in this course increased_____

12. I have trouble using the technologies in this course_____

13. I feel more anxious in this course_____

14. This course required more time and effort_____

Please provide additional comments (such as, I felt more engaged/isolated/ or anxious in this course because...)

_____

_____

Course Format Preferences (Please circle your answer)

15. If the same course is being offered in difference formats, which course format would you prefer?

a. Entirely face-to-face course format

b. Blended course format (online and face-to-face course)

c. Entirely online course format (no face-to-face class time)

Section II: Course Structure

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	**B**	**C**	**D**
Strongly Agree	Agree	Disagree	Strongly Disagree

16. The material in the courses was meaningful and relevant. ____

17. The instructor was supportive of individual differences and ways of learning.____

18. This course provided appropriate learning challenges.____

In the courses:

19. I felt that I was actively involved in my own learning.____

20. I was able to set personal learning goals._____

21. I used learning strategies such as notes to keep track of my learning goals._____

Any comments on the course structure?_____

_____

Section III: Learning with Technology

Using the scale provided, please indicate how often you used the following applications as part of this course both inside and outside of class time.

A	B	C	D
Very Often	Often	Sometimes	Never

Frequency of use:

22. Overall, how often do you use the following applications outside of class time?

A	B	C	D
Very Often	Often	Sometimes	Never

E-mail____

The Internet (e.g., Search engines such as Google, etc.)____

Skype_____

Twitter_____

Word processor (i.e., Word)_____

Any comments on learning with technology?_____

_____

Section IV: Perceived Effectiveness

Please rate your knowledge of these applications after taking the courses:

1	2	3	4	5
None	Weak	Average	Good	Excellent

12. E-mail____

13. The Internet (e.g. Search engines such as Google) _____

14. Skype___

15. Twitter____

16. Word processing (i.e., Microsoft Word) _____

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

23. Overall, the computer courses were good._____

24. Overall, the instructor was an effective teacher._____

25. Overall, I learned a lot in the courses._____

26. My interest in this subject area has increased as a result of taking these courses._____

27. I would recommend these courses to others._____

Any comments on the effectiveness of the course or Instructor?_____

_____

Section V: The Computer Course Website

28. Did you use the Website as supplementary aid? ___Yes ___No

29. If so, did you find the website helpful? ___Yes ___No

If no, why?_____

Additional Comments:

If there are any questions, comments or suggestions that you would like to add please add them on the sheet below. We would love to hear from you! All comments welcome.

_____

Thank- you for taking the time to fill out our survey!

(Revised from: PedTech - Pedagogy-Technology Survey, Revised Blended Learning Survey for Students, Owston, R. (2012). p. 30-31)

Appendix D

Blended Learning Survey for Students

Using the scale provided, please rate the extent to which you agree or disagree with the following statements.

A	B	C	D
Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**

1. Overall, I am satisfied with this course._____

2. Given the opportunity I would take another course in the future that has both online and face-to-face components._____

3. The online and face-to-face course components enhanced each other. _____

Compared to other face-to-face courses I have taken:

4. This course offered the convenience of not having to go to the center as often ____

5. This course allowed me to reduce my travel time each week and related expenses_____

6. I am more engaged in this course_____

7. I am likely to ask questions in this course_____

8. I feel the amount of my interaction with other students in this course increased_____

9. I feel connected to other students in this course_____

10. I feel isolated in this course_____

11. I feel the amount of my interaction with the instructor in this course increased_____

12. I have trouble using the technologies in this course_____

13. I feel more anxious in this course_____

14. This course required more time and effort_____

Course Format Preferences (Please circle your answer)

15. If the same course is being offered in difference formats, which course format would you prefer?

a. Entirely face-to-face course format
b. Blended course format (online and face-to-face course)
c. Entirely online course format (no face-to-face class time)

Adapted from: Owston, R. (2012). Blended Learning Survey for Students, p. 30-31.

Appendix E

- **Quiz questions** (For both sections)

Microsoft Word 2007 Course Quiz

Q1. What is MS Word?

A. It is a typing tool

B. It is a calculation tool

C. It is a computerized tool

Q2. The simplest way to rearrange text in your document is?

A. Cutting, copying and pasting.

B. Drag and drop

C. Type and replace

Q3. Which button is used to save our document?

A. Home button

B. Review button

C. Insert button

Q4. You use Insert tab to put a Header and Footer in a document?

A. True

B. False

Q5. Which tab do we use to change our font size?

A. Home tab

B. Format tab

C. Review tab

Appendix F

Consent Form (Classroom group)

Consent to Participant in: 'The Efficacy of Blended vs. Classroom Instruction with Older Adults Learning Social Networking and Computer Skills'

I understand that I have been asked to participate in a program of research being conducted by Madeleine Ward of Educational Technology of Concordia University, e-mail: wardmaddy@gmail.com Tel: 514-883-2741.

A. PURPOSE

I have been informed that the purpose of the research is to examine the effectiveness and satisfaction ratings of classroom versus blended (online/classroom) instruction with a series of eight, 11/2 hour computer courses.

B. PROCEDURES

I understand that I will take part in a one and a half hour computer course located in Lachine, Quebec. The computer courses occur once a week, for a total of eight weeks. Madeleine Ward will be the instructor for all eight computer courses. Participants willing to be part of the study will be asked to fill in questionnaires and perform weekly "quizzes" which are standard for the course.

C. RISKS AND BENEFITS

I understand that Survey Monkey will be used to collect data, therefore ' information/data is stored on international servers and/or housed by U.S. service providers and confidentiality can only be assured up to the point where information is assessed/requested by authorities as per local law (ex. U.S. Patriot Act)'. Benefits include learning social networking skills, e-mail skills and how to safely navigate the Web.

D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.
- I understand that my participation in this study is CONFIDENTIAL (i.e., the researcher will know, but will not disclose my identity)
- I understand that I will receive a signed copy of this consent form.
- I understand that the data from this study may be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print)

_____

SIGNATURE
_____DATE_____

Researcher's signature_____
DATE_____

If at any time you have questions about the proposed research, please contact the study's Principal Investigator: Dr. Robert Bernard, Educational Technology Department, 514-848-2424, local 2027, bernard@education.concordia.ca

If at any time you have questions about your rights as a research participant, please contact the Research Ethics and Compliance Advisor, Concordia University, 514.848.2424 ex. 7481 ethics@alcor.concordia.ca

I wish to receive a copy of the final research report for this study (Please check) ☐

Appendix G

Consent Form (Blended group)

Consent to Participant in: 'The Efficacy of Blended vs. Classroom Instruction with Older Adults Learning Social Networking and Computer Skills'

I understand that I have been asked to participate in a program of research being conducted by Madeleine Ward of Educational Technology of Concordia University, e-mail: wardmaddy@gmail.com Tel: 514-883-2741.

A. PURPOSE

I have been informed that the purpose of the research is to examine the effectiveness and satisfaction ratings of classroom versus blended (online/classroom) instruction with a series of eight, 11/2 hour computer courses.

B. PROCEDURES

I understand that I will take part in a one and a half hour computer course located in Lachine, Quebec. The computer courses occur twice a week, for a total of four weeks. Madeleine Ward will be the instructor for all eight computer courses. Participants willing to be part of the study will be asked to fill in questionnaires and perform weekly "quizzes" which are standard for the course. **Participants will also be asked to take part in a Focus group session that will be recorded by the instructor.**

C. RISKS AND BENEFITS

I understand that Survey Monkey will be used to collect data, therefore ' information/data is stored on international servers and/or housed by U.S. service providers and confidentiality can only be assured up to the point where information is assessed/requested by authorities as per local law (ex. U.S. Patriot Act)'. Benefits include learning social networking skills, e-mail skills and how to safely navigate the Web.

D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.

- I understand that my participation in this study is CONFIDENTIAL (i.e., the researcher will know, but will not disclose my identity)
- I understand that I will receive a signed copy of this consent form.
- I understand that the data from this study may be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print)
_____

SIGNATURE
_____DATE_____

Researcher's signature_____
DATE_____

If at any time you have questions about the proposed research, please contact the study's Principal Investigator: Dr. Robert Bernard, Educational Technology Department, 514-848-2424, local 2027, bernard@education.concordia.ca. If at any time you have questions about your rights as a research participant, please contact the Research Ethics and Compliance Advisor, Concordia University, 514.848.2424 ex. 7481 ethics@alcor.concordia.ca

I wish to receive a copy of the final research report for this study (Please c ☐

Appendix H

SPF Form

UNIVERSITÉ Concordia UNIVERSITY

Summary Protocol Form (SPF)

University Human Research Ethics Committee

Important

Approval of a *Summary Protocol Form* (SPF) must be issued by the applicable Human Research Ethics Committee prior to beginning any research involving human participants.

The University Human Research Ethics Committee (UHREC) reviews all Faculty and Staff research, as well as some student research (in cases where the research involves more than minimal risk - please see below).

Research funds cannot be released until appropriate certification has been obtained.

For faculty and staff research

Please submit one signed copy of this form to the UHREC c/o the Research Ethics and Compliance Unit, GM-1000. Please allow one month for the UHREC to complete the review.

Electronic signatures will be accepted via e-mail at ethics@alcor.concordia.ca

For graduate or undergraduate student research

- If your project is included in your supervising faculty member's SPF, no new SPF is required.
- Departmental Research Ethics Committees are responsible for reviewing all student research, including graduate thesis research, where the risk is less than minimal. In Departments where an ethics committee has not been established, please contact the Research Ethics and Compliance Unit.
- In cases where the student research is more than minimal risk (i.e. the research involves participants under the age of 18yrs, participants with diminished capacity, participants from vulnerable populations or participants from First Nations), an SPF must be submitted to the UHREC, c/o the Research Ethics and Compliance Unit, GM-1000, by the Course Instructor/Supervisor on the student's behalf.

Instructions

This document is a form-fillable word document. Please open in Microsoft Word, and tab through the sections, clicking on checkboxes and typing your responses. The form will expand to fit your text. Handwritten forms will not be accepted. If you have technical difficulties with this document, you may type your responses and submit them on another sheet. Incomplete or omitted responses may cause delays in the processing of your protocol.

Does your research involve

☐ Participants under the age of 18 years?

☐ Participant with diminished mental or physical capacity?

☐ Aboriginal peoples?

☐ Vulnerable groups (refugees, prisoners, victims of violence, etc.)?

1. Submission Information

Please provide the requested contact information in the table below:

Please check ONE of the boxes below :

☐ This application is for a new protocol.

x☐ This application is a modification or an update of an existing protocol:

Previous protocol number (s): _____

2. Contact Information

Please provide the requested contact information in the table below:

Principal Investigator/ Instructor (must be Concordia faculty or staff member)	Department	Internal Address	Phone Number	E-mail
Dr. Robert Bernard	Educational Technology	LB 583-3	(514) 848-2424x 2027	bernard@education.concordi.ca

Co-Investigators / Collaborators	University / Department	E-mail
Madeleine Ward	Educational Technology	wardmaddy@gmail.com
Research Assistants	Department / Program	E-mail

3. Project and Funding Sources

Project Title:	**The Efficacy of Blended vs. Classroom Instruction With Older Adults Learning Social Networking and Computer Skills.**

In the table below, please list all existing internal and external sources of research funding, and associated information, which will be used to support this project. Please include anticipated start and finish dates for the project(s). Note that for awarded grants, the grant number is REQUIRED. If a grant is an application only, list APPLIED instead.

Funding Source	Project Title	Grant Number	Award Period	
			Start	End

4. Brief Description of Research or Activity

Please provide a brief overall description of the project or research activity. Include a description of the benefits which are likely to be derived from the project. Do not submit your thesis proposal or grant application.

This study will examine the effectiveness and satisfaction ratings of classroom versus blended (synchronous online/classroom) instruction with a series of eight, 11/2 hour computer courses to an older adult population. Courses included Social Networking, advanced e-mail, Google, Skype or Adobe Connect (depending on the section), Web Safety, Microsoft Word and Computer Brain Training games.

The format of the blended courses will consist of courses 1-3 in class: advanced e-mail, Adobe Connect and Web Safety, courses 4-7 online: Facebook, Twitter, Google, Word, and course 8 in class: Brain Training games. The classroom courses will have the same format except that participants will learn Skype instead of Adobe Connect.

The students will benefit from the courses as they will learn social networking skills, e-mail skills, and how to safely navigate the Web. The blended class will also learn the technology required to take courses online and acquire experience in taking online courses.

All courses are geared towards adults aged 55+.

Facebook	**Skype**	**Twitter**	**Advanced e-mail functions**	**Web Safety**	**Microsoft Word**
Set-up profile & picture	Create an account	Set-up an account & picture	Sending attachments in e-mail	Social Networking & computer safety	Open a new document
Set-up privacy settings	Add/Import contacts	Following people/organizations	Download /Save attachments	Phishing defined	Open an existing document
Find friends	Manage contacts	Send/Receive tweets	Set-up folders	Keep my computer safe	Save/Save As/Print documents
Compose & post messages	Use Call function		Retrieve e-mail from folders	Reviewing Privacy settings	Insert Header/Footer/Page number
Upload photos	Use Video function		E-mail search		Insert Table

	Instant Messaging		Add signature to e-mail		Mail/Labels
					Spell check/ Thesaurus

5. Scholarly Review / Merit

Has this research been funded by a peer-reviewed granting agency (e.g. CIHR, FQRSC, Hexagram)?

☐ Yes Agency: _____

If your research is beyond minimal risk, please complete and attach the Scholarly Review Form

x☐ No

6. Research Participants

a) Please describe the group of people who will participate in this project.

The participants in the group will are aged 55+ years and older. Participants will have good reading skills and intermediate computer skills.

b) Please describe in detail how participants will be recruited to participate. Please attach to this protocol draft versions of any recruitment advertising, letters, etcetera which will be used.

In the initial recruiting phase, participants will be asked a series of questions to determine their level of computer knowledge. According to the inclusion criteria, participants in the blended group will have a laptop computer with a microphone and camera, and high speed internet at home. Participants in the classroom group will have access to a laptop computer. All participants are retired, and members of the CCS Community Services Lachine group. The researcher has access to this group through CCS.

c) Please describe in detail how participants will be treated throughout the course of the research project. Include a summary of research procedures, and information regarding the training of researchers and assistants. Include sample interview questions, draft questionnaires, etcetera, as appropriate.

Participants will sign the consent form at the beginning of the first computer class (both blended and classroom). At the beginning of the courses a questionnaire will be administered to participants to determine why they are interested in taking the computer courses, their expectations of the courses and the instructor, and how often they currently use a computer at home. At the end of the courses, a questionnaire will be administered to determine which instructional method the participants preferred, if they were satisfied with the courses, and if participating in the courses helps them to better integrate into mainstream society. In other words, can they transfer what they learned in the computer courses to their real lives? Do they feel more confident in communicating with their families and friends, either by e-mail, Facebook or Skype? Are they able to perform internet searches on their topics of interest? The questionnaire will also ask the participants about the efficacy of the instructor and the usability of the course website.

In addition, quizzes of the previous class material will be performed every week either on Adobe Connect (blended/online course) or through Survey Monkey (classroom). A modified version of the PedTech Student Survey, downloaded from the CSLP (Concordia University) will be administered pre and post both the blended and classroom courses. In addition, a modified version of the Blended Learning Survey for Students will be administered to the students in the blended learning computer classes (Owston, 2012).

The purpose of this mixed methods study is to investigate the impact of instructional methods on students quiz scores, and student's satisfaction scores, and the impact of the blended instruction on students rating of motivation. To measure this, I will collect data from 20-30 older adults (aged 55+) using quizzes and questionnaires.

The design of this study is quasi-experimental. Participants will be assigned to the classroom or blended courses depending on whether they meet certain criteria. To take part in the blended courses, participants need to have a laptop computer with a camera and microphone, have high-speed internet at home, have some computer experience (e-mail, internet searches) and be able to attend 4 classroom courses. Participants who do not meet the computer requirements will be placed in the classroom courses. Convenience sampling will be used in this study as I will have access to participants because they are willing to take computer courses and are available.

7. Informed Consent

a) Please describe how you will obtain informed consent from your participants. A copy of your written consent form or your oral consent script must be attached to this protocol. *Please note: written consent forms must follow the format of the sample consent form template provided for you at the Ethics and Compliance webpage*

The participants will complete the consent form at the beginning of the computer courses. Please see attached copy of consent form for this study.

b) In some cultural traditions, individualized consent as implied above may not be appropriate, or additional consent (e.g. group consent; consent from community leaders) may be required. If this is the case with your sample population, please describe the appropriate format of consent and how you will obtain it.

Does not apply to this study.

8. Deception and Freedom to Discontinue

a) Please describe the nature of any deception, and provide a rationale regarding why it must be used in your protocol. Is deception absolutely necessary for your research design? Please note that deception includes, but is not limited to, the following: deliberate presentation of false information; suppression of material information; selection of information designed to mislead; selective disclosure of information.

No deception will be used in this study.

b) How will participants be informed that they are free to discontinue at any time? Will the nature of the project place any limitations on this freedom (e.g. documentary film)?

As outlined in the consent form, all participants can choose not to participate in the study without penalty.

9. Risks and Benefits

a) Please identify any foreseeable risks or potential harms to participants. This includes low-level risk or any form of discomfort resulting from the research procedure. When appropriate, indicate arrangements that have been made to ascertain that subjects are in "healthy" enough condition to undergo the intended research procedures. Include any "withdrawal" criteria.

Does not apply to this study. If the participants experience boredom, they can stop the computer courses at any time, without risk. The participant's involvement in the courses will not affect their access to services at the CCS.

b) Please indicate how the risks identified above will be minimized. Also, if a potential risk or harm should be realized, what action will be taken? Please attach any available list of referral resources, if applicable.

The participants are aware that they can contact the Manager at CCS Lachine, Carolyn Arseneault, at any time. Participants in the computer courses are all members of the CCS, and therefore have received a Welcome Package that contains the coordinates for Carolyn Arseneault.

c) Is there a likelihood of a particular sort of "heinous discovery" with your project (e.g. disclosure of child abuse; discovery of an unknown illness or condition; etcetera)? If so, how will such a discovery be handled?

Is not expected in this study. Should information emerge that suggests problems, the participant will be referred to the proper authority/professional.

10. Data Access and Storage

a) Please describe what access research participants will have to study results, and any debriefing information that will be provided to participants post-participation.

Participants will have access to study results if they so desire, by contacting Madeleine Ward by telephone or e-mail. Her coordinates are listed on the consent form. There will also be a debriefing session after the questionnaires are completed by the participants.

b) Please describe the path of your data from collection to storage to its eventual archiving or disposal. Include specific details on short and long-term storage (format and location), who will have access, and final destination (including archiving, or any other disposal or destruction methods).

The researcher will keep all information on the study in a locked drawer in her office, and a password protected file on her computer. No one will have access to the materials except the researcher. The data will be kept for a maximum of five years, after which the data will be shredded and destroyed.

11. Confidentiality of Results

Please identify what access you, as a researcher, will have to your participant(s) identity(ies):

☐	Fully Anonymous	Researcher will not be able to identify who participated at all. Demographic information collected will be insufficient to identify individuals.
☐	Anonymous results, but identify who participated	The participation of individuals will be tracked (e.g. to provide course credit, chance for prize, etc) but it would be impossible for collected data to be linked to individuals.
☐	Pseudonym	Data collected will be linked to an individual who will only be identified by a fictitious name / code. The researcher will not know the "real" identity of the participant.
x☐	Confidential	Researcher will know "real" identity of participant, but this identity will not be disclosed.
☐	Disclosed	Researcher will know and will reveal "real" identity of participants in results / published material.
☐	Participant Choice	Participant will have the option of choosing which level of disclosure they wish for their "real" identity.
☐	Other (please describe)	

a) If your sample group is a particularly vulnerable population, in which the revelation of their identity could be particularly sensitive, please describe any special measures that you will take to respect the wishes of your participants regarding the disclosure of their identity.

Does not apply to this sample

b) In some research traditions (e.g. action research, research of a socio-political nature) there can be concerns about giving participant groups a "voice". This is especially the case with groups that have been oppressed or whose views have been suppressed in their cultural location. If these concerns are relevant for your participant group, please describe how you will address them in your project.

Does not apply to this sample

12. Additional Comments

a) Bearing in mind the ethical guidelines of your academic and/or professional association, please comment on any other ethical concerns which may arise in the conduct of this protocol (e.g. responsibility to subjects beyond the purposes of this study).

b) If you have feedback about this form, please provide it here.

13. Signature and Declaration

Following approval from the UHREC, a protocol number will be assigned. This number must be used when giving any follow-up information or when requesting modifications to this protocol.

The UHREC will request annual status reports for all protocols, one year after the last approval date. Modification requests can be submitted as required, by submitting to the UHREC a memo describing any changes, and an updated copy of this document.

I hereby declare that this Summary Protocol Form accurately describes the research project or scholarly activity that I plan to conduct. Should I wish to add elements to my research program or make changes, I will edit this document accordingly and submit it to the University Human Research Ethics Committee for Approval.

ALL activity conducted in relation to this project will be in compliance with:

- ***The Tri Council Policy Statement: Ethical Conduct for Research Involving Human Subjects*** **http://www.pre.ethics.gc.ca/pdf/eng/tcps2/TCPS_2_FINAL_Web.pdf**

- **The Concordia University Code of Ethics: Guidelines for Ethical Actions**

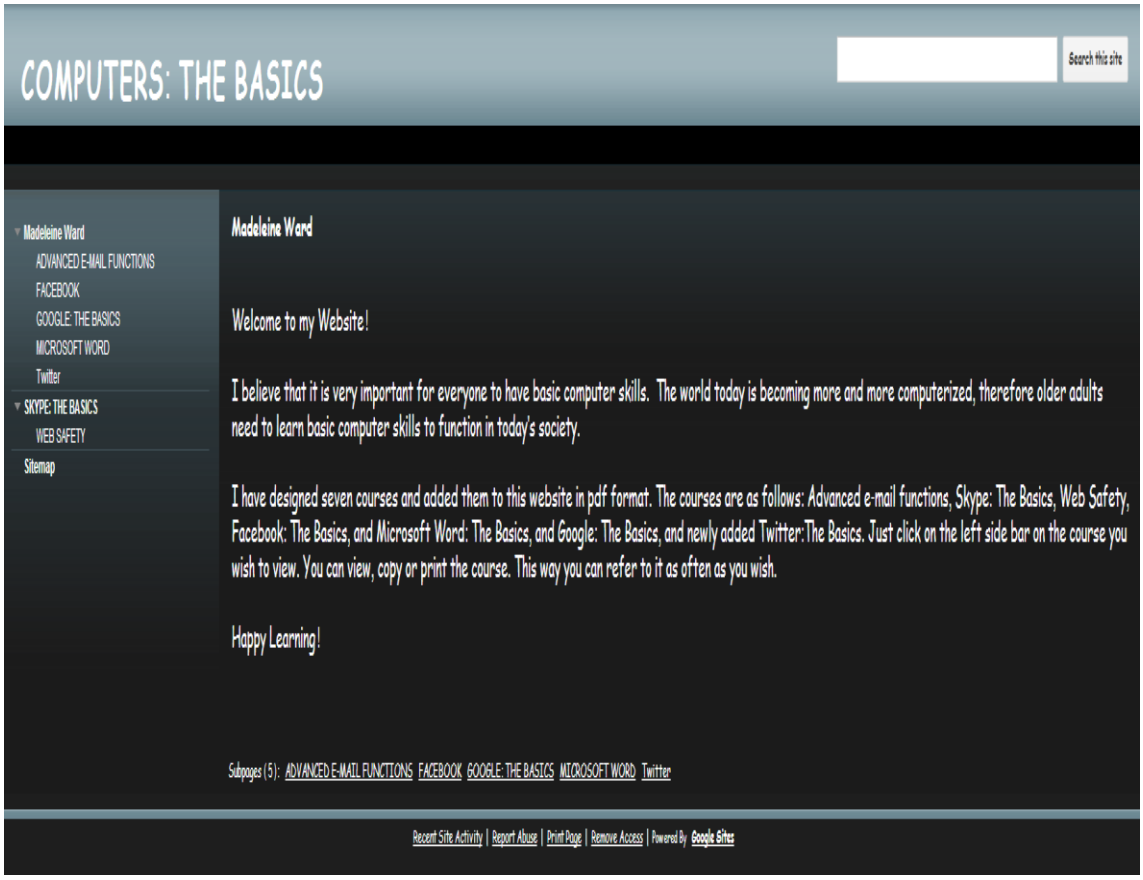
Signature of Principal Investigator:_____

Date: _____

Note that SPF's with electronic signatures will be accepted via e-mail

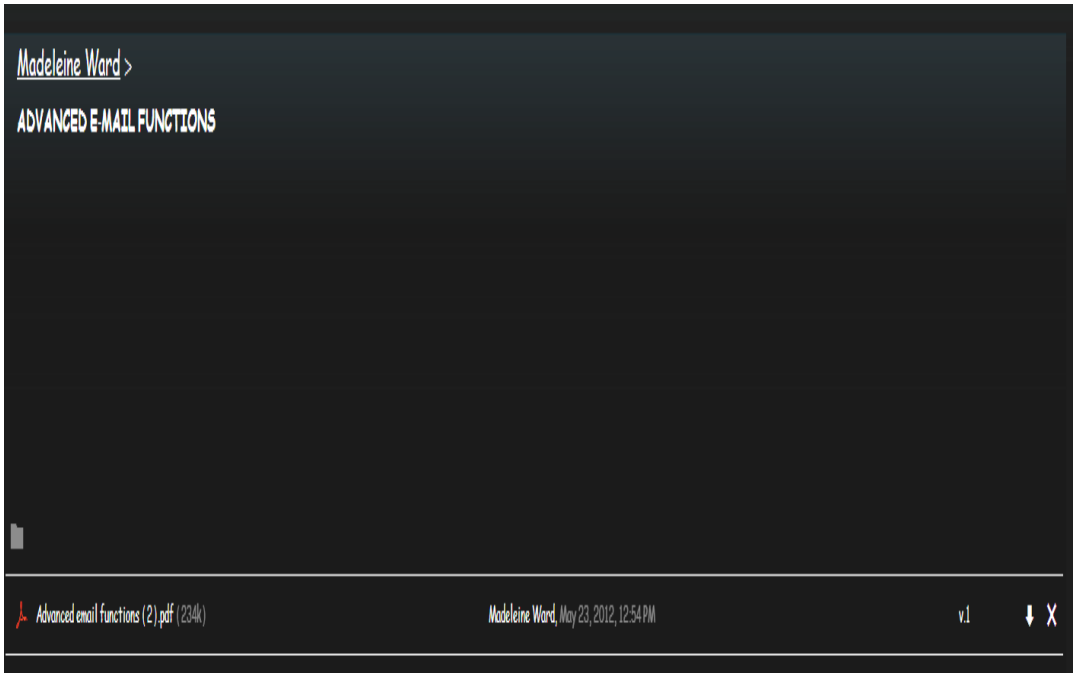
Figure 7: Google Website Screen Shots

Google website with all the computer courses listed.



When clicking on a link for the required course, for example Advanced E-mail Functions

Figure 8: Choosing the Advanced email functions course



After clicking on the PDF file for the course the course slides appear. Students can view or print the slides.

Figure 9: Advanced email functions course slides


Course 1:
Advanced e-mail functions
MADELEINE WARD
I'm out of bed and I made it to the keyboard. What more do you want?
YAHOO! MAIL
GMail
Sending attachments in e-mail
3
Click on Compose Message
WHAT'S NEW
INBOX (2877)
CONTACTS
New Email
Compose Message
Send
Cancel
Save as Draft

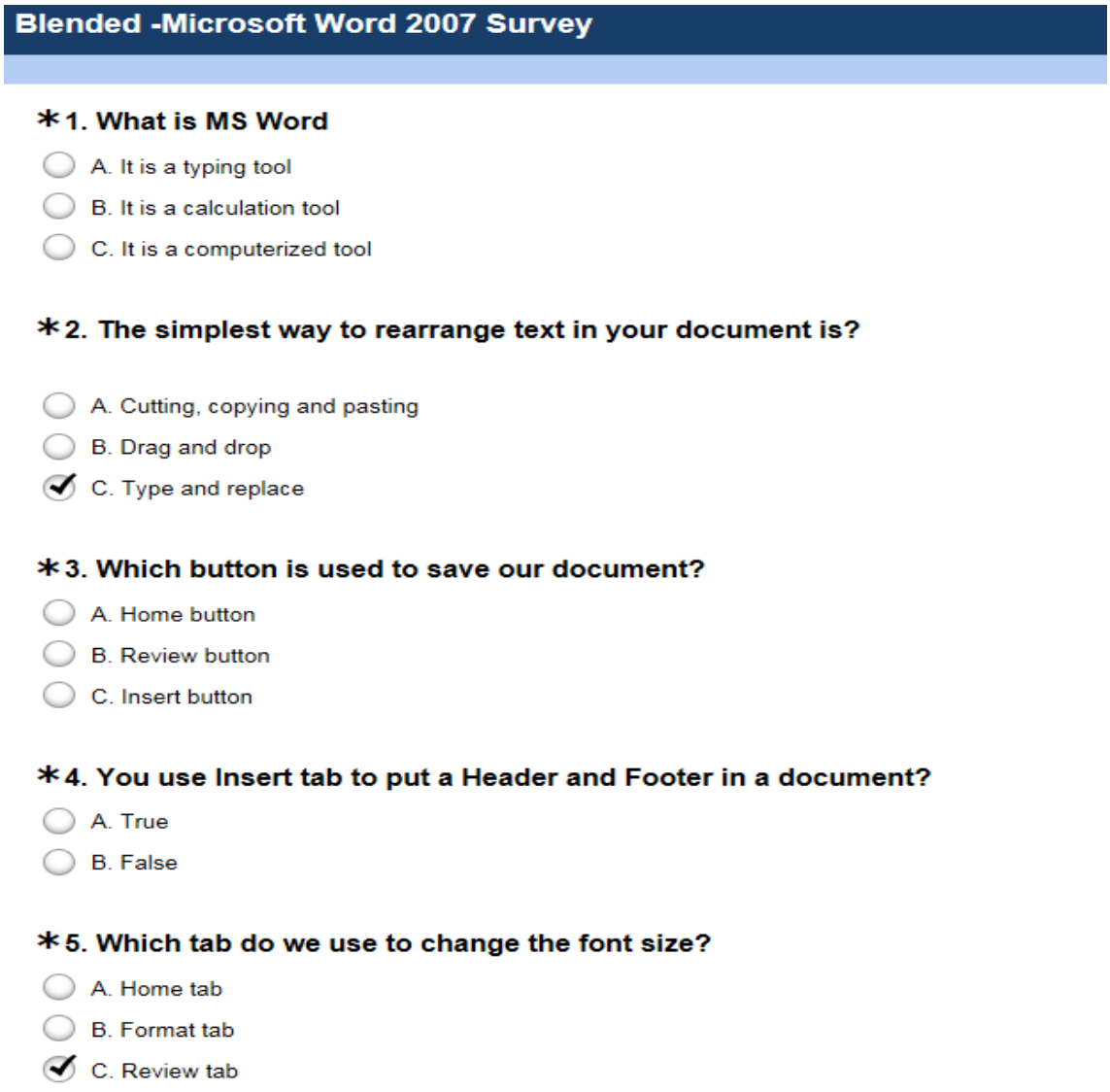
Appendix I

Frequency Data for the Knowledge Survey

		Blended			Classroom		
Course	Question	A	B	C	A	B	C
Facebook	1	7*		1	4*		
	2			8*			4*
	3	8*			4*		
	4			8*	3		1*
	5	8*			4*		
Word	1	4*		3	4*		1
	2	6*	1		4*	1	
	3	3*		4	2*		3
	4	5*	2		4*	1	
	5	1*	6		1*	3	1
Web Safety	1			9*			7*
	2	6*	3		6*		1
	3		9*			6	1
	4			9*			7*
	5		9*			7*	
Twitter	1	7*		1	5*		1
	2	1	6*	1	2	4*	
	3	5		3*	5		1*
	4	8*			6*		
	5			8*		1	5*
Skype	1	9*			4*		1
	2		9*			4*	1
	3	8*		1	1*	1	3
	4		9*		3	2*	
	5			9*		4	1*
Google	1	7*		2	7*		
	2	1	8*			7*	
	3	8*		1	7*		
	4		1	8*		1	6*
	5	3*	2	4	3*	1	3
Advanced e-mail	1	8*		1	3*	1	2
	2		9*			6*	
	3	1	1	7*		2	4*
	4		1	8*			6*
	5		1	8*			6*

Note: The asterisks denote the correct answer to the questions.

Figure 10: Survey Monkey Quiz Screen Shot



Appendix J: Proposal to the CCS Community Services

Madeleine Ward

Master's Candidate in Educational Technology

Concordia University

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October 13, 2012

CCS Community Services
1857 de Maisonneuve Blvd West
Montreal, Quebec
H3H 1J9

Attention: Dorothy Gleason
Coordinator of Volunteer Services

Dear Dorothy,

I am currently completing my Master's in Educational Technology. For my degree, I am required to perform a Master's Thesis. For my thesis I would like to perform a study which would include teaching computer skills to older adults, either in a classroom or blended (classroom and online) environment. As part of the study, participants would be taught a series of eight computer courses, included Social Networking, Advanced e-mail, Google, Skype or Adobe Connect (depending on the section), Web Safety, Microsoft Word and Computer Brain Training games. Participants would also be completing questionnaires and weekly quizzes either on Adobe Connect (blended/online course) or through Survey Monkey (classroom). Participants would need to have access to a laptop computer, have intermediate computer skills and for the blended course, have a laptop with a microphone and a camera and have high speed internet at home.

Therefore, I am proposing a training program of eight weeks of computer courses, with two sections, one in the classroom and the other blended with half the courses in the classroom and the other half online. It would be ideal if both sections could be held on the same day, one following the other, in the same classroom, with 10-15 people in each course.

If you think that any of the CCS centers would be interested in this project, please do not hesitate to contact me. I expect to be ready to begin the third week of November 2012, and am available to teach any day except Thursday.

Thank you for your interest in this project,
Madeleine Ward

Figure 11: Screen Shot of Lumosity Website

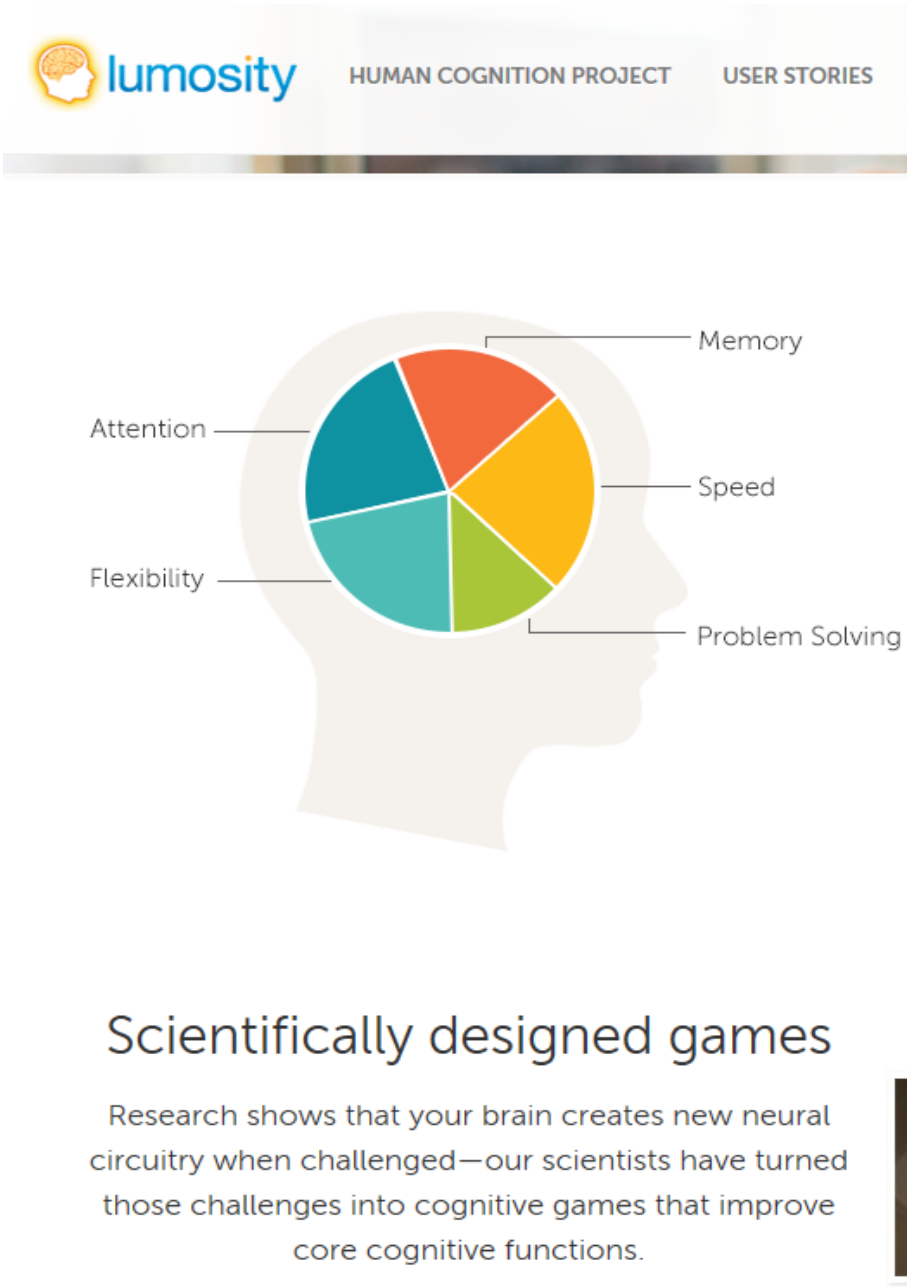
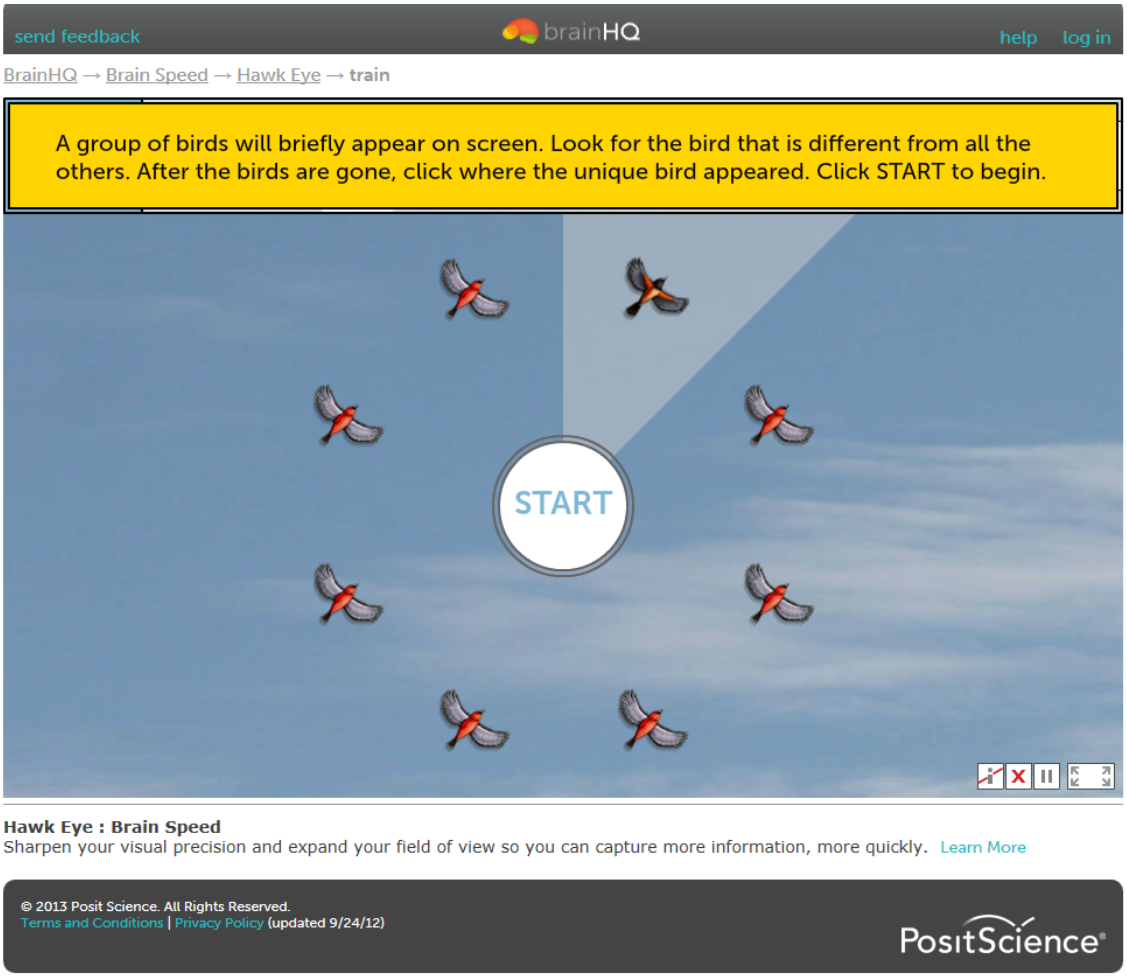


Figure 12: Screen Shot of PositScience Website


send feedback
brainHQ
help
log in
BrainHQ → Brain Speed → Hawk Eye → train
A group of birds will briefly appear on screen. Look for the bird that is different from all the others. After the birds are gone, click where the unique bird appeared. Click START to begin.
START
Hawk Eye : Brain Speed
Sharpen your visual precision and expand your field of view so you can capture more information, more quickly. Learn More
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