

# SWDYT: So What Do You Think? Canadian students' attitudes about *peerScholar*, an online peer-assessment tool

Lisa-Marie Collimore · Dwayne E. Paré · Steve Joordens

Received: 27 January 2012 / Accepted: 11 February 2013 / Published online: 12 December 2014  
© Springer Science+Business Media Dordrecht 2014

**Abstract** Middle- and high-school students' attitudes towards online peer-assessment were described and examined in this study. One hundred and eighty-four (184) students answered a 16-item questionnaire about their experiences with an online peer-assessment tool called *peerScholar*. Overall, students in Canada converged with those in other countries with respect to attitude. That is, Canadian students tended to have a positive attitude towards the implementation of online peer-assessment in their classrooms. Additionally, students reported that they found the peer-assessment process helpful and that they felt that they benefited from the process. Unlike previous studies, students from a wider range of grade levels and subject areas were questioned. Directions for future studies that involve the peer-assessment process in the school system are discussed.

**Keywords** Computer-mediated communication · Elementary education · Interactive learning environments · Media in education · Secondary education · Teaching/learning strategies

## Introduction

The application of computer technology to education, or *e-learning*, continues to garner attention from various Canadian, and presumably other, Ministries of Education. This is probably because digital technology is popping up everywhere, including in the classroom. Some common types of digital technology used in the classroom include access to the internet, interactive SMARTboards, and online peer- and self-assessment tools. Given the increasing use of such technologies in the classroom, it is important to understand how students feel about using digital technologies as they relate to learning. This study explored students' attitudes about using online peer-assessment in middle and secondary schools

---

L.-M. Collimore (✉) · D. E. Paré · S. Joordens  
Department of Psychology, University of Toronto Scarborough, 1265 Military Trail, Toronto,  
ON M1C 1A4, Canada  
e-mail: lisamarie.collimore@utoronto.ca

across various locations in Canada and highlighted attitudes toward a specific peer-assessment tool called *peerScholar*.

In Canada, the use of digital technology to administer curriculum-based lessons in middle or secondary schools is a relatively uncommon teaching practice, despite the belief that digital technologies can help to foster a variety of 21st century student outcomes like collaboration and critical thinking. Reasons for this scarcity include the lack of scientific evidence supporting the effectiveness of using online educational technologies in classrooms (Canadian Council on Learning 2009), digital tools frightening some educators and school boards (Canadian Council on Learning 2009), and the challenges associated with students lacking appropriate experience in using online systems for learning or assessment (Tsai 2009). The resources needed to support digital technology can also vary between school districts and even across provinces. For example, the e-learning Ontario initiative promotes the use of various digital learning tools to enhance student learning from Kindergarten to Grade 12 (Ontario Ministry of Education website 2012), whereas there is only one project on Alberta's initiative list, namely, Curriculum Redesign for which technology is mentioned as an outcome (e.g. "enhanced access to curriculum that is supported by technology"; Alberta Ministry of Education website 2012).

Despite differences in provincial educational initiatives, it is well known that many Canadian students use the internet regularly to acquire information (Gibson and Oberg 1999, 2004). Chat rooms, forums and other online applications, for instance, are examples of common online avenues that students use to seek information for learning. Students often use chat rooms for help with homework assignments (Community Access Program Government of Canada; Swift and Taylor 2003) and use Wikipedia "to communicate, collaborate, or contribute to a common pool of knowledge" (Ebner et al. 2008, p. 200). Moreover, voluntarily participating in a forum has been found to enhance course performance and also slightly increase examination performance among university level students (Cheng et al. 2011). These findings demonstrate that students are using the internet for learning despite it being a non-traditional method of learning information.

The reliance of such online applications is not confined to higher education; middle- and high-school students engage in technology-enhanced learning as well. Garland (2006) noted that portable computers are becoming increasingly common in kindergarten to Grade 12 (K–12) schools, as is online access (Gray and Lewis 2009). Students are using such technologies for many domains including writing, drawing, logical arguments and mathematics. Studies have shown that students who use digital technologies show greater gains in intelligence, problem solving and language skills compared with those who do not use such technologies (Clements and Sarama 2003; Haugland 1999; Swaminathan and Wright 2003; Vernadakis et al. 2005). Learning online is thus becoming ubiquitous in the Canadian school system across all levels and domains.

Past research has also revealed that when technology is used in the classroom student engagement is heightened. For instance, using computers or other technologies to complete an assignment has been found to encourage students to engage in both problem solving and critical thinking exercises (Muir 1994; Peck and Dorricot 1994). Similarly, teachers reported that students were excited to use tablet computers in their class, and that preschool students said that they liked using the tablets even in light of technical difficulties (Couse and Chen 2010). These are promising, albeit indirect, reports of students' attitudes about digital technology use in the classroom.

In conjunction with increased digital technology use, there has been a shift in how educators assess their students. Educators typically assess how well a student is reaching curriculum expectations through tests and examinations (i.e. summative assessment or

assessment *of* learning). This type of assessment is performed by the educator and involves very little interaction with students. However, research has suggested that some control should be given to students in order to achieve higher student engagement and to promote learning (Orsmond et al. 2002). Thus alternative assessment approaches, such as formative assessment for which educators assess students by identifying and responding to the students' learning needs, has been promoted in recent years. There are two types of formative assessment: assessment *for* learning and assessment *as* learning (Bennett 2011; Black and Wiliam 1998). With assessment for learning, educators give students' rich feedback and encouragement through scaffolding and instruction for improvement. Educators who use assessment as learning help their students to develop the capacity to be independent learners who are able to set individual goals, monitor their own progress, determine next steps and reflect on their thinking and learning.

One way for educators to implement assessment as learning in their classrooms is through the use of online peer-assessment in which groups of students' rate and give written comments to the work of their peers (Falchikov 1995). The notion is that students learn as they assess the work of their peers and, in a formative manner, they learn to improve their own work thanks to the guidance provided by their peers. Online peer-assessment is the process that was examined in the current investigation.

Online peer-assessment tools are being used more frequently in the classroom, with studies showing that students are benefiting from the use of these tools (Black and Wiliam 1998; Cho and MacArthur 2010; Falchikov 2001; Lin et al. 2002; Paré and Joordens 2008, 2009; Tsai 2009); this is especially true of higher education classrooms. Paré and Joordens, for example, have a series of studies that highlight the use of online peer-assessment and its benefits in large-sized university courses. Their work has shown that the peer-assessment process fosters the development of critical thinking skills by exposing students to a wide range of levels of work produced in the classroom. By asking students to give comments and rate each other's work, students are encouraged to think deeply about what makes something 'a good' paper versus 'a bad' one. More specifically, Paré and Joordens (2008) found that, when a summative online peer-assessment tool was used, the average grade given by a set of peer markers was similar to the grade given by experts, and that 5–6 is the optimal number of peer-assessors to use in higher education classrooms to ensure the validity of peer-assessment grades (Paré and Joordens 2009). Convergent findings have been reported elsewhere in the literature (Cho and Schunn 2007; Cho et al. 2006).

In addition to examining the reliability and validity of peer-given marks, Paré and Joordens (2008) also examined student attitudes towards the online peer-assessment process used in their study. Students reported positive attitudes to the online peer-assessment method, as measured by a questionnaire. This finding of a positive attitude towards the use of online peer-assessment has been reported elsewhere (Davies 2004). These positive findings can be used to reassure those university students who report having negative attitudes about the fairness of other online peer-assessment tools (Kaufman and Schunn 2010). Given these findings, and the increased use of peer-assessment in the classroom, it becomes important for educators to continually find out how students feel about the presence of online assessment tools in the classroom in order to make the learning environment as cohesive and appropriate as possible.

Past research on the usability of software and websites is relevant to our goal of finding out more about student attitudes about online peer-assessment. Studies by Andreasen et al. (2007) and Castillo et al. (1998) have suggested that the self-report method is effective for identifying user attitudes about software applications (e.g. Mozilla). In fact, these studies suggest that novice users do reasonably well at reporting usability problems. On average,

novice users report about half the problems that trained usability professionals find while watching novice users in a laboratory, and novice users are good at finding problems that experts often miss. For example, novice users are good at finding learnability issues compared to experts because novice users tend to have a different frame of mind when testing software for usability (Andreasen et al. 2007). Keeping these findings in mind, research on students' attitudes about digital technology use in the classroom could benefit from the use of a self-reporting method. Our method is thus built upon these findings.

Questionnaires are a type of self-report measure consisting of a set of highly-structured questions that can directly examine student attitudes. Studies that use questionnaires to investigate student' attitudes about the internet, and specifically the use of digital technology in the classroom, are becoming more commonplace in the literature. Wen and Tsai (2006) found that Taiwanese university students mostly held positive attitudes towards peer-assessment exercises and the peer-assessment process in general. However, these students seemed to consider online peer-assessment as a technical tool rather than as an e-learning process. Other studies with university students have reported convergent findings (Kaufman and Schunn 2010; Kingsley 2010; Li et al. 2008; Liaw et al. 2007; Vickerman 2009; Wen et al. 2006). Students have reported mostly positive perceptions of online peer-assessment tools when their work is graded by both an instructor and a set of peers (Kaufman and Schunn 2010), and students have reported having a positive experience with peer-assessment exercises because they believed it enhanced their learning and development (Vickerman 2009).

Much less is known about high-school students attitudes about using technology in the classroom, although findings from existing studies suggest that high-school students' attitudes about technology use are somewhat consistent with those of university and college level students (Tsai et al. 2001; Lin et al. 2002; Tseng and Tsai 2007). Wong and Ng (2005) found that even though some younger students are not as good at giving feedback to their peers or they find the process to be long and arduous, overall, younger students find assignments that use online peer-assessment more interesting than regular non peer-assessment assignments, and they find learning more interesting when online peer-assessment is used. Slight variations in attitudes could arise because high-school students are more impressionable than university students, with studies demonstrating that student attitudes towards all subjects, including computing, are significantly affected by the attitudes of high school teachers (Barker et al. 2009; Tillberg and Cohoon 2005).

Given that not much research has been collected on the attitudes of students in middle-school and high-school, especially in the North American school system, the current study was exploratory, and its purpose was to describe and assess students' attitudes about the use of online peer-assessment across a number of school regions and grade levels in Canada. We asked students to complete a questionnaire about their experience after using an online peer-assessment tool, and we anticipated finding that, in general and similar to university students, students in Grades 8–12 would have positive attitudes about using this online peer-assessment tool to complete a class assignment.

## Method

### Participants

In total, 391 students participated in this study. Upon completion of an online class assignment, all students received a link to the online survey. The final sample included 184

students ( $n_{\text{males}} = 96$  and  $n_{\text{females}} = 88$ ). Information about student age was not collected; instead, we collected information about student grade level. Students in the final sample were, for the most part, high-school students ( $n_{\text{grade 8}} = 38$ ,  $n_{\text{grade 9}} = 9$ ,  $n_{\text{grade 10}} = 37$ ,  $n_{\text{grade 11}} = 84$ ,  $n_{\text{grade 12}} = 16$ ). Students were sampled from five provinces across Canada (Alberta, British Columbia, Nova Scotia, Ontario and Saskatchewan). In order to maintain school region anonymity, provinces are arbitrarily labeled as Locations 1–5. The breakdown of student participation from each location was as follows: Location 1 (20.7 %), Location 2 (23.4 %), Location 3 (23.9 %), Location 4 (11.4 %), and Location 5 (20.7 %). The data reported here are based on this final sample.

## Materials

The student questionnaire (see the “[Appendix](#)”) consisted of 16 items. The first part of the questionnaire asked about demographic information. The second part of the questionnaire asked about student attitudes and included 11 five-point Likert items with responses ranging from one (strongly disagree) to five (strongly agree) and three open-ended questions about what students liked and disliked about peerScholar and what they learned from the peer-assessment process. Items 3, 4, 5, and 16 asked students about their attitudes on internet use and online peer-assessment in general, while Items 6–15 asked about their attitudes on using peerScholar specifically. The questionnaire was administered using Survey Monkey, an online questionnaire service; this allowed quick and easy administration to respondents who were not in the same city as the primary investigator.

## Procedure

Teachers received an email to set up a field test for their class and were responsible for determining whether or not the field test would be undertaken in class or as a homework assignment. Once permission was granted, each teacher received a user account for the online peer-assessment tool used in this study. The online tool, called peerScholar, has been effectively used in higher education settings (Paré and Joordens 2008, 2009) and was modified for middle- and high-school aged students to include a formative peer-assessment process. For all of these students, the peer-assessment process consisted of four phases: Create, Assess, Reflect/Revise, and Evaluate. In the Create Phase, students created a draft of their assignment and submitted it to the system, while making sure that it followed the rubric’s guidelines and their teacher’s instructions. In the Assess Phase, students anonymously assessed a fixed number of peer draft assignments. Because the number of assessors was selected by the teacher, the number of assessors varied across class. In the Reflect/Revise Phase, students actively reflected upon the anonymous peer feedback they received and used it for guidance to help them rewrite their assignment and then submit it to their teacher. In the Evaluate Phase, the teacher evaluated the students’ work, including the various stages of the peer-assessment process. This peer-assessment process can be easily remembered as the C.A.R.E process (Create, Assess, Reflect/Revise, and Evaluate).

Each teacher used an assignment of their choice, thus the rubrics and the lengths of each assignment were class specific. The rubrics selected were ones familiar to the students and had been used all year long for other non-peer-assessment assignments. Thus students had previous detailed discussions on the rubric in class before the start of the online peer-assessment assignment. The length of time given by teachers to complete the assignments also differed. For locations 2, 4, and 5 the assignment (from the Create Phase to the

Reflect/Revise Phase) was scheduled for 1 week, whereas Location 3 was scheduled for 1 month, and Location 1 was scheduled for 1 day.

All assignment details/instructions were available within peerScholar, and all submissions were done electronically through this tool. Students were expected to complete the assignment online and in a timely manner. Students were aware that they were participating in a field test and were told that they would be asked about their experiences afterward.

Once the assignments were completed, teachers were sent the web link to the student questionnaire. Teachers were asked to distribute the questionnaire link to their students. All teachers received the link approximately 1 week after the completion of the assignment (i.e. upon completion of the Evaluate Phase).

## Results and discussion

### Questionnaire response rate

The response rate for the student questionnaire was 47.1 %, which is lower than previously-reported response rates with high school students (e.g. around 70 %; Lin et al. 2002; Wong and Ng 2005). One reason for the lower response rate could be that our students received the link to the questionnaire from their teacher and not from the researcher directly. Because of this, students might not have seen the completion of the questionnaire as mandatory but rather as an exercise that did not need to be completed in a timely manner. Another reason for the lower response rate could be timing. Because students received the link for the questionnaire only after they had completed the assignment, and because teachers determined when the assignment ended, some students finished the assignment earlier in the semester than others. As a result, students finishing later in the term probably did not have time to complete the questionnaire before the semester ended.

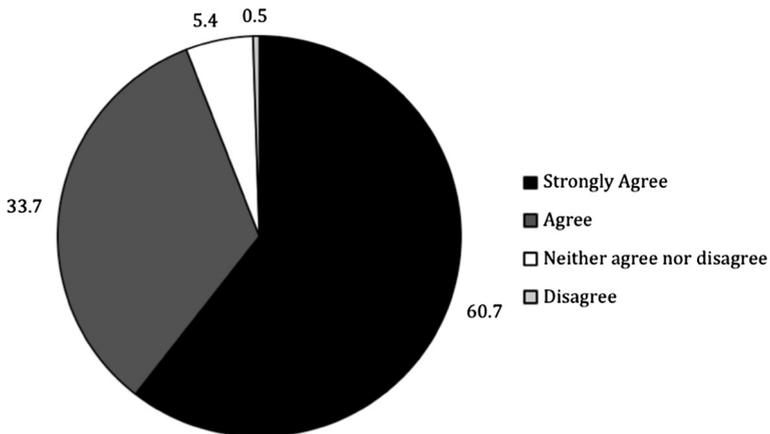
### Questionnaire results: quantitative and qualitative

Quantitative analyses (means and standard deviations) for the five-point items are shown in Table 1. Responses to the majority of these items suggested that, overall, students held a positive attitude towards peer-assessment in general and the peer-assessment process within peerScholar specifically, because mean scores for most items were closer to four (the 'agree' range). Figures 1, 2, and 3 further illustrate the students' positive attitudes towards internet usage and peer-assessment. Moreover, although students agreed that the peer-assessment process could help them to understand ideas from a different perspective before participating in an assignment (Item 7;  $M = 3.38$ ,  $SD = 1.00$ ), their agreement significantly increased after having participated in only one peerScholar assignment (Item 9;  $M = 3.66$ ,  $SD = 1.01$ ),  $t(179) = -4.80$ ,  $p < 0.001$ .

Taken together, these findings suggest that students were comfortable with the idea of using online tools in the classroom, and they felt that the peer-assessment process was enjoyable and beneficial. The increase in agreement from Item 7 to Item 9 also suggests that, even after one exposure, students still agreed strongly with the idea that the activity was a way to get experience with additional perspectives about the assignment topic. This latter finding is indicative that participating in a peer-assessment assignment helps to foster assessment as learning skills, such as learning to understand ideas from a different perspective other than their own.

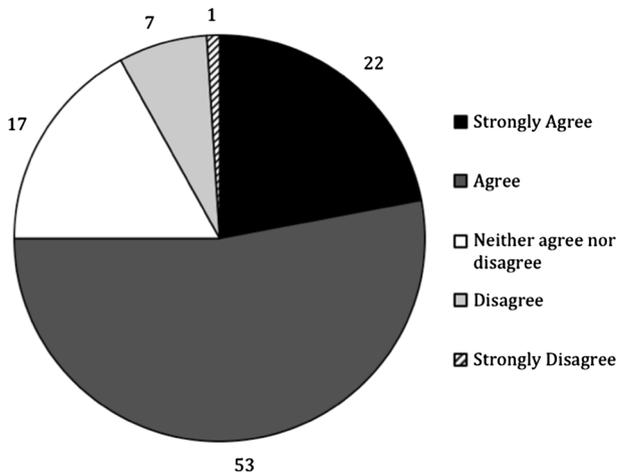
**Table 1** Mean and standard deviations for each five-point item

Item	Mean	SD
3 I feel very confident using the internet	4.54	0.63
4 I think there is a benefit to online peer-assessment	3.86	0.89
5 I like online peer-assessment	3.49	1.10
6 Before I used peerScholar, I thought of this activity as a procedure for submitting my assignment	3.12	0.98
7 Before I used peerScholar, I thought of this activity as a way to understand an idea from different perspectives	3.38	1.00
8 After I used peerScholar, I still think of this activity as a procedure for submitting my assignment	3.19	1.04
9 After I used peerScholar, I still think of this activity as a way to understand an idea from different perspectives	3.66	1.01
10 It was easy to submit my composition/work in peerScholar	3.64	1.13
11 It was easy to read all of my peers' work in peerScholar	3.86	0.97
12 It was easy to revise and resubmit my work in peerScholar	3.42	1.13
13 Overall, peerScholar was easy to use to complete my assignment	3.65	1.11

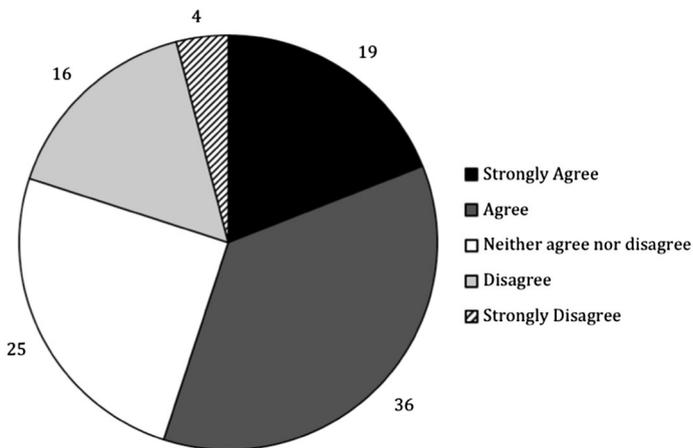
**Fig. 1** Percentage of student responses to Item 3 “I feel confident in using the internet” ( $N = 184$ )

Additional findings from the questionnaire were that the majority of students (67.4 %) held positive attitudes about the ease of submitting their composition to peerScholar (Item 10) and that the majority (77.2 %) held positive attitudes about reading their peers' compositions within peerScholar (Item 11). Clearly, high-school students felt that using peerScholar to complete an online peer-assessment assignment was manageable and easy to do, which suggests once again that the use of online technology was not a hindrance for this group of high-school students.

Qualitative analyses using tag clouds were examined for the open-ended items of the questionnaire, namely, Items 14, 15 and 16. A tag cloud is a visual representation for text data often made up of single words that are weighted using font size (e.g. a word that occurs most often will be displayed in the largest font). Table 2 contains the most-



**Fig. 2** Percentage of student responses to Item 4 “I think there is a benefit to online peer-assessment” ( $N = 184$ )



**Fig. 3** Percentage of student responses to Item 5 “I like online peer-assessment” ( $N = 182$ )

frequently used words from the open-ended questions along with a random selection of student responses associated with each tag. These open-ended responses revealed that, although students disliked some functionality about the online peer-assessment tool (such as the saving features not working as expected), most students reported that they liked the anonymity associated with peerScholar and hearing the opinions of their peers. With respect to assessment for learning, students were very open about what they felt that this online peer-assessment process did for them. For example, students were able to use the feedback that they received to correct errors in their work which, in their opinion, led to better essays.

**Table 2** Tags and examples of student responses to open-ended Items 14, 15 and 16

Item	Tag	Student example
14 What did you like?	Anonymity	I liked how it sent my work to all my peers anonymously and how I was able to type right on the website
	Opinions	I enjoyed submitting my own work to get feedback from my peers because it allows me to see where I am stronger and weaker in my writing. I liked knowing sections of my writing that others liked, and those that others thought needed to be supported/developed more. When my peers used my exact words to explain a concept to me in the feedback, it sounded effective, and I think it really helped me understand their point of views and opinions too
15 What did you dislike?	Confusing	How the formatting didn't always stick while submitting my essay (i.e. the spaces between paragraphs were gone). Confusing
16 What did you feel you learned from the online peer-assessment process?	Write	That getting other people to read over your work helps me write better quality essays
		With the online peer assessment system, since the anonymity was ensured, it was easier to write the assessment in a more objective point of view

### Effects of gender, grade level and school region

Additional quantitative analyses were conducted with the questionnaire responses. Because our sample consisted of both genders and various grade levels, one of its goals was to explore whether or not student attitudes about peer-assessment differed among these groups. There were no significant group differences among attitude responses for gender or grade; males did not differ from females, nor did the grade levels differ from one another. Given this, all subsequent analyses were collapsed across gender and grade level.

Also of interest was whether student attitudes about peer-assessment differed across school regions (i.e. location). Several one-way analyses of variances (ANOVA) were conducted to examine the effect of school location on scores for each item in the questionnaire. There were some significant differences for student attitude of peer-assessment across the different school locations tested [Item 3,  $F(4, 183) = 2.80, p = 0.03$ ; Item 5,  $F(4, 183) = 3.65, p = 0.01$ , Item 9,  $F(4, 183) = 2.64, p = 0.04$ , Item 10,  $F(4, 183) = 3.02, p = 0.02$ , Item 13,  $F(4, 183) = 3.70, p = 0.01$ ] Post hoc comparisons using Bonferroni corrections revealed five significant differences, with mean numbers closer to one representing agreement and mean numbers closer to two representing disagreement. Students from Location 3 ( $M = 1.32, SE = 0.07$ ) and from Location 1 ( $M = 1.32, SE = 0.08$ ) agreed more with Item 5 "I like online peer-assessment" than those in Location 5 ( $M = 1.63, SE = 0.08$ ). This difference in student attitude for this item could be because the teacher administering the online peer-assessment assignment in Location 3 was highly technical and experienced in using digital technologies. This could explain why these students liked and might have had more confidence in using the online system than those in Location 5. This latter location was one where the teacher only had some (to very little) technical experience.

Students from Location 3 ( $M = 1.25$ ,  $SE = 0.07$ ) also agreed with Item 9 “After using peerScholar, I still think of this activity as a way to understand an idea from different perspectives” more than those in Location 2 ( $M = 1.55$ ,  $SE = 0.08$ ). This result could stem from the fact that the teacher in Location 3 gave students clearer instructions about what to expect from the online peer-assessment assignment. For instance, the teacher from Location 3 gave these instructions to her students prior to the start of the assignment: “You are required to include two specific questions that you would like to ask for peer feedback about your writing”, whereas the teacher from Location 2 did not elaborate on what kind of feedback was expected of the peer assessors. Lack of clear instructions for the Assess Phase could thus have explained why students in Location 2 did not agree strongly with Item 9.

Students from Location 3 ( $M = 1.13$ ,  $SE = 0.05$ ) agreed more with Item 10 “It was easy to submit my composition/work in peerScholar” than those in Location 2 ( $M = 1.45$ ,  $SE = 0.08$ ) and Location 5 ( $M = 1.42$ ,  $SE = 0.08$ ), and finally students in Location 3 ( $M = 1.18$ ,  $SE = 0.06$ ) agreed more with Item 13 “Overall, peerScholar was easy to use to complete my assignment” than students in Location 5 ( $M = 1.49$ ,  $SE = 0.08$ ). These differences in attitude make sense when thought of in relation to the length of the scheduled assignments at the different locations. The assignment was longer in Location 3 than it was in Location 2 or 5. Perhaps students with longer assignments had more time to submit and complete all aspects of the online assignment without added stressors, and therefore had more positive attitudes about assignment submission. Shorter assignments in Location 2 and 5 mean that these students could have encountered more time-sensitive issues when submitting their assignment, which in turn could have negatively influenced their attitudes about submission and completion. Students in location 5, for example, would often miss the due dates for each phase, thus resulting in less positive attitudes about the overall ease of use of an online system. Another reason why student attitudes about submitting (Item 10) and completing (Item 13) an online peer-assessment assignment were more positive for students from Location 3 is believed to be because of experience using digital technologies to submit assignments; these students were already using other e-learning strategies in their classroom prior to this field test.

## Conclusion

Overall, this study revealed that the majority of students in Canadian high schools held positive attitudes about using peerScholar, an online peer-assessment tool. This was true despite the fact that the students completed various types of assignments with different rubrics and requirements (which was a limitation of this study). Nevertheless, the current findings are the first to highlight that using peerScholar within the K-12 school system was associated with positive student attitudes. This was also the first study in which peerScholar was used to examine attitudes toward formative assessment assignments.

While there were no differences across grade levels, students in different school regions/locations varied in attitudes. We attribute these differences in attitude to several factors, including instructions given, teachers’ skill level, and appropriate assignment type. In line with Tsai’s (2009) suggestions for using peer-assessment with high-school students, our findings illustrate that in order to obtain positive student attitudes about online peer-assessment, and peerScholar more specifically, educators need to give clear instructions about what is expected from high-school students, educators need to be highly trained in the peer-assessment tool that they wish to implement, and educators need to select an

assignment and an appropriate amount of time for the length of the peer-assessment assignment, with longer assignments leading to more time for teachers to ‘fix’ any technical issues that might arise during the assignment.

Despite the limited exploratory nature of this study, the presence of positive attitudes towards online peer-assessment and peerScholar converges with data from past studies. Davies (2003) reported positive attitudes in his study of computerized assessment by peers (CAPS), with over 86 % of his sample reporting that completing the peer-assessment process helped in the learning of the course module, as did Wong and Ng (2005). Given these positive attitudes and the possibility that student participation could rise if we use methods that capture their attention and current interests, it is important to implement teaching and learning strategies that can maintain student interest and engagement.

Moreover, these findings are encouraging for educators who want to implement assessment for learning strategies, such as peer-assessment into their 21st century skills teaching and learning practices. Through an online peer-assessment tool like peerScholar, it is easy for students to set individual goals when they create their own composition, and it is easy for them to reflect on their thinking and learning after reviewing their peer feedback. Using peerScholar to administer assignments is thus a relatively simple way for educators to encourage students to develop the capacity to be independent learners, to monitor their own progress and to determine their next steps in the learning process.

In sum, it is important to continually survey student attitudes to ensure that students are engaged with, and hopefully learning from, online peer-assessment processes. Future studies of peerScholar should focus on some of the following empirical questions. How do peer-assessment assignments differ from traditional, non peer-assessment based assignments with respect to student learning? What type of feedback is most helpful for the development of critical thought in high-school students? How long should an assignment last to be effective and enjoyable? And does a peer-assessment assignment lead to higher student engagement and more positive attitudes towards learning compared to a traditional assignment? Until then, in light of our findings, we encourage educators to implement online peer-assessment in their teaching and learning practices so that our middle- and high-school students can have a positive, enjoyable peer-enhanced educational experience.

## Appendix: Student Questionnaire

### Demographic questions

1. All about you—Please list your name, your teachers name, grade, name of school city, province. (open-ended)
2. Did you know anything about the concept/topic of this assignment beforehand?

### Attitude questions

3. I feel very confident using the internet.
4. I think there is a benefit to online peer-assessment.
5. I like online peer-assessment.
6. Before I used peerScholar, I thought of this activity as a procedure for submitting my assignment.
7. Before I used peerScholar, I thought of this activity as a way to understand an idea from different perspectives.

8. After I used peerScholar, I still think of this activity as a procedure for submitting my assignment.
9. After I used peerScholar, I still think of this activity as a way to understand an idea from different perspectives.
10. It was easy to submit my composition/work in peerScholar.
11. It was easy to read all of my peers' work in peerScholar.
12. It was easy to revise and resubmit my work in peerScholar.
13. Overall, peerScholar was easy to use to complete my assignment.
14. What did you LIKE about using peerScholar? (open-ended)
15. What did you DISLIKE about using peerScholar? (open-ended)
16. What do you feel you learned from the online peer-assessment process? (open-ended)

## References

- Alberta Ministry of Education. (2012). Current initiatives. Retrieved from <http://education.alberta.ca/departement/ipr.aspx>.
- Andreasen, M., Nielsen, H., Schroder, S., & Stage, J. (2007). What happened to remote usability testing? An empirical study of three methods. In *Proceedings of CHI 2007*. ACM Press. Retrieved from <http://www.takebay.net/data/chi07/docs/p1405.pdf>
- Barker, L. J., McDowell, C., & Kalahar, K. (2009). Exploring factors that influence computer science introductory course students to persist in the major. In *Proceedings of the 40th ACM technical symposium on computer science education* (pp. 153–157). Chattanooga, TN
- Bennett, R. (2011). Formative assessment: A critical review. *Assessment in Education: Principles, Policy & Practice*, 18, 5–25.
- Black, P., & Wiliam, D. (1998). Inside the black box: Raising the standards through classroom assessment. Retrieved from <http://ww2.fcoe.org/uploads/cgreenlaw/blackbox.pdf>
- Canadian Council on Learning (2009). State of E-Learning. Retrieved from <http://www.ccl-cca.ca/CCL/Reports/StateELearning.html>
- Castillo, J. C., Hartson, H. R., & Hix, D. (1998). Remote usability evaluation: Can users report their own critical incidents? In *Proceedings of CHI 1998*. Los Angeles, CA, April 18–23. ACM Press, New York, NY, USA, pp. 253–254.
- Cheng, C. K., Paré, D. E., Collimore, L.-M., & Joordens, S. (2011). Assessing the effectiveness of a voluntary online discussion forum on improving students' course performance. *Computers & Education*, 56, 253–261.
- Cho, K., & MacArthur, C. (2010). Student revision with peer and expert reviewing. *Learning and Instruction*, 20, 328–338.
- Cho, K., & Schunn, C. (2007). Scaffolded writing and rewriting in the discipline: A web-based reciprocal peer review system. *Computers & Education*, 48, 409–426.
- Cho, K., Schunn, C., & Wilson, R. (2006). Validity and reliability of scaffolded peer assessment of writing from instructor and student perspectives. *Journal of Educational Psychology*, 98, 891–901.
- Clements, D. H., & Sarama, J. (2003). Young children and technology: What does the research say? *Young Children*, 58, 34–40.
- Couse, L. J., & Chen, D. W. (2010). A tablet computer for young children? Exploring its viability for early childhood education. *Journal of Research on Technology in Education*, 43, 75–98.
- Davies, P. (2003). Closing the communications loop on the computerized peer assessment of essays. *Association of Learning Technology Journal*, 11(1), 41–54.
- Davies, P. (2004). Don't write, just mark: the validity of assessing student ability via their computerized peer-marking of an essay rather than their creation of an essay, *ALT-J*, 12(3), 261–277.
- Ebner, M., Kickmeier-Rust, M., & Holzinger, A. (2008). Utilizing wiki-systems in higher education classes: A chance for universal access? *Universal Access in the Information Society*, 7, 199–207. doi:10.1007/s10209-008-0115-2.
- Falchikov, N. (1995). Peer feedback marking: Developing peer assessment. *Innovations in Education and Teaching International*, 32, 175–187.
- Falchikov, N. (2001). *Learning together: Peer tutoring in higher education*. London: Routledge Falmer.
- Garland, V. E. (2006). Digital literacy and the use of wireless portable computers, planners, and cell phones for K–12 education. In L. Hin & R. Subramaniam (Eds.), *Literacy in technology at the K–12 level: Issues and challenges* (pp. 308–321). Hershey: Idea Group Publishing.

- Gibson, S., & Oberg, D. (1999). What's happening with internet use in Alberta schools? *Alberta Journal of Educational Research*, 45, 239–252.
- Gibson, S., & Oberg, D. (2004). Visions and realities of Internet use in schools: Canadian perspectives. *British Journal of Educational Technology*, 35, 569–585.
- Gray, L., & Lewis, L. (2009). *Educational technology in public school districts: Fall 2008 (NCES 2010-003)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Haugland, S. W. (1999). What role should technology play in young children's learning? *Young Children*, 54, 26–31.
- Kaufman, J. H., & Schunn, C. D. (2010). Students' perceptions about peer assessment for writing: Their origin and impact on revision work. *Instructional Science*. doi:10.1007/s11251-010-9133-6
- Kingsley, B. (2010). But I'm no expert! Peer assessment by first-year psychology undergraduates. *Psychology Learning and Teaching*, 9, 7–15.
- Li, L., Steckelberg, A. L., & Srinivasan, S. (2008). Utilizing peer interactions to promote learning through a web-based peer assessment system. *Canadian Journal of Learning and Technology*, 34. Retrieved from <http://www.cjlt.ca/index.php/cjlt/article/view/497>
- Liaw, S. S., Huang, H. M., & Chen, G. D. (2007). Surveying instructor and learner attitudes toward e-learning. *Computers & Education*, 49, 1066–1080.
- Lin, S., Liu, E., & Yuan, S. (2002). Student attitudes toward networked peer assessment: Case studies of undergraduate students and senior high school students. *International Journal of Instructional Media*, 29, 241–254.
- Muir, M. (1994). Putting computer projects at the heart of the curriculum. *Educational Leadership*, 5, 30–33. Ontario Ministry of Education. (2012). E-learning Ontario. Retrieved from <http://www.edu.gov.on.ca/elearning/strategy.html>
- Orsmond, P., Merry, S., & Reiling, K. (2002). The use of exemplars and formative feedback when using student derived marking criteria in peer and self-assessment. *Assessment & Evaluation in Higher Education*, 27, 309–323.
- Paré, D. E., & Joordens, S. (2008). Peering into large lectures: Examining peer and expert mark agreement using peerScholar, an online peer-assessment tool. *Journal of Computer Assisted learning*, 24, 526–540.
- Paré, D. E., & Joordens, S. (2009). *peerScholar: Tired of marking? Using peerScholar to explore the change in peer grading reliability as a function of increased number of peer evaluations*. Presentation at the Society for Computers in Psychology Conference (SCiP), Long Beach, CA. Retrieved from <http://peerScholar.com>
- Peck, K. L., & Dorricot, D. (1994). Why use technology? *Educational Leadership*, 51, 11–14.
- Swaminathan, S., & Wright, J. L. (2003). Education technology in the early and primary years. In J. P. Isenbergh & M. R. Jalongo (Eds.), *Major trends and issues in early childhood education: Challenges, controversies, and insights* (2nd ed., pp. 136–149). New York: Teachers College Press.
- Swift, C., & Taylor, A. (2003). The digital divide—a new generation gap. Parental knowledge of their children's Internet use. *Paediatric Child Health*, 8, 275–278.
- Tillberg, H. K., & Cohoon, J. M. (2005). Attracting women to the CS major. *Frontiers: A Journal of Women Studies*, 26, 126–140.
- Tsai, C.-C. (2009). Internet-based peer assessment in high school settings. In T. Hin & R. Subrambiam (Eds.), *Handbook of research on new media literacy at the K-12 level* (pp. 743–754). Singapore: National Institute of Education.
- Tsai, C.-C., Lin, S. S. J., & Tsai, M.-J. (2001). Developing an internet attitude scale for high school students. *Computers & Education*, 37, 41–51.
- Tseng, S. C., & Tsai, C.-C. (2007). On-line peer assessment and the role of the peer feedback: A study of high school computer course. *Computers & Education*, 49, 1161–1174.
- Vernadakis, N., Avgerinos, A., Tsitskari, E., & Zachopoulou, E. (2005). The use of computer assisted instruction in preschool education: Making teaching meaningful. *Early Childhood Education Journal*, 33, 99–104.
- Vickerman, P. (2009). Student perspectives on formative peer assessment: An attempt to deepen learning? *Assessment & Evaluation in Higher Education*, 34, 221–230.
- Wen, M. L., & Tsai, C.-C. (2006). University students' perceptions of and attitudes toward (online) peer assessment. *Higher Education*, 51, 27–44.
- Wen, M. L., Tsai, C. C., & Chang, C. Y. (2006). Attitudes toward peer assessment: A comparison of the perspectives of pre-service and in-service teachers. *Innovations in Education and Teaching International*, 43(1), 83–92.
- Wong, A., & Ng, H. (2005). Peer assessment and computer literacy for junior high school students in geography lessons in Hong Kong. *International Journal of Education and Development using Information and Communication Technology*, 1, 120–134.