Examining a Web-Based Peer Feedback System in an Introductory Computer Literacy Course

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ABSTRACT
This study focused on formative use of peer feedback in an online system that was used in basic computer literacy for word processing assignment-related purposes. Specifically, the effect of quantity, modality and satisfaction of peer feedback provided through the online system on students' performance, self-efficacy, and technology acceptance was investigated. Participants were 32 freshmen elementary and Turkish education pre-service teachers who were enrolled in two sections of the mandatory Computer I course in a public university in Turkey in the fall semester of 2013. Groups of students who submitted their assignments and received feedback in varying quantity and two different forms (text or text and video together) did not differ respectively in terms of students' performance test scores as well as self-efficacy and technology acceptance ratings. Students' feedback satisfaction ratings were significantly correlated only with their technology acceptance scores. All results were interpreted with the support of peer feedback content in both text and video formats to clarify the details and contribute more to the literature.
Keywords: peer assessment, peer feedback, self-efficacy, technology acceptance, word processing

INTRODUCTION

Peer feedback, in which peer learners reflectively criticize each other's performance according to pre-defined criteria electronically or face-to-face, is used in peer assessment, but mainly for formative use, and known to enhance the quality of learning process (Falchikov & Blythman, 2001; Pavlou & Kyza, 2013; Wen & Tsai, 2006). In peer feedback, learners generate message in teaching and learning process in response to their peers' action in order to correct their future iterations of the action, or related actions (Mason & Bruning, 2001). Although learners may

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State of the literature

- Peer feedback is surely known in the literature to enhance the quality of learning process and is presented in many different forms in terms of quantity, quality, content and medium.
- With emerging technology, alternative media and delivery system have been implemented to deliver peer feedback to investigate their impact on teaching and learning process in a formative or summative way.
- Online peer feedback systems improve quality of feedback and students' work, and increase students' attitude and support them to correct and revise their assignments. However, there is very little research on the use of web-based or online peer feedback systems with alternative presentation forms.

Contribution of this paper to the literature

- This study examined the feedback module of an online system designed to generate and assess assignments automatically in word processing with instructors or peers and looked for any impact of number of assignments with peer feedback delivered in two forms: text only or video and text together.
- This research also included the experience of the participants related with the quantity and forms of feedback through online system and the results related with this experience contributed to the literature on the peer feedback discussions.

consider instructor feedback more valuable than peer feedback to improve the quality of students' work, no significant difference was found between these two types of feedback (Ertmer et al., 2007). Even, a research study investigating the quality of feedback revealed that peer markers and experts assessed students' writing assignments similarly in a large undergraduate course (Paré & Joordens, 2008). Likewise, in another study, grades given to high school students' assignments by their peers as feedback were significantly correlated with that given by experts (Tseng & Tsai, 2007). Peer feedback is largely investigated in the literature with respect to its distribution form and media, quantity and quality.

The feedback provided by peers or experts has been presented in various forms, such as positive or negative, concise or general and elaborated or specific, etc. (Gielen et al., 2010; Strijbos, Narciss & Dünnebier, 2010). For instance, feedback provided by classmates via online environment in the form of managerial, procedural and social messages were more favored by peers as compared to cognitive messages. Informative, procedural, diplomatic, social and intellectual messages, or combinations of these, significantly contributed to quality of the students' work (Lee and Lim, 2012). Positive peer feedback, but not cognitive one, had a significant association with students' learning performance. Furthermore, in addition to quantitative one, providing qualitative peer feedback was found to be more effective (Lu & Law, 2012). A similar result was derived from a study by Xiao and Lucking (2008), that is, quantitative and qualitative feedback method, together, were more effective than quantitative feedback-only-method in improving undergraduate students' writing performance and their satisfaction with peer feedback. While dictative and corrective feedback provided by peers is

not effective in subsequent improvement of students' work, supportive and reinforcing feedback better help students to develop their projects.

Quantity and quality determine the significance of peer feedback. Quantity of feedback is related to descriptive statistics of a provided feedback including its number, amount, duration and length. On the other hand, quality of feedback is related to usefulness of a provided feedback, including its accuracy, specificity, legibility and perceived value, in order to support and progress students (Gibbs & Dunbar-Goddet, 2007; Lees & Carpenter, 2012; Nisbet, 2004; Ruegg, 2014). The amount of peer feedback received by students, particularly metacognitive-oriented ones, is significantly correlated with the improvement of their course performance (Chen & Tsai, 2009). To illustrate, Shannon and her colleagues (2016) designed and developed an online peer feedback system called PeerPresents to allow both 15 students and faculty to guide the feedback process and provide feedback to six PhD students during their research presentations. It was reflected that participants had sufficient amount of feedback compared to traditional feedback forms, and PeerPresents reduced the effort in giving feedback. Students who received higher quality of descriptive comments which were measured by a quantitative rating scale tended to demonstrate better performance in course-related activities than those who received lower quality of descriptive comments (Yu & Wu, 2013).

Various studies have also been conducted to investigate online peer feedback and its impact on teaching and learning process. Alternative electronic medium used by peers or instructors, such as video and audio to provide feedback, significantly improve the quality of feedback (Crook et al., 2012; Hattie & Timperley, 2007; Hsia, Huang & Hwang, 2016; Rapee & Hayman, 1996; Thiemann & Goldstein, 2001). For instance, a web-based tool developed to conduct self and peer-assessment flexibly was found efficient in improving the quality of students' work after they received feedback (Sung, Chang, Chiou & Hou, 2005). West and Turner (2016) stated that online video feedback increased the quality and quantity of feedback received and was preferred more than the other forms of feedback among the participants. In another study, Hung (2016) investigated the influence of multimodal video and text-based feedback on learner engagement respectively and found that students favored the video feedback. It was also reported that video feedback was more effective on students' interactions, personalized learning and attentive engagement than written feedback. Students' appreciation of peer feedback provided through online systems were positively correlated with their tendencies to correct and revise their assignments (Van der Pol et al., 2008). As a result of an evaluation (Murray & Boyd, 2015) of an open source online peer feedback system named as WebPA developed by Loughborough University, students indicated that they used the system easily and were willing to use the system in their future courses. However, some students may not perceive web-based peer assessment as a learning activity and they rather consider it as a technical tool (Wen & Tsai, 2006). In general, it could be said that students developed positive attitude towards online systems providing critical and constructive feedback (Li & Steckelberg, 2004).

With regard to this, in this study, an online system was used in a basic computer literacy course and it was designed to generate assignments in word processing automatically, share those assignments with assessors including instructors and peers, and give feedback on the assignments provided by the assessors. In this study, specifically the effect of quantity, modality and satisfaction of peer feedback provided through the online system on students' performance, self-efficacy, and technology acceptance was investigated. The following research questions were examined:

1. Do students who received a varying number of peer feedback ranging from 1 to 5 differ in terms of their learning performance, self-efficacy and technology acceptance?
2. Do students who received video and text-based feedback together differ in terms of their learning performance, self-efficacy and technology acceptance as compared to students who received only text-based feedback?
3. Is there any relationship between students' peer feedback satisfaction and their learning performance, self-efficacy and technology acceptance?

METHOD

This study employed quantitative methods in which the qualitative data were used as supplementary in order to investigate the effect of the form and quantity of peer feedback on students' learning performance, self-efficacy and technology acceptance.

Participants

A total of 78 freshmen elementary and Turkish education pre-service teachers who were enrolled in two sections of the mandatory Computer I course in a public university in Turkey in the fall semester of 2013 were participants of this study. In general, students enrolled to Computer I course took an exemption test at the beginning of fall semester and those scoring 60 or above out of 100 were exempted from the course. Of the participants who were required to take the course, 54 were female (69,2 %) and 24 were male (30,8%). However, the data from all participants were filtered and the ones (N = 32) —who submitted their assignments and received text-only (n = 12) or text-and-video (n = 20) feedback from their peers before the next assignment and final performance test— were selected for the purpose of the study. Furthermore, a total number of 22 peers volunteered to provide feedback for the assignments of participants during the study. The peers were senior computer education pre-service teachers registered to School Experience-I course and took the Computer I course before.

Online Peer Feedback System

A web-based assessment and feedback system called Online Automated Evaluation and Feedback System (OAEFS), developed under a project supported by The Scientific and Technological Research Council of Turkey (TUBITAK), was used in this study. The OAEFS consists of two major modules, "Automated Evaluation and Feedback" and "Peer Assessment and Feedback." In this study, only the second module was considered.

Using the OAEFS, course instructors are able to define, step by step, the parameters of a word processing assignment, such as text size, color, alignments, paragraph format etc. Then, the system creates an electronic document with ".docx" extension and sends it to the students. Peers to provide feedback also receive information on the assignments including the parameters of the assignment and the actual electronic document with ".docx" extension. The general framework of the OAEFS was presented in **Figure 1**.

Students prepare their assignments and upload it to the system. Peers log in to the system and review the uploaded assignments (see **Figure 2**). They either provide written feedback indicating where in the assignments the mistakes are and how they should be corrected, or video feedback showing how to correct the mistakes in the assignment visually (see **Figure 3**). The peers can also provide feedback combination of the two different forms, text and video.
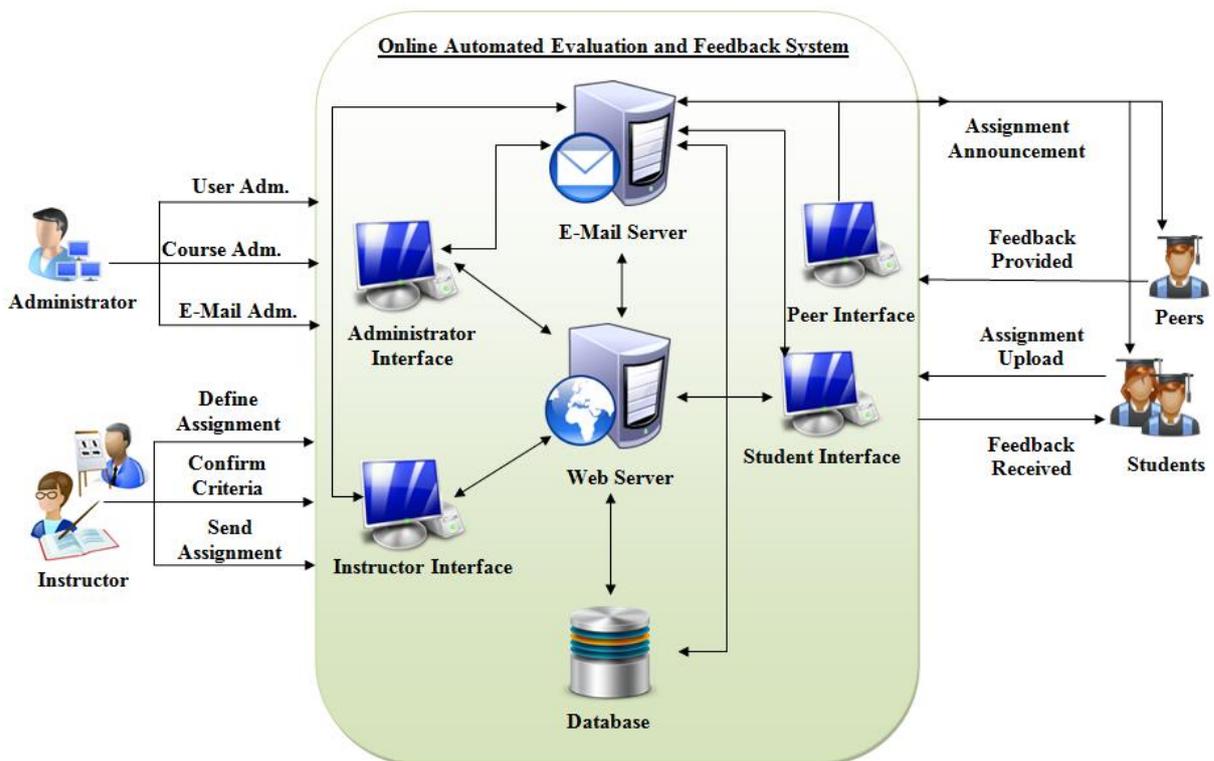
Figure 1. Online automated evaluation and feedback system
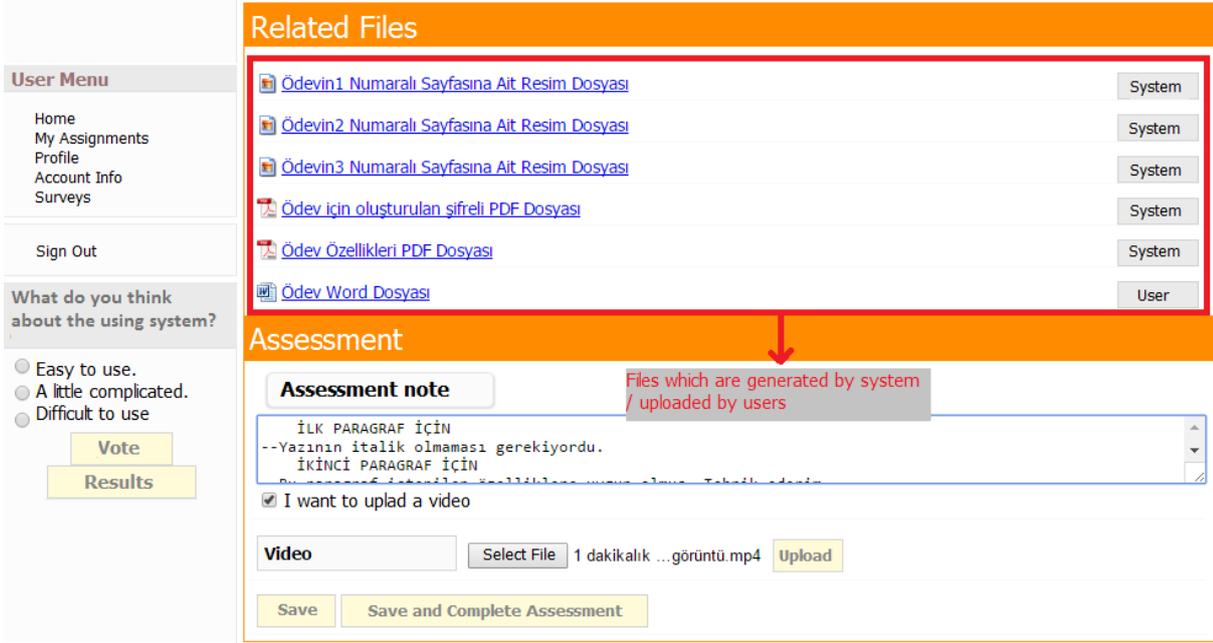
Figure 2. Uploaded assignments
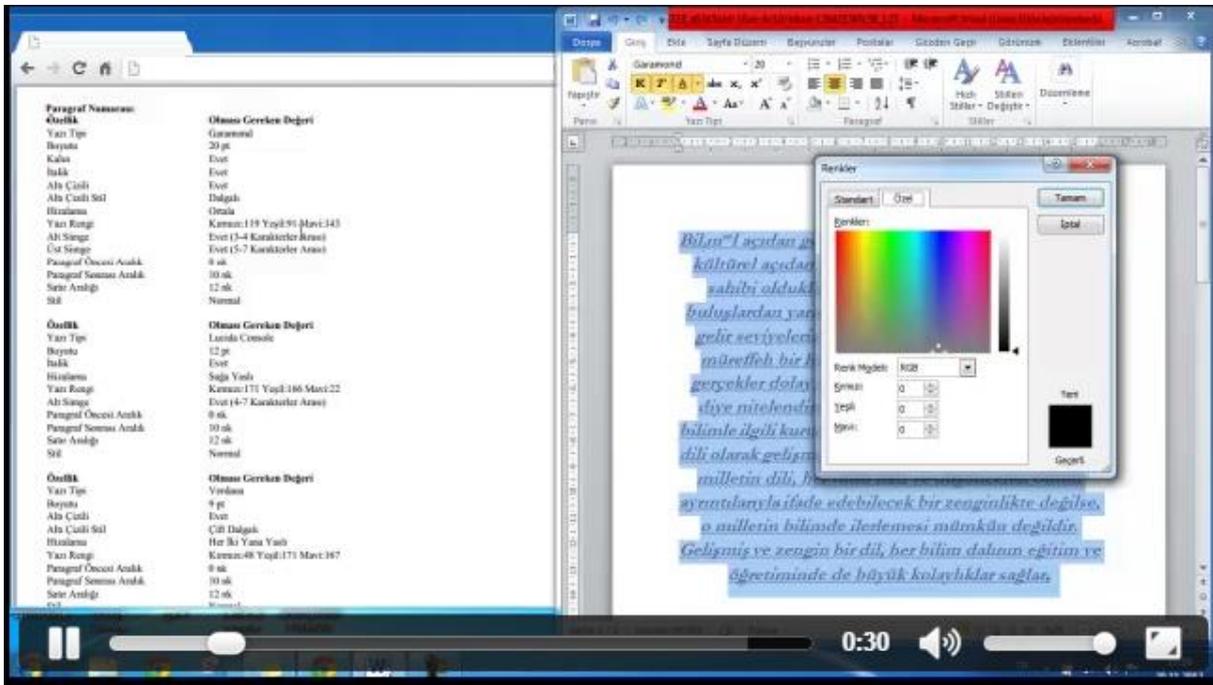
Figure 3. Feedback showing how to correct mistakes

Data Collection Instruments

Four instruments, all of which were administered over the OAEFS, were used to collect quantitative data including Word Processing Skills Performance Test, Word Processing Skills Self-Efficacy Perception Questionnaire, Technology Acceptance Questionnaire and Feedback Satisfaction Questionnaire. All, except Technology Acceptance Questionnaire, were developed, pilot tested and revised by the researchers. Technology Acceptance Questionnaire was adapted from Technology Acceptance Model (TAM) (Adiguzel, Capraro & Willson, 2011; Davis, Bagozzi & Warshaw, 1989; Hu, Chau, Liu Sheng & Tam, 1999; Ma, Andersson & Streith, 2005; Taylor & Todd, 1995). In addition to the test and the questionnaires, the peer feedback in text and video formats provided for each student was retrieved from the OAEFS.

Word Processing Skills Performance test measured the participants' word processing skill performance. It consisted of 20 multiple-choice questions such as *"Which of the following steps should be followed to add numbering or bullets to the text?" "What should you do to add footnote to the word document?"* and *"Which of the following buttons is used for changing the selected text?"* The test questions were based on ECDL (European Computer Driving License) which is an international computer skills and competencies certification program required to use common applications such as Word Processing. The content and face validities of the performance test were established through expert judgments, consisting of reviews by two educational technology faculty and three experienced computer teachers. Internal consistency reliability of performance test was analyzed using Kuder-Richardson formula 20 (KR-20) that was .53. The students received one point for each correct answer.

Word Processing Skills Self-Efficacy Perception questionnaire measured the participants' beliefs on their word processing skills. The questionnaire consisted of 25 five-point Likert items ranging from "1 = Very Poor" to "5 = Very Good." Similar to the Word Processing Skills Performance test, the items of the questionnaire were based on ECDL word processing competencies. Some of the items of the questionnaire are, "I feel competent at opening and closing the word processing program," "I feel competent at adding and removing bullets," and "I feel competent at text alignment." Regarding content and face validity of the instrument, expert opinions were gathered from three educational technology faculty members and three experienced computer teachers. Cronbach's alpha used to measure the reliability of the questionnaire was .98 in this study.

Technology Acceptance questionnaire was used for gathering data about the participants' acceptance of the OAEFS. The scale consists of 21 five-point Likert items ranging from "1 = Strongly Disagree" to "5 = Strongly Agree" and has four sub-constructs, Perceived Usefulness (PU, 6 items), Perceived Ease of Use (PEU, 7 items), Intention to Use (IU, 5 items), and Subjective Norm (SN, 3 items). Example questions for each sub-construct respectively are, "Using OAEFS improves my course performance," "Using OAEFS is easy for me," "I want to use OAEFS in my other courses," and "The courses using OAEFS are more prestigious in the

university." The reliability coefficient of this adapted questionnaire was .97 as calculated in this study.

Feedback Satisfaction questionnaire measured the quality of feedback provided for the students by peers. It consisted of 17 three-point Likert items (3 = I Agree, 2 = I am not sure and 1 = I don't Agree). Some of the items in the feedback satisfaction questionnaire are, "The content of the feedback given to my assignments were clear," "The feedback was given in a short period of time (quickly)," "I think the assessment process of my assignments was fair and reliable." The content and face validities were constructed by having reviews from five educational technology faculty. For the reliability of the questionnaire, the Cronbach's alpha value was found .92.

Procedure

The Computer I course syllabus was prepared and distributed to the students at the beginning of the study. The syllabus included information on course procedures and five assignments that would be submitted over the OAEFS. Then, the students were instructed on using the OAEFS for downloading and uploading assignments, receiving feedback, and correcting and re-uploading the assignments. A similar instruction on providing text and video feedback for the submitted assignments was provided to 22 peers as well.

The students attended the course for 10 weeks during which the course instructor provided the students with instructions on using word processing software, Microsoft Word. Students were required to prepare five assignments posted by their instructors on OAEFS. Total number of submitted assignments was 105. For each assignment, a peer was supposed to provide feedback in the form of text only or text and video together via the system within one week. Of all submitted assignments, 35 were with only text-based feedback from peers and 70 were with text and video feedback together. Peers uploaded video for only 49 assignments. After receiving the feedback, the students were allowed to make corrections on their assignments and re-submit them.

At the end of the study, the students were asked to take the Word Processing Skills Performance test and respond to three questionnaires—Word Processing Skills Self-Efficacy Perception, Technology Acceptance and Feedback Satisfaction. Regarding the scope of research questions, the feedback received (by students) after conducting the tests and questionnaires were not considered for data analysis.

Data Analysis

Both parametric and non-parametric statistical tests were used to address the research questions. Shapiro-Wilk Test of Normality revealed no violation for the data from Performance test and Technology Acceptance questionnaire while the normality for Self-Efficacy data were not satisfied. With the satisfaction of Levene's Test of Homogeneity of Variance, one-way ANOVA and the Kruskal-Wallis tests were carried out to investigate the

differences in participants' performance, technology acceptance and self-efficacy scores. For the purpose of testing two different forms of peer feedback in how they impacted on participants' test and questionnaire scores, independent samples t-test and Mann-Whitney U-test were conducted. To answer the last research question, standard correlation method, Pearson's r, was calculated to examine the relationship between Feedback Satisfaction score and the other three scores derived from Performance test, and Technology Acceptance and Self-efficacy questionnaires. Feedback given in text and video forms was also analyzed for the quality purposes and the results were handled to support quantitative data.

RESULTS

Data from the instruments were analyzed to test the differences in terms of quantity and form of peer feedback on three dependent variables (performance, technology acceptance and self-efficacy) and the relations among such dependent variables and feedback satisfaction. Comparison statistics did not reveal any significant difference according to quantity and form of feedback received by students. However, significant correlations were found between feedback satisfaction scores and the scores from performance, technology acceptance and self-efficacy scales. The descriptive and inferential statistical results were reported specifically below according to the research questions in both text and tabular format.

Quantity of Peer Feedback

One-way ANOVA and Kruskal-Wallis tests were separately performed comparing test and questionnaire scores of students grouped according to number of assignments (up to five) they submitted and on which they received peer feedback. The analyses did not include the group with two assignments since there was only one student in that group. It was found that four groups did not differ significantly on their performance ($F(3,26) = 1.023$, $p > .05$), technology acceptance ($F(3,25) = 1.960$, $p > .05$) and self-efficacy ($H(3) = .080$, $p > .05$) results (see **Table 1**). In other words, there was no significant effect of quantity of assignments which received peer feedback on performance test scores, technology acceptance and self-efficacy levels. Specifically, when the mean scores of each group with respect to dependent variables are considered, performance mean score of students who received peer feedback for their five assignments is greater than the others. This is not the case for mean scores of technology acceptance and self-efficacy. However, it should be noted that the quality of peer feedback might be included to clarify this situation.

Table 1. One-way ANOVA and Kruskal-Wallis Test Results

Dependent V.	Number of Assignments				F	p
	1	3	4	5		
Performance	11.38 (4.69)	12.83 (3.82)	13.80 (2.86)	14.18 (2.75)	1.023	.399
Technology Acceptance	82.43 (15.93)	77.17 (18.29)	99.40 (15.03)	82.45 (15.20)	1.960	.146
					Chi-square	
Self Efficacy	102.86 (26.05)	99.33 (29.96)	108.40 (12.72)	106.91 (17.88)	.080	.994

Note: Standard deviations appear in parentheses below means.

Form of Peer Feedback

Independent samples t-test and Mann-Whitney U-test were separately performed comparing test and questionnaire scores of students grouped according to form of peer feedback (text only, video and text together) they received. Similar to the first research question, no significant difference was found in the scores of two groups in terms of their performance ($t(29) = .307$, $p > .05$), technology acceptance ($t(28) = -1.033$, $p > .05$) and self-efficacy ($U = 74.50$, $p > .05$) respectively (see **Table 2**). Accordingly, performance test scores, technology acceptance and self-efficacy levels of students who received peer feedback only in text form were not significantly different from the ones who received peer feedback in both text and video forms. In addition, mean scores respectively yielded that students who received only text-based feedback from their peers did better in performance test and had better self-efficacy levels at the end of 10 weeks than the other students in the study. However, opposite is true for technology acceptance levels.

Table 2. Independent Samples t-test and Mann-Whitney U-test Results

Dependent V.	Forms of Feedback		t	p
	Text	Text-Video		
Performance ($N_{Text} = 11$, $N_{Tx-Vd} = 20$)	13.36 (1.91)	12.95 (4.21)	.307	.761
Technology Acceptance ($N_{Text} = 10$, $N_{Tx-Vd} = 20$)	80.20 (17.20)	86.85 (16.34)	-1.033	.310
			U	
Self Efficacy ($N_{Text} = 10$, $N_{Tx-Vd} = 20$)	112.7 (12.98)	101.60 (23.83)	74.50	.261

Note: Standard deviations appear in parentheses below means.

Feedback Satisfaction

In addition to analyses related to the quantity and form of feedback, students' feedback-satisfaction scores were obtained and put into Pearson r correlation analysis together with the scores of performance, self-efficacy and technology acceptance instruments. Of mean scores of all 17 questions with the scale ranging from 1 to 3, mean scores of only two questions, which were about understanding the content of feedbacks and thinking of unfair assessment by some peers, were slightly lower than 2.00 (M = 1.97). When means of total scores across by the form of feedback, text only (M = 42, SD = 4.92) and text and video together (M = 41.47, SD = 5.80), are considered, the results yielded no significant difference (t(27) = .244, p > .05). Pearson r correlation revealed that students' feedback satisfaction was significantly correlated with their technology acceptance levels (r(29) = .461, p = .012), but its correlation with performance scores (r(28) = .204, p = .297) and self-efficacy ratings (r(29) = .272, p = .153) did not reach significance (see **Table 3**).

Table 3. Pearson Correlation Matrix among Feedback Satisfaction Scores and Performance Test Scores, and Self Efficacy and Technology Acceptance Ratings

	Performance	**Self Efficacy**	**Technology Acceptance**
Feedback Satisfaction	.204	.272	.461[*]
Performance		.504[**]	.329
Self Efficacy			.400[*]

Note: * p < .05, **p < .01

DISCUSSION AND CONCLUSION

This study was conducted to examine a web-based peer feedback system (OAEFS) in an introductory computer literacy course. Quantity and forms of feedback uploaded by peers were tested with students' performance test scores, and self-efficacy and technology acceptance ratings respectively, however no significant difference was found for any combination. Also, students' satisfaction ratings on peer feedback they received for their assignments were gathered to look for any potential relationship with scores of such three measures, but no significant correlation was detected. On the other hand, some specific information on the tests and results could help to understand potential reasons and answers to these insignificancies.

Although grouping students based on number of assignments they submitted and for which they received feedback from peers did not reveal any significant difference on performance test scores, mean scores of students who received five feedbacks (M5 = 14.18) were slightly higher than mean scores of the other students (M1 = 11.38), which is parallel to the findings in the literature (Chen & Tsai, 2009). One reason of not having significance might be related to the quality of feedback. There was even some text-only feedback explaining the mistakes done in the assignment very well and corrections to fix the problems (Ruegg, 2014;

Yu & Wu, 2013). Such explanatory feedback less in number could be enough for some students to complete the other assignments. Another reason may be the complexity of the course and assignments since the study encapsulated the word processing skills not requiring metacognitive skills a lot. However, this direct proportion was not the same for the other two constructs, self-efficacy and technology acceptance. When specific data were considered, the low scores for these two constructs could be due to intentional ratings because of study design or some other factors during the semester. This can be explained with decreasing number of feedback considered by the students for their assignments and possibly decreasing use of the OAEFS accordingly which may also cause students to see the system not as a learning activity (Van der Pol et al., 2008). Total number of assignments with peer feedback received by the students was 105. Of 32 students, 31 received peer feedback in the first assignment while this number was 22 in the last assignment. Such decreasing use of the system could cause the change in self-efficacy and technology acceptance scores though no technical issues were posted related to the system use by both peers and students. Game mechanics such as leaderboard for attendance, time spent, performance and number of assignments and feedback can be added to the OAEFS to increase the engagement.

Performance test scores and technology acceptance and self-efficacy ratings of students grouped with respect to form of feedback (text only, or text and video together) did not yield any significant score. Of 105 assignments, 35 were with only text-based feedback from peers and 70 were with text and video feedback together. Peers uploaded video for only 49 assignments, but there were sound-related problems for videos of eight assignments. When mean scores and ratings were taken into action, such scores were higher only in technology acceptance in favor of students who received both text and video feedback. This might be related to perceived ease of use and perceived usefulness sub-domains (Murray & Boyd, 2015) in Technology Acceptance Model, which allows the user to get used to the system and take advantage of it. The opposite was true for the mean scores of other two constructs, performance and self-efficacy. Having high performance test score with text only feedback, which contradicts the studies carried out by Hung (2016) and West and Turner (2016), can be explained with the useful, satisfactory and explanatory written feedback (Gibbs & Dunbar-Goddet, 2007; Lees & Carpenter, 2012; Lu & Law, 2012; Nisbet, 2004; Ruegg, 2014; Xiao & Lucking, 2008; Yu & Wu, 2013). Some written feedback was even stated step by step: "Your assignment; - include only one paragraph – text must be left aligned – space after paragraph must be 10nk – Line space must be 12nk – Subscript must be used in the first word of the sentence and applied on the fourth and fifth characters." One other reason might again be non-complexity of the study topic for which visual presentation was not needed.

Students' feedback satisfaction scores were significantly correlated with only the technology acceptance ratings. Examining satisfaction scores one by one yielded that two peers received significantly different scores respectively, two of which were also the lowest scores. As this cannot be explained from the factors included in the study, it should be related to external factors or that instruments were not taken seriously. Similar to the findings of the

study by Van der Pol et al. (2008), another interesting result was the feedback satisfaction scores of students who received positive and socialized messages in the feedback were higher than scores of the others.

It should be noted that the current study was conducted with undergraduate students in an introductory computer literacy course. Future research should design and examine more on-line peer assessment systems by using larger samples, more diverse student populations and a variety of courses. This study did not have a control group, thereby left some related issues unresolved. A more controlled research design as in pre-test, post-test control group studies will be useful to examine this relation in the future. Task- or project-based approach should be used to measure students' performance in Word processing since the performance test with only multiple-choice items may not measure actual student performance. The online system in this study involved two forms of feedback, video and text, so more detailed research into the forms of feedback is recommended to further investigate the relationship between the form of feedback and learning effectiveness. Overall, this study brought on an important point that having Web and multimedia supported feedback in different forms, content and quantity is yet to be included in all learning settings due to both theoretical and practical advantages.

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