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Impact of Computer-Based Peer Review on College Students' Performance and Perceived Self-Efficacy in an Online Graphic Design Course

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Abstract

Prior research has indicated that the incorporation of computer-based peer review into writing instruction increases student engagement, improves student performance, and increases student perceptions of self-efficacy. This study used a quasi-experimental untreated control group design to examine the impact of computer-based peer review on student performance and perceived self-efficacy in an undergraduate agricultural graphic design course. The impact of participation in computer-based peer review on performance scores was investigated using a MANOVA. After two rounds of peer review, students improved their overall course performance by one-half letter grade. Perceptions of self-efficacy were further analyzed using a one-way repeated measures ANOVA. Most (54.17%) students who participated in the computer-based peer review process reported increases in perceived self-efficacy in graphic design. The findings from this study indicate the benefits of computer-based peer review extend to instruction in graphic design courses.

Keywords

peer review, self-efficacy, graphic design, teaching strategy, distance learning

Cover Page Footnote/Acknowledgements

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Introduction

Employees with media production skills are being increasingly sought after by employers in professional mass communication fields (Hopp & Gangadharbatla, 2016). The highly desired skillset includes media writing, project management, critical thinking skills, acute attention to detail, and proficiency in a variety of software applications, as well as a strong grasp of basic branding, marketing, and design concepts. Communicators must be able to convey targeted messages to a wide variety of audiences across an array of channels. Technology changes rapidly, requiring communicators to be able to learn and adapt quickly (Hopp & Gangadharbatla, 2016). Despite the widespread incorporation of multimedia production instruction into postsecondary communications curricula, administrators and instructors are still defining best practices for the efficient and effective delivery of instruction (Hopp & Gangadharbatla, 2016). Further, many students may struggle to implement the critical thinking skills and attention to detail necessary to successfully complete graphic design projects.

Prior research has indicated that self-efficacy is a key determinant in predicting student performance; students with higher self-efficacy tend to work harder and persevere longer when tackling challenging projects (Collins & Bissell, 2001). Computer-based peer review, in particular, helps students to improve their writing quality (Hicks, Pandey, Fraser, & Klemmer, 2016; Leijen, 2017; Sloan, 2017). Dedicated peer review applications have been incorporated into existing online learning management systems (Sloan, 2017), which has increased the use of peer assessment to support the development of student self-efficacy in writing in higher education (Fischer & Meyers, 2017; Leijen, 2017; Yang & Tsai, 2010). The impact of peer review on student performance and/or perceived self-efficacy in other contexts, such as an online graphic design course, has not yet been examined.

Theoretical Framework

Bandura's (1986) social cognitive theory, which posits that people learn by observing others, served as the framework for this study. Under social cognitive theory, reproduction of observed behaviors is influenced by personal, behavioral, and environmental factors (Lingwall & Kuehn, 2013). The personal, or self-efficacy, component explains the powerful influence that a person's beliefs about their abilities have on their outcome expectancies and motivation (Bandura, 1997; Fischer & Meyers, 2017). Collins and Bissell (2001) defined self-efficacy as a person's perception of his or her ability and achievement in media writing. In the present study, self-efficacy will be operationally defined as students' perceptions of their ability and achievement in graphic design.

Literature Review

Peer Assessment

Computer-based peer review systems offer a rich learning environment with benefits for both students and instructors. Leijen (2017) noted increased student engagement, increased improvement in student writing after receiving multiple sources of feedback, and reduced workloads for instructors. Hicks et al. (2004) noted computer-based peer reviewers provide crucial social contact and performance benchmarks for students while increasing social motivation and learning. Students participating in computer-based peer review were more likely to integrate peer comments into their final revisions (Li, Liu, & Steckelberg, 2010). Commenting on the weaknesses of peer drafts prompts reviewers to reflect on their own writing strategies and develop more effective problem-solving strategies and to develop a deeper understanding of what makes good writing (Leijen, 2017; Li et al., 2010; Sloan, 2017). Studies focusing on peer reviewer language in

verbal feedback settings have found the use of hedges is common; these indirect speech acts are not always understood by the reviewee and negatively impact the effectiveness of peer feedback (Leijen, 2017). In computer-based peer review settings, reviewers tend to use much more direct language, which is more easily understood and taken more seriously; feedback is thus more likely to be incorporated by reviewees (Leijen, 2017). Fischer and Meyers (2017) found the incorporation of peer review into multiple assignments over the course of a semester magnified the positive impact of peer review on student writing.

Self-Efficacy

According to Chu (2003), the roots of computer self-efficacy are derived from Bandura's (1997) broader construct of self-efficacy. Self-efficacy is defined as a person's confidence in his or her ability to successfully perform the actions needed to attain a goal (Bandura, 1997). People develop self-efficacy through successful completion of tasks and observation of others successfully completing tasks (Bandura, 1986; McKim & Velez, 2017). Social persuasion, particularly in the form of encouragement from others, as well as physiological and emotional states, also contribute to the development of self-efficacy (Bandura, 1986; McKim & Velez, 2017). People are more motivated to participate in activities when they believe they are likely to succeed and as such, self-efficacy is a predictor of success for a wide variety of tasks (Bandura, 1997; Saadé & Kira, 2009).

Hopp and Gangadharbatla (2016) identified a number of variations of self-efficacy within the context of technology usage and information systems adoption. Of note, Achim and Kasim (2015) found an association between computer anxiety and computer self-efficacy. Computer self-efficacy, the belief in one's ability to be successful using a computer, influences both the degree of effort and persistence of effort expended in performing tasks on a computer. (Bandura, 1986; Bandura, 1997; Compeau & Higgins, 1995; Saadé & Kira, 2009). Further, Chu (2003) found that experience on one system tends to increase computer self-efficacy on other related systems. Prior experience with software also has a significant effect on student self-efficacy in the context of graphics software (Hasan, 2003). This study focused on task-specific self-efficacy—graphic design self-efficacy.

Design for Agricultural Media

Design for Agricultural Media is a required course for students seeking to major or minor in agricultural communications and journalism at [University]. This course focuses on the principles and practices of graphic design, including design and production of printed publications and graphics using computer-assisted design, in an agricultural context. Course outcomes include: (1) student understanding of the uses of various electronic graphic programs in the agricultural communications industry; (2) planning and performing the graphic production process; and (3) creation of a logo, advertisement, brochure, and detailed brand guide for an agricultural product or service. In addition to branding, marketing, and design concepts, students learn to use software within Adobe Creative Suite: Bridge, Illustrator, InDesign, and Photoshop, via online tutorials accessed on Lynda.com. Students may enroll in either an online section or a face-to-face section of the course. Online content is delivered to students via an online learning management system (Blackboard Learn) and is comprised of PowerPoint slides, samples, and readings. Face-to-face students receive weekly lectures by an instructor and have access to all online content. All students have access to one-on-one assistance from graduate teaching assistants during a two-and-a-half-hour session in the computer laboratory each week. Performance scores reflect students' comprehension and mastery of course content, critical thinking skills, and attention to detail.

Purpose of Study

There is a growing body of research documenting computer-based peer review as a beneficial formative assessment tool with a positive effect on student achievement in writing (Leijen, 2017; Powell, 2013). This study aimed to contribute to the body of knowledge regarding the use of computer-based peer review assessments by examining the implications for student success in another context, namely graphic design. The purpose of this study was to determine how participation in peer review impacted student perceptions of self-efficacy in and performance of agricultural graphic design in an online course. The research hypotheses are as follows:

H_1: Participation in computer-based peer review increases student performance of graphic design skills.
H_2: Participation in computer-based peer review increases student perceptions of self-efficacy.
H_3: Student performance, perceived self-efficacy, and computer-based peer review are positively correlated.

This study addresses research priority three of the American Association of Agricultural Educators' National Research Agenda: develop a sufficient scientific and professional workforce (Roberts, Harder, & Brashears, 2016).

Methods

This study used a quasi-experimental untreated control group design (Shadish, Cook, & Campbell, 2002) to determine what impacts, if any, computer-based peer review had on student performance and/or perceptions of self-efficacy in an agricultural graphic design course. This section details the sampling, design, data collection, and analysis procedures used.

Sample

The population of interest for this study was undergraduate students enrolled in a graphic design course. Participants were recruited from students enrolled in Design for Agricultural Media, a graphic design course, at [University] during the fall 2017 semester. Students self-select the semester they will register for the course, as well as which section, either an online or face-to-face format. Approximately 30 students register for each section each semester. A total of 52 students enrolled in Design for Agricultural Media for the fall 2017 term. Of these, 27 enrolled in the face-to-face section and 25 enrolled in the online section. Three students were sophomores, 26 were juniors, 20 were seniors, and one was a graduate student. Two students did not complete the course.

Study Design

Participants were asked to complete pre- and post-course questionnaires, which were adapted from Compeau and Higgins' (1995) Computer Self-Efficacy Measure and Nielsen, Fleming, Kumarasuriyar, and Gard's (2010) Content Specific Survey to reflect the software applications used in Design for Agricultural Media. This questionnaire measured students' prior use of course software, general ability to solve problems, and confidence in using Adobe Bridge®, Adobe Illustrator®, Adobe InDesign®, and Adobe Photoshop®. Prior experience may influence both student performance and self-efficacy scores (Collins & Bissell, 2001). To control for this possible influence, participants' prior experience in each of the software applications used in Design for Agricultural Media was measured by asking participants to indicate their level of experience on a

10-point interval ranging from 1, indicating "No Experience" to 10, indicating "Very Experienced" (Hasan, 2003; Nielsen, Fleming, Kumarasuriyar, & Gard, 2010). Students in the online section each peer reviewed four submissions for a task grade. Details are described in the findings section.

Measures

H_1: Participation in computer-based peer review increases student performance of graphic design skills. Performance scores were determined by rubrics that measured the comprehension of the required design skills and attention to detail (Liu, 1998; Powell, 2013). Attention to detail was a reflection of the completeness of all required elements in the assignment. Participants were tested on their ability to perform design skills after each of five modules of course material. Participants in the online section were required to peer review four of the five assignments using Peerceptiv, a dedicated peer review application that is incorporated into the university's online learning management systems, Blackboard Learn. Face-to-face students did not perform peer reviews, as they had direct interaction with instructors for feedback. Performance scores of online section participants were compared to their face-to-face counterparts to identify what impact computer-based peer review may have had on performance of agricultural graphic design skills, as diagrammed below.

$$\frac{NR \quad O_{A1} \quad X \quad O_{A2}}{NR \quad O_{A1} \quad O_{A2}} \quad \ldots \quad \frac{NR \quad O_{E1} \quad X \quad O_{E2}}{NR \quad O_{E1} \quad O_{E2}}$$

In previous semesters, students in the face-to-face sections of this course have consistently outperformed their peers in the online sections. Using scores from spring 2017 as a baseline, we demonstrated that students in the face-to-face section do perform significantly better than students in the online section in four of the five assignments (Beginning InDesign, $p=.273$; Illustrator, $p=.080$; Photoshop, $p=.027$; Advanced InDesign, $p=.027$; Integrated Project, $p=.052$), as shown in Figure 1. These differences lowered students' overall course grade by one full letter grade (*9.9%*). Therefore, the peer review process was designed to emphasize the importance of paying attention to assignment details, with the intent of bringing online student performance in line with face-to-face student performance

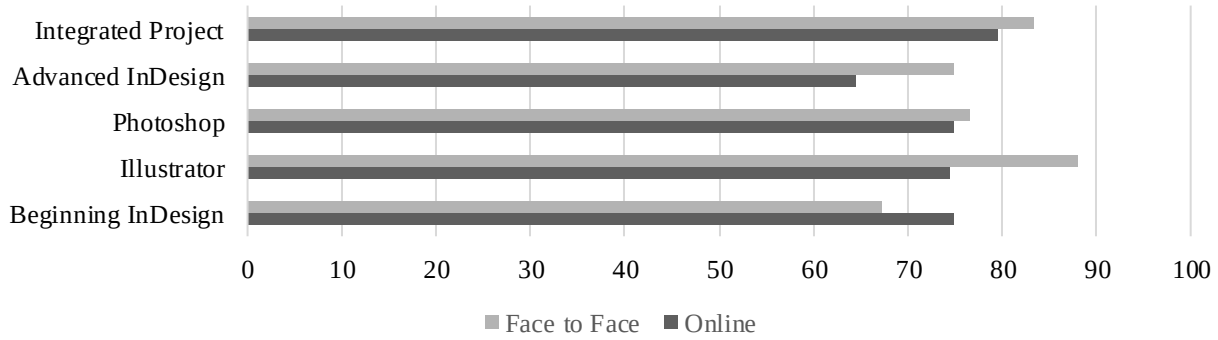

Figure 1. Spring 2017 Mean Performance Scores for Face-to-Face and Online Students

H_2: Participation in computer-based peer review increases student perceptions of self-efficacy. Perceived self-efficacy of participants was assessed using a pre/post-test measure adapted from

Compeau and Higgins' (1995) Computer Self-Efficacy Measure. Participants were asked to indicate their level of confidence on a 10-point interval ranging from 1, indicating "Not at all Confident," to 10, indicating "Totally Confident." Participants in the face-to-face section served as a control group; they did not perform peer reviews. Pre- and post-semester self-efficacy scores were compared to determine what impact computer-based peer review has on self-efficacy in agricultural graphic design skills, as diagrammed below.

NR O_1 X O_2

NR O_1 O_2

H_3: Student performance, perceived self-efficacy, and computer-based peer review are positively correlated. It is possible a relationship exists among participation in computer-based peer review, prior experience, student performance, and/or perceived self-efficacy. The interaction of these variables was examined to determine if and how the variables are related.

Data Collection

The Design Experience and Self-Efficacy Questionnaire was disseminated to all enrolled students via Qualtrics® during the first week of the semester and the fourteenth (final) week of the semester. The pre- and post-assessments were assigned as course participation assignments; students were given a completion grade if they responded. Performance scores for each of the five assignments were recorded after final course grades were posted.

Data Analysis

All data were analyzed using IBM® SPSS Statistics® 25. A one-way between subjects MANOVA was used to analyze the data, with Peer Review as the independent variable, each of the five assignments as dependent variables, and Previous Experience and Change in Self-Efficacy as the covariates. Box's M test of equality of covariance (*30.112; p=.031*) indicated that the data did not meet the assumption that variance-covariance matrices are equal across the independent variable and covariates (Meyers, Gmast, & Guarino, 2017). However, Bartlett's test of sphericity (χ^2*=73.297; df=14; p=.001*) showed that the dependent variables were adequately correlated to continue with the MANOVA (Meyers, Gmast, & Guarino, 2017). Levene's test of homogeneity of variance indicated that we did not achieve homogeneity of variance for all assignments (Beginning InDesign, *p=.344*; Illustrator, *p=.001*; Photoshop, *p=.907*; Advanced InDesign, *p=.512*; Integrated Project, *p=.095*), as shown in Table 1. We therefore decreased the alpha level for MANOVA and univariate analyses from .05 to .001 (Meyers, Gmast, & Guarino, 2017).

Table 1.
Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Beginning InDesign	.91	1	48	.344
Illustrator	15.91	1	48	**.001**
Photoshop	.01	1	48	.907
Advanced InDesign	.43	1	48	.512
Integrated Project	2.91	1	48	.095

Tests the null hypothesis that the error variance of the dependent variable is equal across groups[a]
a. Design: Intercept + PreviousExperience + ChangeInSelfEfficacy + PeerReview

Validity and Reliability

Design Experience and Self-Efficacy Questionnaire

The validity and reliability of alternate versions of this instrument has been deemed acceptable in other studies (*α=.89*, Chu, 2003; *α=.92*, Hasan, 2003). Validity for this study's version of the instrument was confirmed by a faculty panel. Cronbach's alpha reliability coefficient was used to test the consistency of items in the self-efficacy measurement in this study's version of the instrument. As shown in Table 2, our instruments for measuring previous experience (*α=.875*), and perceptions of self-efficacy (*pretest α=.932; posttest α=.855*) produced sufficient alpha values, and were considered acceptable and reliable (Achim, 2015; Raykov & Marcoulides, 2011).

Table 2.
Reliability Analysis for Study Instruments

Instrument	Cronbach's Alpha	Items	N	Valid
Self-Efficacy Pre-Test	.93	10	50	48
Self-Efficacy Post-Test	.86	10	50	42
Previous Experience	.88	8	52	49

Brand Guide Assignments

The content of Design for Agricultural Media has been reviewed by university faculty and administration, as well as by the Texas Higher Education Coordinating Board. The five brand guide assignments were therefore deemed to be valid measures of content mastery and performance skills. The grading rubrics had been evaluated by the Center for Teaching Excellence at [University] and deemed reliable measures of student performance.

Results

Pillai's Trace is the most robust test for evaluating statistical significance when violations of homogeneity of variances/covariances exist (Meyers, Gmast, & Guarino, 2017). There was a statistically significant difference in performance on the combined assignments based on a student's participation in Peer Review after controlling for Change in Self-Efficacy and Previous Experience, (*F(5,42)=3.696, p=.007, Pillai's Trace=.306, partial η2=.306*). The interaction effects between combined performance scores and Change in Self-Efficacy; combined performance scores and Previous Experience; and combined performance scores, Change in Self-Efficacy, Previous Experience and Peer Review were not statistically significant (Table 3).

Table 3.
Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[f]
Corrected Model	Beg-InDesign	1091.610[a]	3	363.870	2.214	.099	.126	6.643	.089
	Illustrator	2570.087[b]	3	856.696	3.771	.017	.197	11.313	.252
	Photoshop	402.517[c]	3	134.172	.298	.827	.019	.894	.004
	Adv-InDesign	1370.804[d]	3	456.935	.786	.508	.049	2.359	.013
	Int-Project	381.336[e]	3	127.112	1.230	.310	.074	3.690	.029
Intercept	Beg-InDesign	91335.941	1	91335.941	555.866	.000	.924	555.866	1.000
	Illustrator	118576.793	1	118576.793	521.948	.000	.919	521.948	1.000
	Photoshop	106587.498	1	106587.498	236.684	.000	.837	236.684	1.000
	Adv-InDesign	79680.890	1	79680.890	137.108	.000	.749	137.108	1.000
	Int-Project	104616.824	1	104616.824	1012.414	.000	.957	1012.414	1.000
PreExp	Beg-InDesign	202.247	1	202.247	1.231	.273	.026	1.231	.012
	Illustrator	218.817	1	218.817	.963	.332	.021	.963	.009
	Photoshop	337.356	1	337.356	.749	.391	.016	.749	.007
	Adv-InDesign	19.953	1	19.953	.034	.854	.001	.034	.001
	Int-Project	187.851	1	187.851	1.818	.184	.038	1.818	.022
ChangeSE	Beg-InDesign	38.764	1	38.764	.236	.629	.005	.236	.002
	Illustrator	3.580	1	3.580	.016	.901	.000	.016	.001
	Photoshop	150.734	1	150.734	.335	.566	.007	.335	.003
	Adv-InDesign	29.462	1	29.462	.051	.823	.001	.051	.001
	Int-Project	28.955	1	28.955	.280	.599	.006	.280	.003
PeerRev	Beg-InDesign	792.446	1	792.446	4.823	**.033**	.095	4.823	.111
	Illustrator	1924.651	1	1924.651	8.472	**.006**	.156	8.472	.291
	Photoshop	.229	1	.229	.001	.982	.000	.001	.001
	Adv-InDesign	1355.565	1	1355.565	2.333	.134	.048	2.333	.032
	Int-Project	275.023	1	275.023	2.661	.110	.055	2.661	.040
Error	Beg-InDesign	7558.390	46	164.313					
	Illustrator	10450.333	46	227.181					
	Photoshop	20715.483	46	450.337					
	Adv-InDesign	26733.116	46	581.155					
	Int-Project	4753.364	46	103.334					
Total	Beg-InDesign	260700.000	50						
	Illustrator	344807.000	50						
	Photoshop	308400.000	50						
	Adv-InDesign	272824.000	50						
	Int-Project	337899.520	50						
Corrected Total	Beg-InDesign	8650.000	49						
	Illustrator	13020.420	49						
	Photoshop	21118.000	49						
	Adv-InDesign	28103.920	49						
	Int-Project	5134.700	49						

a. R Squared = .126 (Adjusted R Squared = .069)
b. R Squared = .197 (Adjusted R Squared = .145)
c. R Squared = .019 (Adjusted R Squared = -.045)
d. R Squared = .049 (Adjusted R Squared = -.013)
e. R Squared = .074 (Adjusted R Squared = .014)
f. Computed using alpha = .001

Impact of Peer Review on Students' Performance

The influence of participation in computer-based peer review on performance scores was investigated using multivariate analysis of variance (MANOVA). There was a statistically significant difference in performance based on a student's participation in Peer Review, *F(5, 44)=3.931, p=.005, Pillai's Trace=.309, partial* η^2*=.309,* α*=.001*. Descriptive statistics for student performance during the fall 2017 semester are shown in Table 4.

Table 4.

Descriptive Statistics for Student Performance on Assignments in the Fall 2017 Semester

	n	Minimum	Maximum	Mean	Std. Deviation
Beginning InDesign	50	40	90	71.000	13.286
Face-to-Face	26	40	90	67.307	13.434
Online	24	40	90	75.000	12.158
Illustrator	50	30	100	81.460	13.601
Face-to-Face	26	75	100	87.962	7.513
Online	24	30	95	74.417	20.130
Photoshop	50	0[a]	100	75.800	20.760
Face-to-Face	26	25	100	76.539	19.838
Online	24	0[a]	100	75.000	22.116
Advanced InDesign	50	0[a]	100	69.960	23.949
Face-to-Face	26	0[a]	100	74.923	26.513
Online	24	30	95	64.583	19.995
Integrated Project	50	52	100	81.580	10.237
Face-to-Face	26	62	100	83.469	11.071
Online	24	52	100	79.533	9.034
Valid N (listwise)	50				

a. Students who failed to follow assignment instructions (e.g. packaging) received an automatic zero on their submitted assignments.

Pairwise comparisons revealed that students in the fall 2017 face-to-face section performed significantly better than students in the online section in the beginning assignments (Beginning InDesign, *p=.033*; and Illustrator, *p=.006*). After utilizing the peer review process for these beginning assignments, students in the online section performed as well as their face-to-face peers in the more advanced assignments (Photoshop, *p=.982;* Advanced InDesign, *p=.134*; and the Integrated Project, *p=.110*), as shown in Table 5.

Table 5.

Pairwise Comparisons of Fall 2017 Online (Peer Review) and Face-to-Face (No Peer Review) Section Performance Scores

						99.9% Confidence Interval for Difference[a]	
Dependent Variable	(I) Peer Review	(J) Peer Review	Mean Difference (I-J)	Std. Error	Sig.[a]	Lower Bound	Upper Bound
Beg-InDesign	No	Yes	-8.230	3.748	**.033**	-21.403	4.943
	Yes	No	8.230	3.748	**.033**	-4.943	21.403
Illustrator	No	Yes	12.826	4.407	**.006**	-2.663	28.316
	Yes	No	-12.826	4.407	**.006**	-28.316	2.663
Photoshop	No	Yes	.140	6.204	.982	-21.668	21.948
	Yes	No	-.140	6.204	.982	-21.948	21.668
Adv-InDesign	No	Yes	10.764	7.048	.134	-14.010	35.539
	Yes	No	-10.764	7.048	.134	-35.539	14.010
Integrated Project	No	Yes	4.849	2.972	.110	-5.598	15.295
	Yes	No	-4.849	2.972	.110	-15.295	5.598

Based on estimated marginal means
a. Adjustment for multiple comparisons: Sidak.

Face-to-face students received a mean final grade of 80.5% or a B; online students' mean final grades were one half letter grade lower (75.4% or a C). Figure 2 illustrates performance in relation to assignment grades. These finding supports H_1, participation in computer-based peer review increases student performance of graphic design skills.

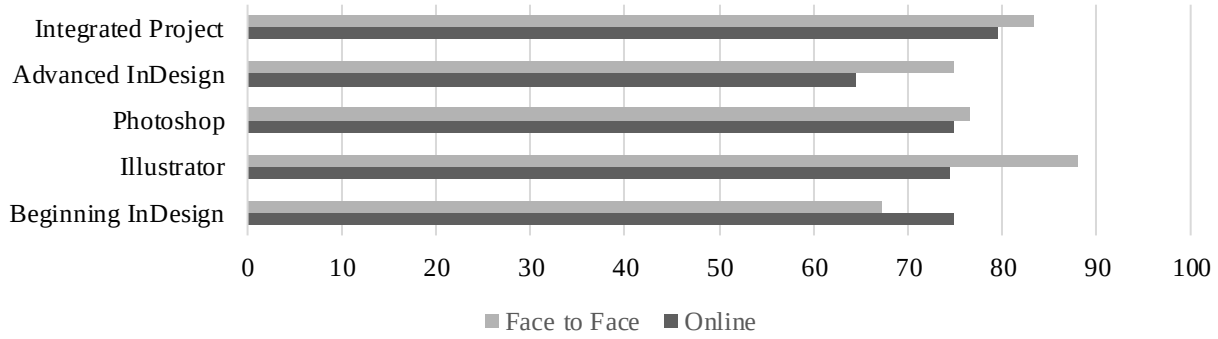

Figure 2. Fall 2017 Mean Performance Scores for Face-to-Face and Online Students

Impact of Peer Review on Students' Perceptions of Self-Efficacy

Perceptions of self-efficacy were analyzed using a one-way repeated measures analysis of variance (ANOVA). Most students in the online (54.17%) and face-to-face (71.43%) sections experienced an increase in self-efficacy in graphic design. Students who participated in the peer review process had larger changes in perceived self-efficacy (*M=8.160*) than students who did not (*M=-0.037*); however, the differences between these group means were not statistically significant, (*F(1,50)=.622*). See Table 6 below.

Table 6.
Descriptive Statistics for Students' Change in Self-Efficacy

Section	Mean	Std. Deviation	N
Online	8.1600	25.43731	25
Face-to-Face	-.0370	32.67260	27
Total	3.9038	29.42472	52

Although participation in the peer review process was correlated with an increase in student perceptions of self-efficacy (*r=.141*), this increase was also not significant (*p=.32*), as shown in Table 7. We did not find sufficient evidence to support H_2, participation in computer-based peer review increases student perceptions of self-efficacy.

Table 7.
Tests of Between-Subjects Effects for Students' Change in Self-Efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	872.196[a]	1	872.196	1.008	.320	.020	1.008	.054
Intercept	856.504	1	856.504	.989	.325	.019	.989	.054
Section	872.196	1	872.196	1.008	.320	.020	1.008	.054
Error	43284.323	50	865.686					
Total	44949.000	52						

Corrected Total	44156.519	51

a. R Squared = .020 (Adjusted R Squared = .000)
b. Computed using alpha = .001

Relationship between Peer Review, Previous Experience, and Perceived Self-Efficacy

We then examined the possibility that a relationship existed among participation in computer-based peer review, prior experience, and/or perceived self-efficacy using Pearson's *r* correlation analysis. No correlation existed between Performance and Previous Experience. A weak negative correlation existed between Change in Self-Efficacy and Previous Experience (*r=.292*) at the .05 level (Table 8). No correlations existed at *p=.001*. H_3, online student performance, perceived self-efficacy, and computer-based peer review are positively correlated, was not supported.

Table 8.
Correlations between Change in Self-Efficacy, Previous Experience, and Peer Review

		Change in Self-Efficacy	Previous Experience	Peer Review
Change in Self-Efficacy	Pearson Correlation	1	**-.292***	.141
	Sig. (2-tailed)		**.036***	.320
	N	52	52	52
Previous Experience	Pearson Correlation	**-.292***	1	.153
	Sig. (2-tailed)	**.036***		.278
	N	52	52	52
Peer Review	Pearson Correlation	.141	.153	1
	Sig. (2-tailed)	.320	.278	
	N	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

Conclusions

Employees with media production skills, project management, critical thinking skills, acute attention to detail, and proficiency in a variety of software applications are highly valued by employers (Hopp & Gangadharbatla, 2016). This study examined how participation in peer review impacted student performance and perceptions of self-efficacy in an online graphic design course. Many students may struggle to implement the critical thinking skills and attention to detail necessary to successfully complete graphic design projects (Hopp & Gangadharbatla, 2016). Peer review helped students to improve their performance scores, which were a reflection of their comprehension and mastery of course content, critical thinking skills and attention to detail. According to social cognitive theory (Bandura, 1986), students who receive positive feedback from their peers will have more confidence that they can successfully complete tasks such as graphic design assignments. Knowing that their peers would see their work, students may have been motivated to put forth more effort in the production of their assignments. Seeing the work of their peers also allows students to set a realistic benchmark for comparing the quality of their own work, which would further increase confidence in their ability to successfully complete the assigned tasks (Bandura, 1997).

Technology is ever changing and evolving; communication professionals must be able to learn and adapt quickly (Hopp & Gangadharbatla, 2016). Prior research has shown that students are motivated to work harder when they believe they are likely to succeed (Bandura, 1997), those with higher self-efficacy persevere longer on challenging computer tasks (Achim & Kasim, 2015; Collins & Bissell, 2001), and experience with one program increases students' self-efficacy with other programs (Chu, 2003; Hasan, 2003). The peer review process was designed to emphasize

the importance of paying attention to assignment details, with the intent of bringing online student performance in line with face-to-face student performance which historically had been a full grade letter higher. After two rounds of peer review, online students reduced this difference by one half letter grade (5.1%). This improvement could not be accounted for by students' previous experience. Most students who participated in the computer-based peer review process reported an increase in perceived self-efficacy in graphic design. However, one-third reported a decrease in self-efficacy. It is possible that students were overly confident of their abilities prior to taking the course and became more realistic over the course of the semester. It is also possible that students did not fully understand the importance of their participation in this research and as such gave inaccurate answers on the self-efficacy scale. More students in the face-to-face section than in the online section reported an increase in self-efficacy in graphic design. This may be because they had not compared their work to their peers and did not experience the same reality check as their online peers. Future research should test these possibilities.

We explored the possibility of a relationship between student performance, perceptions of self-efficacy, and prior experience. While we did not find evidence for a statistically significant relationship, it is possible that the issues with the self-efficacy scale we addressed above also impacted the outcome of this research objective as well.

The incorporation of a computer-based peer review system into instruction offers increased student engagement, improvement in student performance, and increased perceptions of self-efficacy. Students are more likely to reflect on their own work, pay more attention to detail, and develop effective problem-solving strategies, particularly when peer review is incorporated into multiple assignments over the course of a semester. The benefits of computer-based peer review for student writing achievement have been well documented in the literature (Fischer & Meyers, 2017; Leijen, 2017; Li et al., 2010; Sloan, 2017); the findings from this study indicate those benefits extend to achievement in graphic design as well.

Limitations

Peerceptiv was designed for writing assignments, which as a rule are smaller in file size than graphic design projects. Students were only able to complete two rounds of peer review rather than the four rounds we had hoped to complete. Uploads to Peerceptiv are capped at 2 MB so more complex assignments (e.g., advertisements created in Adobe Photoshop) were too large to upload. This study examined performance scores from a relatively small number of students in one course at one university. Further, it was assumed that the historical pattern of grade discrepancies between sections would also occur in the semester studied. Despite these limitations, this study provides valuable insight into the role of computer-based peer review on student performance and perceptions of self-efficacy.

Recommendations

Agricultural educators should expand the incorporation of peer review from writing courses to all courses, when feasible. The active, experiential component of the peer review process can be used to reinforce student success in many contexts, from graphic design and public relations to floral design and agricultural mechanics.

Future research should determine if the results can be replicated elsewhere and in other contexts. Other computer-based peer review platforms may have more capability than Peerceptiv to receive large files, which would better enable their use in a graphic design course setting. Future research using alternate platforms may provide more generalizable results. Finally, exploration of

the benefits of computer-based peer review as a tool for increasing student performance in additional agricultural communication course contexts is warranted.

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