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Radiography Faculty Engaged in Online Education: Perceptions of Effectiveness, Satisfaction, and Technological Self-Efficacy

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Purpose To assess radiography faculty perceptions of the effectiveness of online courses.

Methods An original survey instrument was created by selecting items from 3 instruments used in prior research and adding unique questions designed to elicit demographic data from faculty. The sample included a national dataset of radiography faculty members employed in Joint Review Committee on Education in Radiologic Technology–accredited programs in the United States.

Results Findings showed that faculty perceptions of online course effectiveness are not affected significantly by faculty position, type of institution, faculty age, or years of teaching experience. Positive perceptions of the effectiveness of online courses moderately increased with years of teaching online courses, number of online courses taught in the past 5 years, and perceived competence with the use of technology. Faculty satisfaction with interaction in online courses moderately increased as the years of teaching online courses increased. However, the number of years of teaching online courses was not related to faculty satisfaction with teaching online courses or faculty satisfaction with institutional support. Online technology acceptance had a moderately positive relationship with perceived ease of use and a strong positive relationship with perceived usefulness of online technology. In addition, the use of technology-enhanced learning methods had a strong positive relationship with technological self-efficacy.

Conclusion Radiography faculty perceptions of the effectiveness of online courses improved with experience in teaching online courses and competence with use of technology. Perceived ease of use and perceived usefulness of online technology were related directly to online technology acceptance. Furthermore, faculty members with technological self-efficacy were more likely to use technology-enhanced learning methods in the online environment.

Keywords | *online education, faculty perceptions, self-efficacy, educational effectiveness, technology*

Considerable research related to the effectiveness of online education in various disciplines exists; however, the majority of these studies were conducted in local settings. Moreover, the literature is rich with articles on online learning experiences and best practices, but a limited number of studies have examined the effectiveness of online education in radiologic sciences. To the authors' knowledge, a national survey of radiography faculty perceptions of the effectiveness of online education has not been conducted. Therefore, the authors employed a national sample of faculty from 615 radiography programs throughout the United States to solicit the perceptions of radiography faculty of online learning. As more radiography programs use online learning platforms, these findings inform radiography educational practices and might be transferable to other disciplines within online education.

Online learning is an integral component of higher education, and the online education delivery method must be evaluated as a viable learning option.[1] Senior academic officers in the United States report that online education is critical to their institutions' long-term strategy, increasing from 49% in 2002 to 66% in 2013.[1] The growth of online learning suggests that it is gaining acceptance; however, academic leaders report mixed perceptions when asked to compare learning outcomes

in online courses with those in the traditional classroom. The percentage of leaders reporting that learning outcomes in online courses are inferior increased from 23% in 2012 to 26% in 2013. Interestingly, academic leaders at large institutions (ie, > 15 000 total enrollments) offer the majority of online courses and have the highest opinion of the educational quality of the classes.[1]

Several institutions of higher education define an online course as having 80% or more of the content delivered online and, generally, no face-to-face meetings are conducted.[1-3] Students in online courses are educated in a common virtual environment but a different physical space.[4] Because the virtual classroom has lower levels of direct instructor or classmate presence, students become self-directed learners who develop time-management skills. Indeed, instructors are charged with engaging students and designing the course with pedagogy conducive to the online environment, and students are expected to be motivated and engrossed in the learning process.[4]

Faculty members who teach online courses express satisfaction with greater schedule flexibility, greater access to materials, increased student involvement, increased student access, and learning new technology.[3,5,6] However, they express dissatisfaction regarding technological problems, lack of personal contact with students, increased workload, inadequate compensation for increased workload, and diminished student involvement.[3,5,8] Overall, increased workload is the greatest area of concern for faculty.[2,3-10] Sex, age, employment status, type of institution (community college or university), and computer skills influence faculty motivation in teaching online courses.[6] Instructor learning preferences do not affect faculty satisfaction with online learning; however, faculty who are auditory learners report the lowest satisfaction with teaching online.[11]

Variables that predict student satisfaction with online education and learning effectiveness include student interest in and attitude toward performing learning tasks, perceived instructional quality, self-efficacy, and workload.[9,12] Nevertheless, workload is not a concern among students if course expectations are addressed during course enrollment.[9] The factors that influence student perceptions of learning effectiveness are grade point average and American College Testing scores, attrition, appropriate interactions among students, multiple activities used in online courses, instructor presence, and meaningful interaction between students and the instructor.[13-16] Furthermore, employment status, distance from the student's home to the school, prior experience with taking an online course, and current enrollment in an online course affect student enrollment in additional online courses.[17]

Literature Review

Faculty members are managers, technical advisors, facilitators, social directors, and educators in the online environment.[18] The instructor must facilitate a collaborative and student-centered environment, as well as engage online learners.[18] Attitudinal measures of effective learning include the instructor's positive attitude toward technology, interaction with students, and control of technology.[19] Instructor self-efficacy is another contributing factor that enhances learning in the virtual learning environment (VLE). The instructor must be available to students and willing to devote time and energy to enhance the learning experience. An instructor's attitude, self-efficacy, and availability can improve students' reactions.

The Web-based VLE effectiveness model was the conceptual framework for this study.[19] The VLE is the learning community for faculty and students in an online course and is defined by 2 constructs: the human dimension (faculty and students) and the design dimension (technology). Both human and design dimensions lead to learning effectiveness.[19]

The Human Dimension: Faculty

Shea examined factors that motivate and demotivate faculty to teach in the online learning environment.[6] This study used a broad sample of 386 faculty in 36 different colleges within 1 university system. Confirming prior findings at single institutions, flexibility was cited by faculty as the greatest motivating factor to teaching online courses. Other benefits identified were learning new technology and increased access for students. Inadequate compensation for increased workload was cited as the greatest barrier. Sex, age, employment status, type of institution (community college or university), and computer skills influenced

faculty members' motivation to teach online courses. Faculty most motivated to teach online courses were women younger than 45 years with part-time status at community colleges. The institution encouraged computer-savvy faculty to serve as mentors.[6]

A study of online instructors in a community college used the National Study of Postsecondary Faculty job satisfaction survey and the Readiness for Education at a Distance Indicator assessment.[11] Findings indicated that instructor learning preferences (auditory, verbal, and kinesthetic) did not affect faculty satisfaction with online teaching; however, faculty who were auditory learners reported the least satisfaction with teaching online courses. Therefore, auditory learners might need accommodations, such as synchronous meetings, in the online environment.[11]

The Human Dimension: Students

Studies revealed numerous variables that predicted student satisfaction with online education, including student interest in and attitude toward performing learning tasks, perceived instructional quality, self-efficacy, and workload.[9,12] Workload was not a concern among students if course expectations were addressed during enrollment.[9] Grade point average, American College Testing scores, attrition, appropriate interactions among students, multiple activities incorporated in an online course, instructor presence, and meaningful interaction between students and the instructor influenced student perceptions of learning effectiveness.[13-16] Furthermore, employment status, distance from home, prior experience taking an online course, and current enrollment in an online course affected students' preference to enroll in additional online courses.[17]

The Design Dimension: Technology

Researchers have examined different types of technology and evaluated the effect of different design platforms in the VLE. Technologies and media support have been found to enhance learning, increase student satisfaction, decrease attrition, and lead to a student-centered learning environment.[20] Furthermore, use of technology supports delivery of online courses, increases student engagement, improves interaction between students and faculty, and enhances experiences and collaboration among students.[20-23] Implications for higher education policy are that faculty training can improve Internet self-efficacy and increase the use of technology. Therefore, appropriate investments in technical infrastructure and support should be made to increase the use of technology.[24]

Online Course Effectiveness

Faculty-related factors critical to online learning effectiveness have included components of instructional design and instructor presence.[25,26] Assessment of online instruction at institutions of higher education has enabled faculty to maintain educational quality standards.[27] Furthermore, faculty used a complement of formative and summative evaluation strategies to determine effectiveness of online courses.[28]

Student-related factors critical to online learning effectiveness include active learning, student–student interactions, and student–instructor interactions.[29-32] Self-monitoring, setting goals, effective time management skills, and seeking help from classmates or the instructor also serve to improve online learning.[30] Finally, instructor-generated media, interactive media, simulations, and tools such as online text, static graphics, embedded video, end-of-module activities, and integrated tutorials are technology-related factors critical to online learning effectiveness.[33,34]

Few studies have examined online radiography courses, and even fewer have focused on course effectiveness. Our literature search revealed 6 studies that assessed online learning in radiologic science courses. The first study was related to course effectiveness and explored the process of establishing a distance education program in radiography in 1990. The program was considered beneficial; however, recommendations were made to enhance future offerings that included evaluating faculty workloads, using fiber optics to facilitate the distance learning component of the program, and providing program expectations and requirements to students before enrollment.[35]

The second study evaluated radiologic sciences and nursing faculty and student attitudes regarding online education. Survey results indicated that faculty experienced barriers with increased preparation time, a lack of personal interaction with students, inexperience with

technology, and an increase in email correspondence with students.[10]

The third study examined the effectiveness of 2 online radiologic science courses that were converted from a traditional classroom format. Course grades and national board results in 2 subject areas were compared across participants. Online students' course grades were higher than those of traditional students; however, the results were significant only for one of the course topics. These findings might indicate that online students are more engaged and learn material on a deeper level. Conversely, the traditional students had higher national board results on both content areas.[36]

The fourth study evaluated the self-directed learning characteristics of imaging science professionals who completed online continuing education activities. Responses from 640 imaging professionals included opinions on motivation, self-monitoring, and self-management regarding completion of CE activities. Mandatory certification requirements, clinical competence, awareness of technological changes in the profession, and the possibility of changing jobs or being promoted motivated individuals to complete CE activities.[37]

The fifth study was a report prepared by an American Society of Radiologic Technologists task force that detailed online education delivery methods and types of technological tools that radiography educators could incorporate into their online courses to enhance learning effectiveness. The taskforce advised that new instructional technology methods and tools used to deliver educational content be evaluated to assure effectiveness of online education.[4]

The final study examined the prominence of online education in the radiologic sciences and explored the course management systems, course design, and technology used to teach online courses. The researchers stressed the need for a variety of technological tools and methods to be integrated into online courses to engage students and provide an interactive virtual environment. In addition, online educators should request instruction in course design and technological tools before and after the course is developed to evaluate and improve online learning strategies.[38]

Because the research topics for each of these studies were unrelated, no common themes emerged among them. All of the studies had small sample sizes; therefore, the results might not be applicable to all radiologic science programs in the United States, leaving a paucity of empirical studies on effectiveness of online education in radiography programs.

Methods

Radiography faculty perceptions of the effectiveness of asynchronous online courses were assessed using a nonexperimental quantitative method with a survey research design.[39] A simple random sample permitted results to be generalized across the entire population. The quantitative survey included questions with Likert scales to measure radiography faculty perceptions of the effectiveness of asynchronous online courses.[39] The East Tennessee State University Institutional Review Board determined that this study involved minimal risk to the participants and granted exempt approval.

Research Questions

The questions that guided the study were:

1. Is there a significant difference in radiography faculty perceptions of the effectiveness of online courses as compared by faculty position (A) and type of institution (B)?
2. Is there a significant difference between radiography faculty perceptions of the effectiveness of online courses and age (A), years of teaching experience (B), years teaching online courses (C), number of online courses taught in the past 5 years (D), and perceived competence with use of technology (E)?
3. Is there a significant relationship between the number of years of teaching online courses and faculty satisfaction with teaching online courses (A), faculty satisfaction with interaction (B), and faculty satisfaction with institutional support (C)?
4. Is there a significant relationship between perceived ease of use of technology and online technology acceptance?
5. Is there a significant relationship between perceived usefulness of technology and online technology acceptance?

6. Is there a relationship between technological self-efficacy and use of technology-enhanced learning methods?
7. Are radiography faculty satisfied to a significant degree with teaching online courses?
8. Are radiography faculty satisfied to a significant degree with interaction in online courses?
9. Are radiography faculty satisfied to a significant degree with institutional support while teaching online courses?
10. Do radiology faculty perceive to a significant degree that online courses are effective?

Instrument

An original survey, Radiography Faculty Perceptions of Online Education Survey, was created using survey elements from 3 established surveys: the Online Faculty Satisfaction Survey,[3] the Technology Acceptance Survey,[40] and the Factors Affecting Faculty Use of Technology Survey.[24]

The electronic survey was made available through SurveyMonkey and included questions on demographic characteristics, technical competence, perceptions of the effectiveness of online courses, selected aspects of faculty satisfaction with online courses, perceived ease of use and usefulness of technology, technological self-efficacy, and use of technology-enhanced learning methods.

Demographic questions were designed to categorize faculty by position (program director, clinical coordinator, or other), type of institution at which they were employed (4-year college/university, community college, technical college/institute, hospital, proprietary institution, or other), age, years of teaching experience, years of teaching online courses, and the number of online courses each faculty member taught in the past 5 years. A 5-point Likert scale (excellent, above average, average, poor, and none) was used to assess participants' level of competency with technology.

Additional questions assessed radiography faculty perceptions of online courses, selected aspects of faculty satisfaction with teaching online courses, perceived ease of use, perceived usefulness associated with online technology, technological self-efficacy of faculty, and use or potential use of technology-enhanced learning methodologies. These questions used a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for positively keyed items and from 1 (strongly agree) to 5 (strongly disagree) for reverse-keyed items.

A small number of participants who were similar to those in the sample completed a pilot study. The pilot test determined the directions for the Radiography Faculty Perceptions of Online Education Survey were clear and the length of the instrument was appropriate; it also provided feedback about the clarity and appropriateness of questions.[39]

Sample

The study population included educators who taught radiography courses in programs accredited by the Joint Review Committee on Education in Radiologic Technology (JRCERT). The JRCERT accredits 616 radiography programs throughout the United States, and the programs are sponsored by hospitals, community colleges, private colleges, and universities.[41] The researchers contacted the JRCERT staff to request email addresses for all radiography faculty included in its database. The staff authorized that the names and email addresses of radiography program directors and clinical coordinators be emailed to the researcher.

The inclusion criteria were radiography faculty who were teaching or had taught at least 1 asynchronous online course. A total of 1202 radiography faculty were invited to participate in the survey. SurveyMonkey reported that 5 individuals chose not to complete the survey. An additional 59 individuals explained by email that they did not meet the inclusion criteria. A total of 355 responses were collected; however, only 216 were used in the data analysis because 55 were ineligible and 84 were incomplete. Of the 84 incomplete responses, 20 contacted the researchers by email to explain that they were ineligible. Because 1202 radiography faculty members were in the population and 216 responses were used, the response rate was 18%.

Results

Demographic Characteristics

Among the 216 participants, 44.9% were program directors, 50.0% were clinical coordinators, and 5.1% were other. Written responses for the "other" category

encompassed education coordinator–assistant professor, clinical coordinator–assistant professor, clinical coordinator–didactic faculty, education coordinator, and didactic faculty. Respondents were employed at various types of institutions: 4-year college/university (32.4%), community college (47.7%), technical college/institute (10.6%), hospital (7.9%), proprietary institution (0.9%), and other (0.5%). The written response for the "other" category was a state college (see **Table 1**). The age of the participants ranged from 26 to 69 (mean = 48.25) years. The number of years of teaching experience ranged from 1 to 42 (mean = 15.36). The number of years of teaching online courses ranged from 0.5 to 17 (mean = 5.12). The mean number of online courses taught in the past 5 years ranged from 0 to 120 (mean = 9.55; see **Table 2**).

Faculty Perceptions of Online Courses

A one-way analysis of variance (ANOVA) was conducted to evaluate the relationship between radiography faculty perceptions of the effectiveness of online courses and faculty position for research question 1A. The factor variable, faculty position, had 3 options: program director, clinical coordinator, and other. The dependent variable was radiography faculty perceptions of the effectiveness of online courses. The ANOVA was not significant, $F(2, 213) = .56$, $P = .574$. Therefore, the null hypothesis was retained. The strength of this relationship, assessed by η^2, was small (.005). Results showed that perceptions of effectiveness were not significantly different when analyzed by faculty position.

A second one-way ANOVA was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and type of institution for research question 1B. The factor variable, type of institution, had 6 options: 4-year college/university, community college, technical college/institute, hospital, proprietary institution, and other. The dependent variable was radiography faculty perceptions of the effectiveness of online courses. The ANOVA was not significant, $F(5, 210) = 1.273$, $P = .277$. Therefore, the null hypothesis was retained. The strength of this relationship, assessed by η^2, was small (.029). Results revealed that perceptions of the effectiveness of online courses were not significantly different when analyzed by type of institution.

A Pearson correlation was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and age for research question 2A. Results revealed a weak negative relationship between

Table 1

Respondent Demographic Information by Faculty Position and Type of Institution

Faculty Position	4-Year College/ University	Community College	Technical College/ Institute	Hospital	Proprietary Institution	Other
Program director	26	43	16	9	2	1
Clinical coordinator	40	54	6	8	0	0
Other	4	6	1	0	0	0
Total (%)	70 (32.4)	103 (47.7)	23 (10.6)	17 (7.9)	2 (0.9)	1 (0.5)

Table 2

Respondent Demographic Information by Faculty Position and Other Variables

Faculty Position	Mean Age (years)	Mean Teaching Experience (years)	Mean Teaching Online Courses (years)	Mean No. Online Courses Taught in the Past 5 Years
Program director	51	18.1	5.9	10
Clinical coordinator	46	13.0	4.5	8
Other	45	13.8	4.5	26
All positions	49	16.0	4.2	44

radiography faculty perceptions of the effectiveness of online courses (mean = 24.03, *SD* = 5.02) and age (mean = 48.25, *SD* = 9.88). The Pearson correlation was not significant, $r(213) = -.013$, $P = .854$. Therefore, the null hypothesis was retained. In general, the results revealed that radiography faculty perceptions of the effectiveness of online courses were not significantly related to age.

A second Pearson correlation was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and years of teaching experience for research question 2B. Results revealed a weak negative relationship between radiography faculty perceptions of the effectiveness of online courses (mean = 24.03, *SD* = 5.02) and years of teaching experience (mean = 15.36, *SD* = 9.54). The Pearson correlation was not significant, $r(213) = -.069$, $P = .317$. Therefore, the null hypothesis was retained. In general, the results revealed that faculty perceptions of the effectiveness of online courses were not significantly related to years of teaching experience.

A third Pearson correlation was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and years of teaching online courses for research question 2C. Results showed a significant positive relationship between radiography faculty perceptions of the effectiveness of online courses (mean = 24.03, *SD* = 5.02) and years of teaching online courses (mean = 5.12, *SD* = 3.55), which was statistically significant, $r(214) = .209$, $P = .002$. Therefore, the null hypothesis was rejected. The results suggested that radiography faculty perceptions of the effectiveness of online courses increased as the years of teaching online courses increased.

A fourth Pearson correlation was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and the number of online courses taught in the past 5 years for research question 2D. Results showed a positive relationship between perceptions of the effectiveness of online courses (mean = 24.03, *SD* = 5.02) and the number of online courses taught in the past 5 years (mean = 9.55, *SD* = 12.45), which was statistically significant, $r(213) = .282$, $P < .001$. Therefore, the null hypothesis was rejected. The results suggested that radiography faculty perceptions of the effectiveness of online courses increased as the number of online courses taught in the past 5 years increased.

A fifth Pearson correlation was conducted to evaluate the relationship between perceptions of the effectiveness of online courses and perceived competence with use of technology for research question 2E. Results showed a positive relationship between perceptions of the effectiveness of online courses (mean = 24.03, *SD* = 5.02) and perceived competence with use of technology (mean = 3.97, *SD* = 0.657), which was statistically significant, $r(214) = .169$, $P = .013$. As a result, the null hypothesis was rejected. The results suggested that radiography faculty perceptions of the effectiveness of online courses increased as perceived competence with use of technology increased.

Faculty Satisfaction and Years of Teaching Online

A Pearson correlation was used to examine the relationship between faculty satisfaction with teaching online courses and the number of years of teaching online courses for research question 3A. Results showed a weak positive relationship between satisfaction with teaching online courses (mean = 39.01, *SD* = 6.67) and the number of years of teaching online courses (mean = 5.12, *SD* = 3.55). The Pearson correlation was not significant, $r(214) = .025$, $P = .714$. Therefore, the null hypothesis was retained. In general, the results indicated that faculty satisfaction with teaching online courses was not significantly related to the number of years of teaching online courses.

A second Pearson correlation was used to examine the relationship between faculty satisfaction with interaction and the number of years of teaching online courses for research question 3B. Results showed a positive relationship between faculty satisfaction with interaction (mean= 24.15, *SD* = 4.73) and the number of years of teaching online courses (mean= 5.12, *SD* = 3.55), which was statistically significant, $r(214) = .178$, $P = .009$. Therefore, the null hypothesis was rejected. The results suggested that faculty satisfaction with interaction increased as the years of teaching online courses increased.

A third Pearson correlation was used to examine the relationship between faculty satisfaction with institutional support and the number of years of teaching

online courses for research question 3C. Results showed a weak negative relationship between faculty satisfaction with institutional support (mean = 19.41, *SD* = 4.07) and the number of years of teaching online courses (mean = 5.12, *SD* = 3.55), which was not significant, $r(214) = -.098$, $P = .151$. Therefore, the null hypothesis was retained. In general, the results indicated that faculty satisfaction with institutional support was not significantly related to the number of years of teaching online courses.

Online Technology Acceptance

A Pearson correlation was used to examine the relationship between perceived ease of use of technology and online technology acceptance for research question 4. Results showed a positive relationship between perceived ease of use of technology (mean = 18.73, *SD* = 2.98) and online technology acceptance (mean = 7.16, *SD* = 1.56), which was statistically significant, $r(214) = .382$, $P < .001$. Therefore, the null hypothesis was rejected. The results suggested that online technology acceptance increased as perceived ease of use of technology increased.

A Pearson correlation was conducted to evaluate the relationship between perceived usefulness of technology and online technology acceptance for research question 5. Results showed a strong positive relationship between perceived usefulness of technology (mean = 19.48, *SD* = 3.36) and online technology acceptance (mean = 7.16, *SD* = 1.56), which was statistically significant, $r(214) = .645$, $P < .001$. Therefore, the null hypothesis was rejected. The results suggested that online technology acceptance significantly increased as perceived usefulness of technology increased.

Technological Self-efficacy

A Pearson correlation was conducted to evaluate the relationship between technological self-efficacy and use of technology-enhanced learning methods for research question 6. Results showed a strong positive relationship between technological self-efficacy (mean = 44.37, *SD* = 7.92) and use of technology-enhanced learning methods (mean = 46.88, *SD* = 6.86), which was statistically significant, $r(214) = .440$, $P < .001$. Therefore, the null hypothesis was rejected. The results suggested that use of technology-enhanced learning methods significantly increased as technological self-efficacy increased.

Faculty Satisfaction With Teaching Online Courses

A single-sample *t* test was conducted to evaluate the degree to which faculty were satisfied with teaching online courses for research question 7. The sample mean of 39.01 (*SD* = 6.67) was significantly different from 36.0, $t(215) = 6.65$, $P < .001$. The 95% confidence interval (CI) for faculty satisfaction with teaching online courses mean ranged from 2.12 to 3.91. The effect size d, also known as *Cohen d,* of 0.45 indicated a medium effect. Therefore, the null hypothesis was rejected. The results indicated that faculty were satisfied with teaching online courses (see **Table 3**).

Descriptive statistics were used to report the data for research question 7, including means and standard deviations for survey items related to faculty satisfaction with teaching online courses. Items 15 through 26 used a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) for positively keyed items and from 1 (strongly agree) to 5 (strongly disagree) for reverse-keyed items.

Table 4 provides participant responses regarding the level of faculty satisfaction with elements of the online teaching environment and workload. Faculty were most satisfied with the convenience of accessing a course at any time (mean = 4.29), the flexibility provided by teaching in the online environment (mean = 3.87), the opportunity to try innovative teaching techniques (mean = 3.77), and the increased autonomy offered by participating in online education

Table 3

Descriptive Statistics for Faculty Satisfaction With and Perceptions of Online Courses (N = 216)

Item	Mean ± *SD*
Faculty satisfaction with teaching online courses	39.01 ± 6.67
Faculty satisfaction with interaction	24.15 ± 4.73
Faculty satisfaction with institutional support	19.41 ± 4.07
Faculty perceptions of the effectiveness of online courses	24.03 ± 5.02

Abbreviation: SD, standard deviation.

Table 4

Descriptive Statistics for Faculty Satisfaction With Teaching Online Courses (N = 216)

Item	Mean ± *SD*
15. The flexibility provided by teaching in the online environment is important to me.	3.87 ± .867
16. I appreciate that I can access my online course any time it is convenient for me.	4.29 ± .716
17. I believe teaching online negatively impacts student evaluations of my instruction.	3.45 ± .949
18. Online education does not enhance my teaching effectiveness.	3.34 ± 1.088
19. Participating in online education will increase or has already increased my autonomy.	3.42 ± .870
20. Participating in online education enables greater achievement or success in my career.	3.31 ± .965
21. Teaching online courses provides me with opportunities to try innovative teaching techniques.	3.77 ± .831
22. It takes me longer to develop an online course than a traditional course.	2.19 ± 1.068
23. I need more time to administer an online course than a traditional course.	2.61 ± 1.098
24. I need more time to grade student assignments when teaching an online course.	2.99 ± 1.199
25. I need more time to prepare for an online course on a weekly basis than for a traditional course.	2.93 ± 1.041
26. I have a higher workload when teaching an online course than a traditional course.	2.85 ± 1.011

(mean = 3.42). However, they were most dissatisfied with the negative affect of online teaching on student evaluation of instruction (mean = 3.45), the perception that online education did not enhance teaching effectiveness (mean = 3.34), the increased time it took to grade student assignments (mean = 2.99), and the additional time it took to prepare for an online course (mean = 2.93).

A single-sample *t* test was conducted to evaluate the degree to which faculty were satisfied with interactions in online courses for research question 8. The sample mean of 24.15 ($SD = 4.73$) was significantly different from 24, $t(215) = .48$, $P = .635$. The 95% CI for faculty satisfaction with interactions in online courses mean ranged from −0.48 to 0.79. The effect size d of 0.032 indicated a very small effect. Therefore, the null hypothesis was retained. The results indicated that faculty had nearly neutral responses regarding interactions in online courses.

Descriptive statistics were used to report data for research question 8, including calculation of means and standard deviations for items in the instrument related to faculty satisfaction with interactions in online courses. Statements 27 through 34 were scaled items that used a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) for positively keyed items and from 1 (strongly agree) to 5 (strongly disagree) for reverse-keyed items.

Table 5 provides participant responses regarding levels of faculty satisfaction with interaction in the online teaching environment. Faculty were most satisfied that online students were active in communicating course-related matters (mean = 3.73), that student–student interactions were meaningful (mean = 3.66), and that online courses were more accessible to students who would not be able to enroll in traditional courses (mean = 3.56). However, faculty were most dissatisfied that online students were somewhat passive when they contacted their professor about course-related items (mean = 3.05) and with the lack of face-to-face contact with students when teaching online courses (mean = 2.24).

A single-sample *t* test was conducted to evaluate the degree to which faculty were satisfied with institutional support in online courses for research question 9. The sample mean of 19.41 ($SD = 4.07$) was significantly different from 18, $t(215) = 5.09$, $P < .001$. The 95% CI for faculty satisfaction with institutional support in online courses mean ranged from 0.86 to 1.95. The effect size d of 0.35 indicated a small to medium effect. Therefore, the null hypothesis was rejected. The results indicated that faculty were satisfied with institutional support in online courses.

Descriptive statistics were used to report data for research question 9, including calculation of means and

Table 5

Descriptive Statistics for Faculty Satisfaction With Interaction in Online Courses (N = 216)

Item	Mean ± *SD*
27. Online teaching is gratifying because it provides me with the opportunity to reach students who otherwise would not be able to enroll in traditional courses.	3.56 ± .953
28. The level of my interactions with students in an online course is higher than in a traditional face-to-face course.	2.39 ± .928
29. I miss face-to-face contact with students when teaching online courses.	2.24 ± .929
30. My online students are active in communicating with me when they have questions about course-related matters.	3.73 ± .881
31. I can provide better feedback to my online students on their performance.	2.94 ± .877
32. My online students are somewhat passive when they contact me about course-related matters.	3.05 ± 1.022
33. Teaching online courses improves my ability to build relationships with my students.	2.58 ± .880
34. Student-to-instructor interactions are meaningful in my online course.	3.66 ± .859

Table 6

Descriptive Statistics for Faculty Satisfaction With Institutional Support (N = 216)

Item	Mean ± *SD*
35. I receive support to teach online courses (such as clerical support or graduate assistants).	2.10 ± 1.097
36. I have access to training resources from my college/university to teach online courses.	3.92 ± 1.003
37. I have access to technology resources from my college/university to teach online courses.	4.04 ± .859
38. I receive adequate financial resources from my college/university to teach online courses.	3.28 ± 1.112
39. I receive fair financial compensation for teaching online courses.	3.12 ± 1.076
40. Teaching online courses will lead (or has already led) to greater recognition for me at work.	2.95 ± 1.008

standard deviations for items in the instrument related to faculty satisfaction with institutional support in online courses. Questions 35 through 40 were scaled items that used a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) for positively keyed items and from 1 (strongly agree) to 5 (strongly disagree) for reverse-keyed items.

Table 6 provides participant responses regarding the level of satisfaction with various aspects of institutional support. Faculty were most satisfied with institutional access to technology resources to teach online courses (mean = 4.04) and institutional access to training resources to teach online courses (mean = 3.92).

Overall Perceptions of Online Courses

A single-sample *t* test was conducted to evaluate the degree to which radiography faculty perceived that online courses were effective for research question 10. The sample mean of 24.03 ($SD = 5.02$) was significantly different from 21, $t(215) = 8.87$, $P < .001$. The 95% CI for faculty satisfaction with interactions in online courses mean ranged from 2.36 to 3.71. The effect size d of 0.66 indicated a medium to large effect. Therefore, the null hypothesis was rejected. The results indicated that radiography faculty perceived online courses to be effective to a significant extent.

Descriptive statistics were calculated for research question 10, including calculation of means and standard deviations for items in the instrument related to perceptions of the effectiveness of online courses. Statements 8 through 15 were scaled items that used a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) for positively keyed items and from 1 (strongly agree) to 5 (strongly disagree) for reverse-keyed items.

Table 7 provides an overview of participant responses to survey items related to overall perceptions of the effectiveness of online courses. Some faculty reported that they embraced online learning (mean = 4.12) and

looked forward to teaching the next online course (mean = 3.94). Other faculty, however, reported that when given a choice, they avoid teaching online courses (mean = 3.83).

Summary

Findings indicated that radiography faculty perceptions of the effectiveness of online courses were not significantly affected by faculty position, type of institution, age, or years of teaching experience. Results also suggested that faculty perceptions of the effectiveness of online courses increased as their years of teaching online courses, the number of online courses taught in the past 5 years, and their perceived competence with the use of technology increased.

Participant responses suggested that faculty satisfaction with interaction in online courses increased as the years of teaching online courses increased. However, the number of years of teaching online courses was not related to faculty satisfaction with teaching online courses or their satisfaction with institutional support. Online technology acceptance had a positive relationship with perceived ease of use and a strong positive relationship with perceived usefulness of online technology. In addition, use of technology-enhanced learning methods had a strong positive relationship with technological self-efficacy.

The participants were satisfied with teaching online courses and institutional support but had nearly neutral responses regarding interactions in online courses. Overall, radiography faculty members perceived that online courses were effective.

Table 7

Descriptive Statistics for Overall Perceptions of the Effectiveness of Online Courses (N = 216)

Item	Mean ± *SD*
8. I look forward to teaching my next online course.	3.94 ± .844
9. I am more satisfied teaching online compared with other delivery methods.	2.85 ± .928
10. Assuming I have the opportunity, I teach online courses as much as possible.	3.05 ± 1.077
11. I embrace online learning technology in my workplace.	4.12 ± .709
12. Given the choice, I avoid teaching online courses.	3.83 ± 1.013
13. Teaching online courses is rewarding.	3.56 ± .833
14. Teaching online courses is less rewarding than teaching face to face.	2.70 ± 1.073

Discussion

The population for this study included 1202 radiography faculty members employed at JRCERT-accredited radiography programs. The majority of the 216 participants in the sample were program directors (44.9%) and clinical coordinators (50.0%) from radiography programs sponsored by 4-year colleges/universities (32.4%) and community colleges (47.8%). Participants, on average, were 48 years old, had 15.4 years of teaching experience, had 5 years of experience teaching online courses, and taught an average of 9.6 online courses.

Radiography faculty perceptions of the effectiveness of online courses moderately increased as perceived competence with the use of technology increased. The self-reported mean score for perceived competence with technology was 3.97; however, the mean scaled score for survey items related to faculty perceptions of the effectiveness of online courses was 3.43. Therefore, the participants reported a higher technical competence score than for effectiveness of online courses. These findings were congruent with the literature. Technologies and media supported and enhanced learning, increased student satisfaction, decreased attrition, and led to a student-centered learning environment.[20] Technology increased student engagement,[20-22] improved interaction among students and faculty,[22] and enhanced experiences and collaboration among students.[23] Accordingly, faculty perceptions of the effectiveness of online education increased when faculty perceived that they had greater competence with technology.

Moreover, online technology acceptance increased as perceived usefulness of technology increased. Gibson et al conducted a similar study that showed that perceived usefulness predicted use of technology in online courses[40]; however, ease of use was not a concern among the participants.

The current study revealed that use of technology-enhanced learning methods increased as technological self-efficacy improved. This is consistent with the literature. A similar study showed that Internet self-efficacy was positively related to faculty use of technology.[24] Therefore, use of technology in online courses increased as a result of faculty having more confidence in using tools. Buchanan et al concluded that greater self-efficacy could be a direct result of greater use of technological tools and greater institutional support in the form of training.[24]

Faculty were most satisfied with the convenience of accessing a course at any time, the flexibility provided by teaching in the online environment, the opportunity to try innovative teaching techniques, and the increased autonomy offered by participating in online education. Faculty were most dissatisfied with the negative affect of online teaching on student evaluations of instruction, the perception that online education did not enhance teaching effectiveness, and the increased workload associated with grading assignments and preparing for an online course.

The satisfaction results were congruent with previous findings that faculty members were most satisfied with flexibility and accessibility in teaching online courses and least satisfied with the increased workload.[3] In other studies, faculty expressed satisfaction with flexible schedules[5,6] and learning new technology.[6] Nevertheless, they expressed dissatisfaction with the decreased interaction with students enrolled in their online courses.[5] Increased workload in teaching online courses was generally the greatest area of concern for faculty.[2,3,5-10]

Faculty were most satisfied that online students were active in communicating course-related matters, that student–student interactions were meaningful, and that online courses were more accessible to students who would not be able to enroll in traditional courses. Faculty were most dissatisfied that online students were somewhat passive when contacting them about course-related issues and with the lack of face-to-face contact with students when teaching online courses. Furthermore, faculty were most satisfied that they had access to technology resources from their college/university to teach online courses (mean = 4.04) and that they had access to training resources to teach online courses (mean = 3.92).

Limitations and Delimitations

One limitation of the study is the use of self-reported data to capture the perceptions of radiography faculty. Despite this limitation, self-reported data frequently are used in social science research, particularly in the field of educational evaluation and effectiveness.[42] Another limitation is that the method of data collection limited the sample size.[42] Therefore, the results might not be generalizable to the population of online radiography educators.[42]

The purpose of the study and the research questions delimited the study to online radiography educators.[42] The inclusion criteria limited the sample size by excluding a large number of radiography educators because the list from the JRCERT included only contact information for program directors and clinical coordinators; although didactic instructors were not included, some program directors forwarded the survey to them. Thus, caution should be used when generalizing the findings of this research to radiography programs that include online components taught by didactic faculty.

Recommendations and Conclusion

The purpose of this study was to assess radiography faculty perceptions of the effectiveness of asynchronous online courses. Because faculty benefit from the convenience and flexibility of teaching online courses, institutions should provide professional development training and workshops to introduce the concept of teaching in an online environment. Furthermore, the results from this study should encourage institutional administrators to support faculty with educational resources to interact and connect with students in online courses. These strategies should improve faculty and student satisfaction with online courses and improve online learning effectiveness. In addition, because many online educators miss face-to-face contact with students, institutional administrators should provide professional development training, workshops, and orientations, including the use of synchronous online tools, to enhance faculty–student and student–student interactions in online courses. Institutions need to improve technological infrastructure to

support online technology and acquire the technology and media needed to support faculty and students in the VLE. The technology and tools might improve faculty–student and student–student interactions. Administrators, staff, and faculty should collaborate to enhance technical and library support for the online course environment within the institution.

Future research on this topic should address a larger sample size to better represent the views of online radiography educators and to increase the statistical power of the study. A qualitative study could be conducted to acquire additional information from participants with the use of focus groups or interviews. The qualitative study could permit further investigation into variables that serve to improve online course effectiveness. A similar study should be completed to evaluate online course effectiveness from the students' perspectives. Because the population included radiography educators, the results might not be able to be generalized to other disciplinary areas within higher education. Therefore, the study should be repeated to capture responses of online faculty from other disciplines.

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