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Exploring the Relationships between Student Perceptions and Educational Technology Utilization in Higher Education

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Abstract: *This study examines the perceptions of educational technology use among college students at a small liberal arts university in the United States. Using institutional data analytics, 34,480 survey responses were analyzed to understand how students perceive the use of technology in the classroom and its relationship with teaching methods, progress on learning objectives, and course features. Descriptive and inferential statistical analyses were conducted, revealing a positive correlation between the use of educational technology and effective teaching methods, progress on learning objectives, and overall satisfaction with instructors and courses. However, important to note that the study is correlational in nature and cannot establish causality. Further research is needed to fully understand the impact of educational technology on teaching and learning in higher education, specifically the potential benefits of using technology to support collaboration among students.*

Keywords: educational technology, higher education, students' perceptions, correlational study

1. Introduction

Institutional data analytics is used for decision-making in higher education. The process includes taking large amounts of complex data collected from educational experiences and analyzing the data to support student learning experiences and improve teaching. This study utilizes institutional data analytics to understand the perceptions of educational technology use among college students at a small liberal arts university in the United States. By analyzing a large set of data collected from educational experiences, the study aims to examine the relationships between educational technology use and other critical instructional elements such as teaching methods, progress on learning objectives, and course features. The understanding of these relationships is crucial for those involved in designing courses using technology and for organizations responsible for designing, developing, and deploying faculty professional development. The examination of the relationships between educational technology use and students' perceptions of other instructional elements provides insight into how to support faculty in improving their teaching. This research is an intersection of gathering feedback on instruction from college students, collecting data on higher education design of instruction, including educational technology use, and proposing opportunities for teaching and professional development improvement based on the results. The following hypotheses were developed and tested in this study:

• H1: Educational technology use has a positive correlation when related to the perception of teaching methods.

• H2: Educational technology use has a positive correlation when related to the perception of progress on learning objectives.

• H3: Educational technology use has a positive correlation with the perception of course features.

This study looks at large sets of institutional data regarding educational technology and its use in the context of college teaching in a small liberal arts university in the United States. It provides a basis for decision-making as the interplay between educational technology use and students' perceptions of other instructional elements. It also offers insights for the betterment of technology-enhanced learning in higher education.

2. Educational Technology Use

In this study, educational technology "is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Januszewski & Molenda, 2008, p. 1). Educational technology use is the spectrum of activities seen as the diffusion of innovation processes, including their selection, usability, utilization, and integration into educational experiences to facilitate the learning (Januszewski & Molenda, 2008). Creating educational experiences using educational technology is a crucial aspect of the "practice" component of the definition above. Instructors use practical implementations to design and facilitate learning to improve performance and increase knowledge in a specific discipline. They also design and develop educational experiences that support technology-enhanced learning, while managing the resources and processes that allow students to engage in the learning process. However, important to note is that instructors may require additional support to reach their performance teaching goals.

Historically, technology-based programs

have focused on curriculum development centered around technology and have often been associated with the future of a profession or subject matter (Snyder, 2018). The role of educational technology is particularly emphasized in science, technology, engineering, and mathematics (STEM) disciplines, where it plays an essential role in advancing problem-solving, motivating learners, and increasing competencies in STEM (Snyder, 2018).

This research study seeks to explore and analyze the use of educational technology in higher education. Critical to note that while educational technology and educational technology use are related concepts, they are not interchangeable. To gain a deeper understanding of the subject, this study takes an in-depth look at the classroom environment. Through this examination, two main themes emerged: (1) the design of educational experiences, including the use of educational technology (Gagné, 2005; Reigeluth & Carr-Chellman, 2009; Wiggins & McTighe, 2005), and (2) the impact of student audiences and class size on educational experiences (Gagné, 2005; Holmes & Abington-Cooper, 2000; Knowles, 1980; McKeachie & Hofer, 2002).

Teaching and learning are complex processes, to say the least. There are many learning theories with multitudes of research backing each application of an instructional design process; different learning theories have also been used in various teaching and learning situations (e.g., cognitivism and constructivism). The learning theory needed depends on the chosen learning objectives, how these learning objectives are attained, the content taught, the instructor's teaching philosophy, and any other educational experiences factors, such as class size, student audience and motivation, and technology access.

This research study is similar to previous studies that have investigated the impact of classroom spaces on students' perceptions of the use and effectiveness of one-to-one technology, which found that the full potential of educational technology in teaching and learning has yet to be realized (Byers et al., 2016). Additionally, when examining college instructors' use of digital technologies, various barriers have been identified that prevent instructors from fully utilizing the benefits of these technologies in teaching and learning. Specifically, professional barriers such as lack of training and teaching philosophies are cited as the main obstacle for arts and humanities instructors in embracing digital technologies in their practices (Mercader & Gairín, 2020). The integration of technology in teaching and learning can be promoted through professional development opportunities for faculty. Other barriers to technology integration in teaching and learning include lack of access to technology, technical skills, and time (Barkley et al., 2014; Sun, Yan (2012). Additionally, research has found that there is a lack of understanding of how to effectively use technology to support student learning (Huma et al., 2022; Barkley et al., 2014) and that faculty members tend to rely on traditional teaching methods. To address these issues, institutions should provide ongoing professional development opportunities and resources to support faculty in integrating technology into their teaching and provide access to technology and technical support (Nicholls, 2013).

3. Evaluation of Instruction

Evaluation of instruction is a crucial aspect of teaching and learning in higher education as it allows for reflection and the improvement of future courses or educational experiences. Both informal and formal methods can be used for evaluation,

such as class discussions, soliciting student feedback, and reviewing student-learning activities throughout the course effort. Formal evaluations, such as student evaluations of teaching, are helpful at both the course level for reflecting and redesigning courses and at the institutional level for assessment, accreditation, and further organizational development (Gillespie & Robertson, 2010). One widely used formal evaluation method in the United States is student ratings of instruction. An example of this is the survey instrument prepared by the IDEA Center titled Student Responses to Instruction and Courses (Hoyt & Cashin, 1977).

The IDEA Center is a nonprofit organization that focuses on creating opportunities for innovation in teaching and learning through grantmaking, supporting industry research, and making other investments directly impacting teaching and learning (IDEA Center website, 2021). Research on teaching and learning gained from this survey has been conducted continuously for more than 40 years to develop, maintain, and update the survey instrument for better instructional and institutional feedback (Benton & Li, 2015; Benton et al., 2015).

4. Methodology and Methods

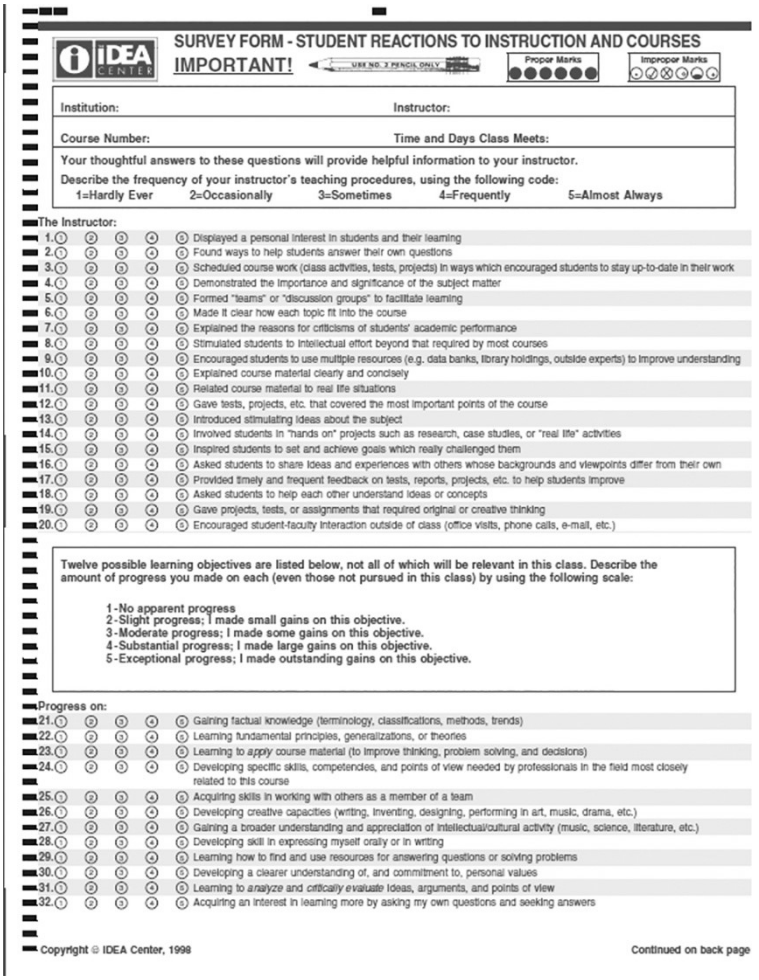
Educational research plays a crucial role in the cultivation of evidence-based research on teaching and learning, including the use of educational technology (Crawford, 2014). One research method used in educational research is correlational studies, which determine the existence and strength of the relationship between two variables (Remler & Van Ryzin, 2015). These relationships can be presented as a positive relationship (agreement or dependence between the variables), no relationship (independence between variables), or a negative relationship (disagreement between variables). However, important to note is that correlational studies can suggest an existing relationship but cannot prove that one variable causes a change in another (Remler & Van Ryzin, 2015).

The data used in this study consisted of secondary data, meaning data that was collected by a small liberal arts university between August 2012 and December 2014 using student evaluations of teaching surveys in the United States. The following paragraphs describe the context of the study, the participants, and the methods used for data collection and analyses.

4.1. Data Collection Instrument

The research used *Student Ratings of Instruction and Courses* from the IDEA Center, otherwise known as a survey of student evaluations of teaching and referred to here as the Survey. The instrument included a total of 47 Likert-type items, of which only 39 were used in this study. These items considered the most influential when designing an educational experience in higher education (IDEA Center, 2021).

The teaching methods section consisted of the first 20 items addressing the importance of the subject matter, involvement with "hands-on" projects, tests, projects and assessments, and student collaboration, to mention a few. The following 12 items were learning objectives. The items range from "learning fundamental principles, generalizations, and theories" to "developing skill in expressing myself orally or in writing." The Course Overall elements included 14 items covering student attitudes and behaviors and student judgments on course features. Each of the Survey items was rated by student respondents using Likert-type items with a 5-point rating scale (see Figure 1).



SURVEY FORM - STUDENT REACTIONS TO INSTRUCTION AND COURSES

IMPORTANT! USE NO. 2 PENCIL ONLY

Proper Marks ●●●●●●

Improper Marks ⊙⊘⊗⊖◒⊙

Institution: Instructor:

Course Number: Time and Days Class Meets:

Your thoughtful answers to these questions will provide helpful information to your instructor.

Describe the frequency of your instructor's teaching procedures, using the following code:
1=Hardly Ever 2=Occasionally 3=Sometimes 4=Frequently 5=Almost Always

The Instructor:

1. ① ② ③ ④ ⑤ Displayed a personal interest in students and their learning
2. ① ② ③ ④ ⑤ Found ways to help students answer their own questions
3. ① ② ③ ④ ⑤ Scheduled course work (class activities, tests, projects) in ways which encouraged students to stay up-to-date in their work
4. ① ② ③ ④ ⑤ Demonstrated the importance and significance of the subject matter
5. ① ② ③ ④ ⑤ Formed "teams" or "discussion groups" to facilitate learning
6. ① ② ③ ④ ⑤ Made it clear how each topic fit into the course
7. ① ② ③ ④ ⑤ Explained the reasons for criticisms of students' academic performance
8. ① ② ③ ④ ⑤ Stimulated students to intellectual effort beyond that required by most courses
9. ① ② ③ ④ ⑤ Encouraged students to use multiple resources (e.g. data banks, library holdings, outside experts) to improve understanding
10. ① ② ③ ④ ⑤ Explained course material clearly and concisely
11. ① ② ③ ④ ⑤ Related course material to real life situations
12. ① ② ③ ④ ⑤ Gave tests, projects, etc. that covered the most important points of the course
13. ① ② ③ ④ ⑤ Introduced stimulating ideas about the subject
14. ① ② ③ ④ ⑤ Involved students in "hands on" projects such as research, case studies, or "real life" activities
15. ① ② ③ ④ ⑤ Inspired students to set and achieve goals which really challenged them
16. ① ② ③ ④ ⑤ Asked students to share ideas and experiences with others whose backgrounds and viewpoints differ from their own
17. ① ② ③ ④ ⑤ Provided timely and frequent feedback on tests, reports, projects, etc. to help students improve
18. ① ② ③ ④ ⑤ Asked students to help each other understand ideas or concepts
19. ① ② ③ ④ ⑤ Gave projects, tests, or assignments that required original or creative thinking
20. ① ② ③ ④ ⑤ Encouraged student-faculty interaction outside of class (office visits, phone calls, e-mail, etc.)

Twelve possible learning objectives are listed below, not all of which will be relevant in this class. Describe the amount of progress you made on each (even those not pursued in this class) by using the following scale:

1-No apparent progress
2-Slight progress; I made small gains on this objective.
3-Moderate progress; I made some gains on this objective.
4-Substantial progress; I made large gains on this objective.
5-Exceptional progress; I made outstanding gains on this objective.

Progress on:

21. ① ② ③ ④ ⑤ Gaining factual knowledge (terminology, classifications, methods, trends)
22. ① ② ③ ④ ⑤ Learning fundamental principles, generalizations, or theories
23. ① ② ③ ④ ⑤ Learning to *apply* course material (to improve thinking, problem solving, and decisions)
24. ① ② ③ ④ ⑤ Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course
25. ① ② ③ ④ ⑤ Acquiring skills in working with others as a member of a team
26. ① ② ③ ④ ⑤ Developing creative capacities (writing, inventing, designing, performing in art, music, drama, etc.)
27. ① ② ③ ④ ⑤ Gaining a broader understanding and appreciation of intellectual/cultural activity (music, science, literature, etc.)
28. ① ② ③ ④ ⑤ Developing skill in expressing myself orally or in writing
29. ① ② ③ ④ ⑤ Learning how to find and use resources for answering questions or solving problems
30. ① ② ③ ④ ⑤ Developing a clearer understanding of, and commitment to, personal values
31. ① ② ③ ④ ⑤ Learning to *analyze* and *critically evaluate* ideas, arguments, and points of view
32. ① ② ③ ④ ⑤ Acquiring an interest in learning more by asking my own questions and seeking answers

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Figure 1

Snapshot of Student Ratings of Instruction and Courses from the IDEA Center

The IDEA Center conducted several validity and reliability studies on the scores generated by the *Student Reactions to Instruction and Courses* between 2002 and 2011 (Benton & Li, 2015). Additionally, expert judgments were used to support the validity of the scores generated by the Survey (Benton et al., 2015). These support the validity and reliability of the scores generated by the Survey. Students were given the Survey near the end of their courses in a paper and pencil format. Once the Survey was distributed, the instructors excused themselves from the classroom. Upon completion, either a student or a proctor sealed the surveys in an envelope and signed the seal. The signed envelope was returned to the institutional data collector, which was a staff member. Surveys were organized as instructed by the IDEA Center and then mailed to the IDEA Center for processing. Each semester the data was returned in a summary format per each section

of a course and original student surveys to the institutional data collector. The institutional data collector re-packaged the results and the original surveys and forwarded these packages to the instructors as feedback. Because the IDEA Center analyzed the data for the institution and the instructors, they kept copies of the raw data in digital form.

A total of 34,480 survey responses were analyzed for the study. As a part of that data set included 617 courses and 10,433 student enrollments. The data was examined "en masse" among the five semesters of collected data. All identifiable information was removed from the data set before any analysis began to protect instructors and student respondents.

4.2. Context of Study

The data analyzed were collected between August 2012 and December 2014 in the context of a small liberal arts university in the Midwestern United States. This university employs approximately 100 full-time faculty members and 200 adjunct instructors and serves 1,800 full-time students annually. These students focus on academics and have the flexibility to be engaged with student organizations, athletics, and the larger community through classroom activities, degree requirements, and service-learning projects. When this research study took place, 45 undergraduate and five graduate programs were offered, totaling 617 courses. There were 10,433 student enrollments at the university, and 192 were at the graduate level (see Table 1) at the time of the data collection.

Table 1
Student Enrollment in Courses per Term between August 2012 and December 2014

Term	Enrollment
Fall* 2012	2,232
Spring** 2013	2,057
Fall 2013	2,129
Spring 2014	1,951
Fall 2014	2,064
Total	10,433

* August to December
** January to May

Throughout the study, the technology hardware and software available at this university remained relatively the same in classrooms, computer labs, and instructors' offices. Although technological consistency was not controlled in this study, classrooms without technology were upgraded to have the same technology available and function similarly during this study. A typical classroom at this university holds approximately 22 students. Markerboards were available in each classroom. Almost all classrooms were equipped with basic technology available at an instructor station. Those with a complete technology setup offered a computer, a hook-up for a laptop, a projector, a document camera, an interactive whiteboard, and a DVD/VCR player. A switcher box on the instructor's desk controlled the display for each piece of the technology. As with any university, not

all classrooms are the same; however, this description fits almost every classroom on campus. During the timeline of this research, class sizes ranged from one to 52 students. The average class size was approximately 16 students, with a median class size of 16 and a modal class size of 20.

4.3. Study Participants

The participants in the study included the entire college student body, as they all responded to Survey after each course between August 2012 and December 2014. Participants in this study included the student body for every course offered for credit during the five semesters of the study. There was a total of 10,433 enrollments in university courses during these five semesters, and 34,480 survey responses were collected from an unknown number of students due to survey anonymity and the possibility of multiple course enrollments. Students were likely enrolled over multiple semesters. However, accurate to say was that a total of 34,480 survey responses were analyzed in this study. The students' demographics are presented in Table 2 (gender by semester), Table 3 (age by semester), and Table 4 (ethnicity by semester).

Table 2
Institutional Gender Demographics by Semester

Gender	**Semester**				
	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014
Female	59%	58%	58%	56%	54%
Male	41%	42%	42%	44%	46%

Table 3
Institutional Age Demographics by Semester

Student Age	**Semester**				
	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014
Up to 24	70.8%	70.5%	72.5%	71.8%	72.50%
25-30	12.9%	12.4%	11.6%	12.6%	11.60%
31-40	9.5%	9.8%	9.1%	9.2%	9.10%
Over 40	6.8%	7.3%	6.8%	6.4%	6.80%

Table 4
Institutional Ethnicity Demographics by Semester Based on Those Who Designated Ethnicity

Ethnicity	**Semester**				
	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014
White	81.5%	74.5%	80.5%	73.5%	79.9%
Black/African American	8.3%	7.6%	8.5%	7.6%	8.8%
American/Alaskan Native	0.5%	0.3%	0.5%	0.4%	0.3%
Asian	2.9%	2.8%	3.5%	3.2%	3.2%
Hispanic	3.1%	3.6%	3.2%	3.5%	4.3%
Hawaiian/Pacific Islander	0.3%	0.2%	0.2%	0.1%	0.1%
2 or more ethnicities	3.4%	3.5%	3.6%	3.1%	3.4%

4.4. Data Analyses

This research study included both descriptive and inferential statistical analyses of survey responses. A chi-squared goodness-of-fit analysis was conducted as a part of the analyses on the five ratings for the survey item addressing educational technology use, which was item 47: "The instructor used educational technology (e.g., internet, e-mail, computer exercises, multi-media presentations, etc.) to promote learning." Goodman-Kruskal's gamma (γ) correlation coefficients were calculated between *educational technology use* (Item 47) and other instructional elements, such as *teaching methods, progress on learning objectives*, and *course features*.

5. Results

This section starts with an analysis of the educational technology use item (item 47), followed by a review of the hypotheses that were tested in this study. The following paragraphs summarize the most significant results.

5.1. A Chi-Squared Goodness-of-Fit Test for Educational Technology Use (Item 47)

A chi-squared goodness-of-fit test was conducted to determine if the observed proportions differed across the responses to each of the Survey five responses. Figure 2 represents the measure of difference between the expected and the observed proportions for five possible responses. The proportions for educational technology use (Item 47) were "Definitely False" = 0.17; "More False than True" = 0.15; "In Between" = 0.02; "More True than False" = 0.02; and "Definitely True" = 0.65. The test was statistically significant (p<.01).

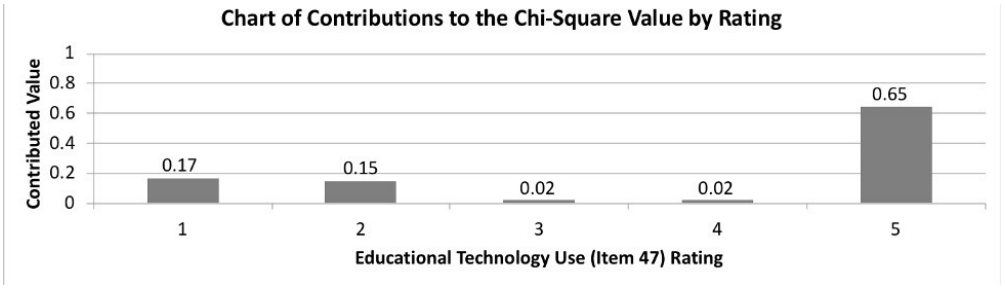

Figure 2

Contributions to the Chi-squared Value on "Educational Technology Use" Using a Likert-type Rating

1 = Definitely False; 2 = More False than True; 3 = In Between; 4 = More True than False; 5 = Definitely True

This analysis indicates that there was a significant difference in the responses for "Definitely True" compared to the other four indicators. Furthermore, Figure 2 shows that the frequency of responses as "Definitely True" is significantly more significant than the frequencies of the other four ratings for Item 47. The chi-squared test indicated that "In Between" and "More True than False" contributed little to the perception

of educational technology use. This result suggested that the students did perceive a high utilization of educational technology in their courses.

5.2. The Correlational Statistical Analysis

Goodman Kruskal's gamma (γ) was computed between educational technology use (Item 47) and other instructional elements from the Survey. However, correlation descriptions can largely be seen as arbitrary and depend upon the gathered data to define them. When trends show higher measures of association, they are likely to use a more moderate description of strength. Based on the correlation coefficients calculated for this research study, the strength of correlation resembled a more conservative description, as shown in Table 5.

Table 5
Correlation Strength Using Goodman-Kruskal's (γ)

Range of γ	Description
.60-1.0	Strong Relationship
.50- .59	Moderate Relationship
0- .49	Not or Weak Relationship

Because this study used a large sample, γ was normally distributed, and therefore, the correlation coefficient analysis was followed by a test of significance (z). In good faith, the smallest correlation coefficient was tested for significance γ= .34, z=3.2, p<.001. The correlation coefficient tested, γ= .34, can be found in Table 6, Item 5. Correlations were performed between item 47 and every one of the other items. γ indicates the strength of the linear relationship between two different variables.

H1: Educational technology use has a positive correlation when related to the perception of teaching methods. The teaching method refers to the strategies and approaches utilized by an instructor to present new content and achieve desired learning outcomes (Gagné, 2005; Trowbridge et al., 2000). The results of this study indicated that there was a positive correlation between *teaching methods and educational technology use* (Item 47) (see Table 6). It could be interpreted as showing that the average variation in teaching methods could be explained by the variation in educational technology use. This suggested that the use of technology, such as the internet, e-mail, computer exercises, and multimedia presentations, was a common strategy employed by instructors as part of their teaching methods. Additionally, *educational technology use* was also a strategy employed by students to aid in their learning. Furthermore, the study found that teaching methods (Items 1-20) had a stronger relationship with educational technology use (Item 47) than learning objectives, as they were more closely tied to the educational experience and the process of designing instruction. Twelve of the teaching methods had a strong correlation, and seven had a moderate correlation. However, Item 5, "Forming 'teams' or 'discussion groups' to facilitate learning," had the weakest correlation with educational technology use.

Table 6
Educational Technology Use (Item 47) and Teaching Methods (Items 1 to 20)

Teaching Methods	**γ**
Item 1. *Displayed a personal interest in students and their learning*	.63
Item 4. *Demonstrated the importance and significance of the subject matter*	.62
Item 13. *Introduced stimulating ideas about the subject*	.62
Item 2. *Found ways to help students answer their own questions*	.61
Item 6. *Made it clear how each topic fit into the course*	.61
Item 19. *Gave projects, tests, or assignments that required original or creative thinking*	.61
Item 3. *Scheduled course work (class activities, tests, projects) in ways which encouraged students to stay up to date on their work*	.60
Item 9. *Encouraged students to use multiple resources (e.g., data banks, library holdings, outside experts) to improve understanding*	.60
Item 10. *Explained course material clearly and concisely*	.60
Item 11. *Related course material to real life situations*	.60
Item 12. *Gave tests, projects, etc. that covered the most important points of the course*	.60
Item 20. *Encouraged student-faculty interaction outside of class (office visits, phone calls, e-mail, etc.)*	.60
Item 15. *Inspired students to set and achieve goals which really challenged them*	.59
Item 8. *Stimulated students to intellectual effort beyond that required by most courses*	.58
Item 7. *Explained the reasons for criticisms of students' academic performance*	.57
Item 14. *Involved students in "hands on" projects such as research, case studies, or "real-life" activities*	.57
Item 17. *Provided timely and frequent feedback on tests, reports, projects, etc. to help students improve*	.57
Item 18. *Asked students to help each other understand ideas or concepts*	.57
Item 16. *Asked students to share ideas and experiences with others whose backgrounds and viewpoints differ from their own*	.55
Item 5. *Formed "teams" or "discussion groups" to facilitate learning*	.34

H2: Educational technology use has a positive correlation when related to the perception of progress on learning objectives. Learning objectives are considered the goals for student success in an educational experience or course. They lead the way for learners. All teaching methods and strategies used during a learning experience have learning objectives as guides. If the backward design is used for preparing instruction, learning objectives are addressed first; data seems to show that students do reach those objectives second; and the teaching methods, activities, and strategies planned are third. Therefore, from an instructional design perspective, learning objectives are slightly more removed from the actual instructional event than are teaching methods. The question remains as to whether a positive correlation exists between educational technology use (Item 47) and the perception of progress on learning objectives (Items 21 to 32). All learning objectives showed a positive correlation (see Table 7), meaning γ

indicated the strength of the linear relationship between educational technology use and individual learning objectives. The single learning objective that showed the strongest relationship was the student's perceived progress in the application of course material (Item 23).

In contrast to the results with teaching methods, all of the learning objectives in this study had correlation coefficients that were within a narrow range of each other (within a .10 range of the other correlation coefficients). This makes it difficult to distinguish between strong and moderate relationships when examining the relationship between *learning objectives* and *educational technology use.* Statistically, the variation in the correlations of the learning outcomes was less likely (on average 56%) to be explained by variations in educational technology (Item 47) use compared to teaching methods. Notably, the weakest relationship found between learning objectives and educational technology use was in the area of acquiring skills in working with others as a member of a team.

Table 7
Educational Technology Use (Item 47) and Learning Objectives (Items 21 to 32)

Learning Objectives	**γ**
Item 23. *Learning to apply course material (to improve thinking, problem solving and decisions)*	.60
Item 24. *Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course*	.59
Item 21. *Gaining factual knowledge (terminology, classifications, methods, trends)*	.58
Item 29. *Learning how to find and use resources for answering questions or solving problems*	.58
Item 32. *Acquiring an interest in learning more by asking my own questions and seeking answers*	.58
Item 22. *Learning fundamental principles, generalizations, and theories*	.57
Item 31. *Learning to analyze and critically evaluate ideas, arguments, and points of view*	.57
Item 30. *Developing a clearer understanding of, and commitment to, personal values*	.55
Item 28. *Developing skill in expressing myself orally or in writing*	.53
Item 26. *Developing creative capacities (writing, inventing, designing, performing in art, music, drama, etc.)*	.52
Item 27. *Gaining a broader understanding and appreciation of intellectual/cultural activity (music, science, literature, etc.)*	.52
Item 25. *Acquiring skills in working with others as a member of a team*	.51

H3: Educational technology use has a positive correlation with the perception of course features. The course features, although grouped, are not a section of similar items. They included:

1. Instructor rating.
2. Overall student perception of a course

rating.

3. Rating for the student putting "…forth more effort than other students on academic work."

4. Rating for "the instructor used a variety of methods—not only tests—to evaluate student progress on the course objectives."

5. Rating for "the instructor expected student to take their share of responsibility for learning."

6. Rating for "the instructor had high achievement standards in this class."

All but one of these course features had the highest correlations with educational technology use compared to any other Survey section or single survey item (see Table 8). The lowest of the strong correlations, Overall, I rate this course as excellent (Item 42; γ = .62), was still above any of the relationships with Item 47 and learning objectives ($\gamma \leq$ .60). Although these correlations cannot be directly compared without a z transform being calculated, three of the Course Overall elements were in the range of very strong ($\gamma \geq$ .70).

The data show respondents in courses where there was higher educational technology use perceived instructors as having higher expectations for responsibility (Item 45 "The instructor expected students to take their share of responsibility for learning"), achievement (Item 46 "The instructor had high achievement standards in this class"), and variety of evaluation strategies (Item 44 "The instructor used a variety of methods—not only tests—to evaluate student progress on course objectives"). On the other hand, there was a weak relationship between educational technology use and self-reported student efforts on their work (Item 43 "As a rule, I put forth more effort than other students on academic work").

Table 8

Educational Technology Use (Item 47) and Course Overall Elements (Items 41 to 46)

Course Overall Elements	**γ**
Item 45. *The instructor expected students to take their share of responsibility for learning*	.77
Item 46. *The instructor had high achievement standards in this class*	.77
Item 44. *The instructor used a variety of methods—not only tests--to evaluate student progress on course objectives*	.76
Item 41. *Overall, I rate this instructor an excellent teacher*	.68
Item 42. *Overall, I rate this course as excellent*	.62
Item 43. *As a rule, I put forth more effort than other students on academic work*	.47

6. Discussion and Conclusions

This research study aimed to investigate college students' perceptions of instruction and courses involving *educational technology use* and other *instructional elements* that promote learning. The data analysis revealed a notable difference when comparing the correlation ranges of teaching methods (Table 6), learning objectives (Table 7), and course overall elements (Table 8). Specifically, the perceptions of teaching methods had

correlation coefficients ranging between .34 and .63, while the perceptions of learning objectives had a narrower range between .51 and .60. Additionally, the perceptions of course features had a wider range of correlation coefficients, from .47 to .77.

Results indicate a weak correlation (r=.34) between *educational technology use* and the perception of forming "teams" or "discussion groups" to facilitate learning (Item 5). This suggested that students' perceptions of teamwork as a teaching method were not strongly associated with technology use. This implies that one area that could improve college instruction is to focus on utilizing educational technology to enhance student engagement in teamwork. Teamwork is commonly recognized as a teaching method that can (a) improve student achievement and productivity, (b) promote supportive and committed relationships, and (c) enhance psychological well-being, social competence, and self-esteem (Johnson et al., 2000).

The positive correlation between students' perceptions of educational technology use and various variables analyzed suggested that an increase in the use of educational technology corresponds to an increase in (1) effective teaching methods, (2) progress on learning objectives, and (3) overall satisfaction with instructors/courses. Furthermore, the results indicated that the students in this study perceived a high level of educational technology usage in their courses. Therefore, it could be inferred that the use of educational technology in teaching was an expectation among college students. These findings were consistent with those of a previous study by Licorish et al. (2018), which examined using a game-based student response system. This study found that the use of this technology-enhanced learning approach improved the quality of the student learning experience (Licorish et al., 2018).

The examination of the large set of institutional data pertaining to students' perceptions of teaching with technology has the potential to inform opportunities for offering timely, targeted, and data-driven faculty professional development by teaching and learning centers in universities and colleges. This can lead to improvements in college teaching. This aligns with the findings of a study by Mercader and Gairín (2020), which investigated the barriers to the use of digital technologies for learning and teaching among college instructors. The authors concluded that more comprehensive professional development for instructors and more intentional strategic plans from higher education institutions were necessary to overcome these barriers (Mercader & Gairín, 2020).

Technology-enhanced learning in the digital age has become a norm in higher education classrooms worldwide. According to research on the benefits of educational technology, there is a significant potential for it to facilitate learning and enhance performance (Januszewski & Molenda, 2008). Understanding the relationship between educational technology and other instructional elements can provide a foundation for the expanded role of technology in teaching and learning. Even though Item 47 in this study refers to technologies such as the internet, e-mail, computer exercises, and multi-media presentations, among others, to promote learning, important to stress is that these are still the most educational technology use across higher education classrooms in the United States. A study by Langan et al. (2016) found that college teaching methods have remained largely unchanged despite advancements in technology, resulting in a "cultural lag" within the classroom. The authors emphasized the importance of understanding students' perceptions and the

role of technology, and the social and political contexts in shaping the current classroom environment (Langan et al., 2016, p. 101). This study aimed to examine the relationship between educational technology use and teaching methods, progress on learning objectives, and the use of other instructional elements in higher education classrooms in the United States. It addresses the current gap in knowledge regarding this relationship. By understanding this relationship, higher education professionals can gain a deeper understanding of educational technology use and its impact on instructional elements. Despite the challenges faced by higher education due, for example, to the COVID-19 pandemic, understanding the use of educational technology prior to the pandemic is crucial for transforming college teaching, particularly through the analysis of large institutional data sets. The shift towards virtual and online formats has highlighted the need for flexibility in educational technology use, with many colleges and universities struggling to adapt. The results of this study indicate that educational technology should be better utilized to support teamwork, as demonstrated by the widespread use of collaborative tools such as videoconferencing systems and social media during the pandemic.

6.1. Recommendations for Practice

The results of this study have the potential to inform decisions related to college improvement for both instructors and developers. Given the ongoing educational changes in the digital age and in response to the demands of the COVID-19 pandemic, college courses are increasingly becoming blended or fully online, and there is a shift towards the use of educational technology for collaborative work, student autonomy and connectedness. This is reflected in the increased use of collaborative online classrooms and redesigned physical learning spaces. However, essential to note that technology alone is not the driving force behind these changes. The global health crisis has also played a significant role. To support this shift, professionals involved in faculty professional development need to be better equipped to train educators and design teaching practices that effectively integrate technology to meet the needs of today's college teaching.

Acquiring knowledge and understanding of teaching and learning, as well as the benefits of educational technology, is a process that occurs through various educational experiences. It is not only the students who gain knowledge, understanding, and skills about content, but also the instructors who teach it. Instructors play a dual role in the learning process, both leading and facilitating content-driven experiences while continuously improving through reflection and professional development. One area that could enhance college teaching is a focus on utilizing educational technology to engage and support students in collaborative endeavors.

6.2. Limitations of the Study

This research has limitations important to consider. The results may be limited by the geographic location (Midwestern United States) and timeframe in which the data were collected and may differ from research conducted by the IDEA Center. Additionally, all the data in this study are self-reported by students, which may introduce potential bias. For example, student participants may have interpreted Item 47 ("The instructor used educational technology (e.g., internet, e-mail, computer exercises, multi-media presentations, etc.) to promote learning") in different ways. To overcome these limitations, it would have been beneficial to conduct focus groups

and interviews with students in addition to student evaluations of teaching. Additionally, important to note that due to the correlational nature of this study, no causal relationships are established. Further research is needed to determine these relationships.

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