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Learning styles preferences, personality characteristics, gender and age of computer information systems students

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Abstract

This study investigates the learning styles preferences and learning personality characteristics of students enrolled in computer information systems courses. The aim is to explore the possible relationships between these learning styles and characteristics and the gender and age of the subjects. The study utilized a survey to collect data from 131 undergraduate and graduate students enrolled in computer information systems courses at three universities. The results of the study concluded that the majority of the students exhibited a hands-on learning style and found classroom interaction only partially useful. In addition, the majority of students were able to prioritize their work, did not need direct supervision, and were skilled at time management. However, these findings are not universal and have variances and demographic differences. These findings are useful for computer information systems educators in designing teaching strategies that cater to different learning styles and to improve students' academic performance within computer information systems courses.

Keywords: learning styles, hands-on learning, computer information systems, interaction

Introduction

Educators' understanding of student learning styles, key personality characteristics related to learning, and the role gender and age play in learning styles and characteristics is a forerunner of their mindfully selecting instructional methodologies to closely mirror student learning inclinations and hence increase student academic performance (Cegielski et al., 2001). Several decades have passed since Cegielski, et al. (2001) stated that information systems-related studies in learning styles were "markedly absent" in the literature. Since then, has there been sufficient research and consistent views on student learning styles in information systems?

Tulsi et al. (2016) examined learning styles among engineering students (including those in computer engineering) and found very few have strong preferences for a particular learning style except for mechanical engineering students' preferences in active, sensing, visual, and sequential learning styles. Long and Hu (2010) measured learning styles of computer majors and found no significant difference in gender in visual, aural, verbal, and physical dimensions of learning styles, although females score higher in logical dimension and lower in social and solitary dimensions than males. Peslak et al. (2021) also found no significant difference in either gender or age regarding student's perceptions on the effectiveness of

different course delivery modes (i.e., on-ground, hybrid, or completely online) when examining students enrolled in computer information systems (CIS) courses over four years from three universities.

However, the devil is in the details. Wang et al. (2019) studied students enrolled in CIS courses across three universities and found that students, who chose an online course delivery mode initially based on scheduling, were influenced by personal characteristics such as the ability to prioritize and demographics such as age; however, those students, who chose an online delivery mode initially based on the professor teaching the course or for other reasons, were not influenced by any personal characteristics (e.g., ability to prioritize, time management, etc.) or demographics (e.g., gender or age). Some researchers such as Husmann and O'Loughlin (2019) suggest that learning styles are a myth and do not reflect student outcomes; however, many of these studies are either broad or conducted on non-information-technology areas. For example, Husmann and O'Loughlin (2019) only studied anatomy students. Szymkowiak, et al. (2021) suggest that Generation Z (Gen Z) information technology learners do have specific preferences in learning modes. Similarly, Azman et al. (2021) found that age matters – Gen Z visual learners in Malaysia preferred technologically inclined active learning activities.

Due to the differences in research conclusions in the literature, this study intends to conduct further investigations and provide more insight into learning styles and learning personality characteristics of students enrolled in CIS courses. The intention is to explore the possible relationships between these learning styles and characteristics and the gender and age of the subjects. Understanding the learning styles of students in CIS courses is important for CIS educators when developing curriculum, course content, assignments and assessments, and choosing a delivery mode. It is also important for CIS educators to be aware of the personality characteristics of students enrolled in CIS courses in order to design courses that best enhance CIS student academic performance. Learning styles and personality characteristics can differ based on gender and age. Tailoring education with the right content and format to the appropriate demographics can fine-tune the education effectiveness and hence increase retention, especially for the demographic groups that are prone to low retention rates.

Specifically, this study sought to answer the following research questions.

RQ1. *What learning style provides the best learning for students enrolled in CIS courses and does learning style vary based on gender or age?*

RQ2. *Do students enrolled in CIS courses express a need for classroom interaction/discussion and does this need vary based on gender or age?*

RQ3. *Do students enrolled in CIS courses work better with or without supervision and does the regard for supervision vary based on gender or age?*

RQ4. *Do students enrolled in CIS courses feel that they have the ability to prioritize their own workload and does this feeling vary based on gender or age?*

RQ5. *In terms of time management, do students enrolled in CIS courses rate themselves as well organized and does this regard vary based on gender or age?*

Literature Review

Multiple studies have indicated a correlation between learning styles and academic performance. Felder and Silverman (1988) introduced the Felder-Silverman Learning Style Model (FSLSM), acknowledging

the need for diverse teaching techniques to accommodate different learning styles for engineering and computer science students. The FSLSM includes dimensions such as active/reflective, sensing/intuitive, visual/verbal, and sequential/global (Felder & Silverman, 1988). Similarly, Allert (2004) explored the relationships between learning styles, previous programming experience, and success in an introductory computer science course and found that students who preferred visual learning tended to perform better in these courses. Cegielski, et al. (2011) studied the learning styles and performance of 196 students majoring in information systems and concluded that student performance increases significantly, when instruction style closely matches the student's learning style. Thomas et al. (2002) examined student scores on their final exam in the second semester of an introductory programming course sequence. The final exam included a traditional question/answer portion and a programming portion; they compared the student scores and learning styles and found that on the traditional question/answer portion of the exam, reflective learners scored higher than active learners and verbal learners scored higher than visual learners. They also noted that sequential learners scored higher than global learners on the programming portion of the exam, but lower on the traditional question/answer portion. The authors make recommendations for enhancing student learning experience based on their learning styles (Thomas, et al., 2002). Seyal et al. (2015) studied a group of students enrolled in a first-year computer programming course that is taken in pursuit of a Bachelor of Internet Computing degree to determine how the students' learning style affected their performance in the course. Their study concluded that the learning styles of most students were identified as convergers and assimilators who exhibit the ability to employ abstract thinking. Further, they found that a student's learning style and gender significantly influenced the student's classroom performance (Seyal et al. 2015).

Several researchers found significant correlations between learning styles and other factors. Çakıroğlu (2014) studied the relationship between a student's learning style, study habits, and performance in an online course that teaches computer programming and found a significant relationship between these three factors. Lang and O'Connell (2015) studied the relationship between learning styles, online content usage, and exam performance amongst students in an introduction to information systems course and found that the number of hours a student spent working on online content during class time and outside of class positively influences exam performance. Interestingly, they also concluded that the number of hours that students spent working ahead of the class negatively impacted exam performance. Students who indicated that their learning style was more reflective were more likely to work ahead of the class (Lang & O'Connell, 2015).

Both the IS 2010 and IS 2020 curriculum guidelines for undergraduate degree programs in information systems stress the importance of hands-on learning (Topi et al. 2010; Leidig & Salmela, 2022). In addition, many researchers have found that information systems students exhibit a preference for hands-on learning. Mills et al. (2015) studied the learning styles of 80 students enrolled in a database management course and concluded that the majority of these students exhibited a preference for active learning. Sibona and Pourrezajourshari (2018) examined students' preference of a lecture versus hands-on activity to learn about the Scrum process; they surveyed 155 undergraduate students enrolled in a senior level information systems course or an introductory level management information systems course over two semesters and found that 70% of the students indicated that they preferred learning via the hands-on activity.

Several authors have studied the importance of classroom interaction with regard to computing courses; they emphasize the need for fostering interaction to enhance learning experiences, promote critical thinking, build a sense of community, and improve student satisfaction. Piccoli et al.(2001) presented a research framework and preliminary assessment of the effectiveness of web-based virtual learning environments in basic IT skills training; they found that the virtual learning environment is effective in delivering IT skills and that interaction is a key component of successful online learning. Swan (2002) emphasized the

importance of interaction in online courses and presented strategies for building learning communities in online environments. The author suggests that interaction is crucial for student satisfaction and perceived learning and offers recommendations for designing courses that foster interaction between classroom participants (Swan, 2002). Coppola et al. (2002) examined the pedagogical roles of virtual professors in asynchronous learning networks; they identified several roles, such as instructional designer, facilitator, and assessor, and discussed the importance of interaction in fulfilling these roles effectively. Arbaugh and Benbunan-Fich (2007) investigated the importance of participant interaction in online learning environments; their study reveals that both student-system and student-instructor interactions are significant predictors of perceived learning and satisfaction in online courses. Rovai (2002) focused on building a sense of community in distance education settings. The author presented a framework for assessing the sense of community in online courses and offered practical suggestions for fostering interaction and connectedness among students. Richardson and Swan (2003) examined the relationship between social presence, perceived learning, and satisfaction in online courses; their findings suggest that higher levels of social presence, facilitated by interaction, are positively related to students' perceived learning and satisfaction. Furthermore, they concluded that a student's gender has some influence on perceptions of social presence, while age and class standing of the student do not affect these perceptions.

Time management has also been shown to be an important component of computing courses. Piccoli, et al. (2001) found a student's possession of time management skills to be a key component to the success of online learning. Göğüş and Güneş (2011) studied the learning styles and effective learning habits of students at a university in Turkey; they found that time management skills are a key factor in effective learning habits and successful academic performance. Çakıroğlu (2014) found a student's ability to plan their work to be a key factor in the student's success in online learning in a computer programming course.

Methodology

This study employed QuestionPro, an online survey platform to create and administer a survey featuring 34 closed-ended questions. These questions addressed student demographics, learning styles, and characteristics concerning CIS courses. They also inquired about students' reasons for choosing or not choosing online courses over on-ground or hybrid courses. The research involved three types of universities: state-related, private, and state-owned public institutions. The state-related university receives state funding but functions as a separate, private entity with its assets, charter, and administration under an independent board of trustees. The private university does not receive any state funding, while the state-owned university relies heavily on state funds and is governed by a Board of Governors, state legislators, the Governor, and the Secretary of Education.

The surveyed students at the state-owned and state-related universities were pursuing bachelor's degrees, while those at the private university were seeking a bachelor's, master's, or doctoral degree. Surveying respondents from various university types ensured a diverse mix of participants with potentially different demographics.

Norvilitis et al. (2006) highlighted several demographic differences between state and private university students, including debt-to-income ratio and significant racial disparities. The research approach of surveying students from different universities aligns with the categorization strategy used in the 2017 Noel-Levitz National Student Satisfaction and Priorities Report (2017).

The survey was completed only by students enrolled in CIS courses, regardless of their major. It was distributed to students in the researchers' courses from the spring of 2020 to the spring of 2021. SPSS 29 was used to analyze the results using a variety of statistical measurements including Crosstabs, Phi,

Cramer's V, and Contingency Coefficient. These were used to determine significance of demographic differences.

The survey provided six possible responses to the question asking students to indicate their age range (i.e., 18-21, 22-30, 31-40, 41-50, 51-60, and 61 or older). No respondents identified as 61 or older; therefore, this age group was eliminated from the analysis of the results.

Chat GPT-4 was used in developing the literature review and assisting in sentence and narrative editing. This is accepted in science journals as long as it is acknowledged (Gaggioli, 2023).

Limitations

This study has several limitations. The survey was distributed to students from spring of 2020 to the spring of 2021during which the existence COVID-19 occurred and may have affected student perceptions and responses. The survey provided six possible responses asking students to indicate their age range, no respondents identified as 61 or older and 82% of the responses were limited to two age groupings 18-21, 22-30. In relation to gender, 77% of the respondents were male.

Results

Research Question 1: What learning style provides the best learning for students enrolled in CIS courses and does learning style vary based on gender or age?

To answer this question, our survey asked the students enrolled in CIS courses to rate the method that provided them the best learning. Possible choices included by seeing (visually), by listening (auditory), by reading, or by doing (hands-on).

The student responses to this question were analyzed using cross tabulation and symmetric measures, as shown in Tables 1 through 4. Overall, 64% of the respondents reported that they learn best by doing (i.e., hands-on learning). When the results were analyzed by gender, it was found that there is a significant difference between males and females at $p < .10$. While 70% of males learn best by doing, only 45% of females classified themselves as hands-on learners. A full 35% of females classified themselves as visual learners, by indicating that they learn best by seeing. This suggests that mixed gender CIS courses need to address the learning styles of each gender. There is no significant difference based on age.

Table 1: Cross tabulation results displaying student responses to the questions concerning their preferred learning style and their gender.

Gender		I learn BEST				Total
		See	Listen	Read	Doing	
Male	Count	17	9	5	71	102
	%	16.7%	8.8%	4.9%	69.6%	100.0%
Female	Count	10	4	2	13	29
	%	34.5%	13.8%	6.9%	44.8%	100.0%
Total	Count	27	13	7	84	131
	%	20.6%	9.9%	5.3%	64.1%	100.0%

Table 2: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their preferred learning style and their gender.

		Value	Approximate Significance
Nominal by Nominal	Phi	.221	.095
	Cramer's V	.221	.095
	Contingency Coefficient	.215	.095
N of Valid Cases		131	

Table 3: Cross tabulation results displaying student responses to the questions concerning their preferred learning style and their age range.

Age		I learn BEST				Total
		See	Listen	Read	Doing	
18 - 21	Count	14	5	5	34	58
	%.	24.1%	8.6%	8.6%	58.6%	100.0%
22 - 30	Count	10	4	2	34	50
	%t	20.0%	8.0%	4.0%	68.0%	100.0%
31 - 40	Count	2	4	0	7	13
	%	15.4%	30.8%	0.0%	53.8%	100.0%
41 - 50	Count	1	0	0	6	7
	%	14.3%	0.0%	0.0%	85.7%	100.0%
51 - 60	Count	0	0	0	3	3
	%t	0.0%	0.0%	0.0%	100.0%	100.0%
Total	Count	27	13	7	84	131
	%	20.6%	9.9%	5.3%	64.1%	100.0%

Table 4: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their preferred learning style and their age range.

		Value	Approximate Significance
Nominal by Nominal	Phi	.309	.404
	Cramer's V	.179	.404
	Contingency Coefficient	.296	.404
N of Valid Cases		131	

These findings are consistent with other findings in the literature. The works of Topi, et al. (2010), Leidig and Salmela (2022), Mills et al.(2015), and Sibona and Pourrezajourshari (2018) all emphasize the benefits of hands-on learning in information systems education and highlight the importance of integrating hands-on methodologies into information systems curriculum.

Research Question 2: Do students enrolled in CIS courses express a need for classroom interaction and does this need vary based on gender or age?

To answer this question, the survey asked the students enrolled in CIS courses if they found classroom interaction and discussion to be not essential, sometimes helpful, or always helpful.

The student responses to this question were analyzed using cross tabulation and symmetric measures, as shown in Tables 5 through 8. Overall, 49% of the students surveyed felt that classroom interaction was sometimes helpful for them to learn/understand, while 36% of them felt that it was always helpful, and a

mere 15% of the students surveyed found classroom interaction non-essential. There were no significant differences in responses based on gender or age.

Table 5: Cross tabulation results displaying student responses to the questions concerning their feelings toward classroom interaction and discussion and their gender.

Gender		Non-essential	Sometimes helpful	Always helpful	Total
Male	Count	15	50	37	102
	%	14.7%	49.0%	36.3%	100.0%
Female	Count	5	14	10	29
	%.	17.2%	48.3%	34.5%	100.0%
Total	Count	20	64	47	131
	%	15.3%	48.9%	35.9%	100.0%

Table 6: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their feelings toward classroom interaction and discussion and their gender.

		Value	Approximate Significance
Nominal by Nominal	Phi	.030	.943
	Cramer's V	.030	.943
	Contingency Coefficient	.030	.943
N of Valid Cases		131	

Table 7: Cross tabulation results displaying student responses to the questions concerning classroom interaction and discussion and their age range.

Age		Non-essential	Sometimes Helpful	Always helpful	Total
18 - 21	Count	7	28	23	58
	%	12.1%	48.3%	39.7%	100.0%
22 - 30	Count	9	26	15	50
	%	18.0%	52.0%	30.0%	100.0%
31 - 40	Count	2	4	7	13
	%	15.4%	30.8%	53.8%	100.0%
41-50	Count	1	5	1	7
	%	14.3%	71.4%	14.3%	100.0%
51+	Count	1	1	1	3
	%	33.3%	33.3%	33.3%	100.0%
Total	Count	20	64	47	131
	%	15.3%	48.9%	35.9%	100.0%

Table 8: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their feelings toward classroom interaction and discussion and their age range.

		Value	Approximate Significance
Nominal by Nominal	Phi	.213	.655
	Cramer's V	.150	.655
	Contingency Coefficient	.208	.655
N of Valid Cases		131	

These findings are aligned with that of other authors. Piccoli et al. (2001), Swan (2002), Coppola et al. (2002), Arbaugh & Benbunan-Fich (2007), Rovai (2002), and Richardson & Swan (2003) all stressed the

importance of interaction in various educational settings, stating that it enhances learning experiences, promotes critical thinking, builds a sense of community, and improves student satisfaction.

Research Question 3: Do students enrolled in CIS courses work better with or without direct supervision and does the regard for supervision vary based on gender or age?

To answer this question, our survey asked the students enrolled in CIS courses if they feel that they work better when someone is there to keep them focused or if they feel that they work better without direct supervision. The student responses to this question were analyzed using cross tabulation and symmetric measures, as shown in Tables 9 through 12. These results were split fairly evenly between needing those students who feel that they work better when someone is there to keep them focused (47%) and those who feel that they work better without direct supervision (53%). This suggests that an instructor needs to be flexible in supervising CIS students' work. This finding is not significantly influenced by gender or age.

Table 9: Cross tabulation results displaying student responses to the questions concerning their feelings toward direct supervision and their gender.

Gender		Without supervision	With supervision	Total
Male	Count	55	47	102
	%	53.9%	46.1%	100.0%
Female	Count	14	15	29
	%.	48.3%	51.7%	100.0%
Total	Count	69	62	131
	%.	52.7%	47.3%	100.0%

Table 10: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their feelings toward direct supervision and their gender.

		Value	Approximate Significance
Nominal by Nominal	Phi	.047	.591
	Cramer's V	.047	.591
	Contingency Coefficient	.047	.591
N of Valid Cases		131	

Table 11: Cross tabulation results displaying student responses to the questions concerning their feelings toward direct supervision and their age range.

Age		Without supervision	With supervision	Total
18 - 21	Count	26	32	58
	%	44.8%	55.2%	100.0%
22 - 30	Count	30	20	50
	%	60.0%	40.0%	100.0%
31 - 40	Count	6	7	13
	%	46.2%	53.8%	100.0%
41 - 50	Count	5	2	7
	%	71.4%	28.6%	100.0%
51+	Count	2	1	3
	%	66.7%	33.3%	100.0%
Total	Count	69	62	131
	%	52.7%	47.3%	100.0%

Table 12: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their feelings toward direct supervision and their age range.

		Value	Approximate Significance
Nominal by Nominal	Phi	.174	.412
	Cramer's V	.174	.412
	Contingency Coefficient	.171	.412
N of Valid Cases		131	

Research Question 4: Do students enrolled in CIS courses feel that they have the ability to prioritize their own workload and does this feeling vary based on gender or age?

To answer this question, our survey asked the students enrolled in CIS courses if they feel that they can prioritize their own workload or if they tend to put work off until later.

The student responses to this question were analyzed using cross tabulation and symmetric measures, as shown in Tables 13 through 16. Overall, 63% of students believe they can prioritize their workload; however, 37% say they tend to put work off until later. Though not as acute, prioritization skills still may be important to educate many students. Prioritization skills are significantly different by gender and age with female students and older students reporting higher prioritization skills.

Table 13: Cross tabulation results displaying student responses to the questions concerning their prioritization skills and their gender.

Gender		Can prioritize	Cannot prioritize	Total
Male	Count	60	42	102
	%	58.8%	41.2%	100.0%
Female	Count	22	7	29
	%.	75.9%	24.1%	100.0%
Total	Count	82	49	131
	%	62.6%	37.4%	100.0%

Table 14: Symmetric measures of cross tabulation results displaying student responses to the questions

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	-.146	.094
	Cramer's V	.146	.094
	Contingency Coefficient	.145	.094
N of Valid Cases		131	

Table 15: Cross tabulation results displaying student responses to the questions concerning their prioritization skills and their age range.

Age		Can prioritize	Cannot prioritize	Total
18 - 21	Count	29	29	58
	%	50.0%	50.0%	100.0%
22 - 30	Count	38	12	50
	%	76.0%	24.0%	100.0%
31 - 40	Count	8	5	13
	%	61.5%	38.5%	100.0%
41 - 50	Count	4	3	7
	%	57.1%	42.9%	100.0%
51+	Count	3	0	3
	%	100.0%	0.0%	100.0%
Total	Count	69	82	49
	%	52.7%	62.6%	37.4%

Table 16: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their prioritization skills and their age range.

		Value	Approximate Significance
Nominal by Nominal	Phi	.271	.047
	Cramer's V	.271	.047
	Contingency Coefficient	.262	.047
N of Valid Cases		131	

Research Question 5: In terms of time management, do students enrolled in CIS courses rate themselves as well organized and does this rating vary based on gender or age?

To answer this question, our survey asked the students enrolled in CIS courses to describe themselves in terms of time management. Possible responses included well organized or having difficulty completing assignments and/or projects.

The student responses to this question were analyzed using cross tabulation and symmetric measures, as shown in Tables 17 through 20. The students surveyed noted high levels of time management skills in response to this question with nearly 78% of students reporting that in terms of time management, they are well organized. There was no significant difference in gender or age with regard to time management.

Table 17: Cross tabulation results displaying student responses to the questions concerning their time management skills and their gender.

Gender		Well organized	Have difficulty	Total
Male	Count	78	24	102
	%	76.5%	23.5%	100.0%
Female	Count	24	5	29
	%	82.8%	17.2%	100.0%
Total	Count	102	29	131
	%	77.9%	22.1%	100.0%

Table 18: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their time management skills and their gender.

		Value	Approximate Significance
Nominal by Nominal	Phi	-.063	.472
	Cramer's V	.063	.472
	Contingency Coefficient	.063	.472
N of Valid Cases		131	

Table 19: Cross tabulation results displaying student responses to the questions concerning their time management skills and their age range.

Age		Well organized	Have difficulty	Total
18 - 21	Count	42	16	58
	%.	72.4%	27.6%	100.0%
22 - 30	Count	41	9	50
	%	82.0%	18.0%	100.0%
31 - 40	Count	10	3	13
	%.	76.9%	23.1%	100.0%
41 - 50	Count	6	1	7
	%	85.7%	14.3%	100.0%
51+	Count	3	0	3
	%.	100.0%	0.0%	100.0%
Total	Count	102	29	131
	%	77.9%	22.1%	100.0%

Table 20: Symmetric measures of cross tabulation results displaying student responses to the questions concerning their time management skills and their age range.

		Value	Approximate Significance
Nominal by Nominal	Phi	.141	.626
	Cramer's V	.141	.626
	Contingency Coefficient	.140	.626
N of Valid Cases		131	

As Piccoli, et al. (2001), Çakıroğlu (2014), and Göğüş and Güneş (2011) have discovered a positive relationship exists between a student's ability to prioritize and their academic performance. Thus, a CIS instructor should consider designing their course to promote time management skills. Some suggestions including providing a course outline within the syllabus that includes due dates and utilizing the calendar feature of many learning management systems to alert students of upcoming course deadlines.

Conclusion

The findings in this paper can be utilized by CIS educators to improve their course delivery and student engagement. Table 21 displays the overall results of our study. Based on these results a CIS educator should strive to include hands-on content in their courses and should also provide plenty of visual aids. These educators should be somewhat confident that their students will work well without constant direct supervision, will be able to prioritize, and will exhibit good time management skills.

Table 21: Summary of student responses regarding questions related to the method of content delivery that provides the best learning.

Question	Top answer	Overall	Age	Gender
How learn best	Learn by doing	64%	Not significant	Sig at .10
Class Interaction	Sometimes Helpful	49%	Not significant	Not significant
Need for supervision	Without	53%	Not significant	Not significant
Prioritize	CAN Prioritize	63%	Sig at .05	Sig at .10
Time Management	Good	78%	Not significant	Not significant

Based on these findings, a CIS educator may want to consider employing an active learning strategy of content delivery wherein traditional lecturing takes a backseat to demonstration of course content through hands-on methods such as utilizing problem solving through case studies and classroom discussions. Making such adjustments to course content delivery will likely result in better student engagement leading to improved student performance and, possibly, the improved retention of CIS majors.

This study is limited in that it only considered students enrolled in CIS courses and only viewed these students in current class situations. As a result, these findings cannot be generalized to other disciplines. However, this was our intent. Thus, the conclusions made in this study only pertain to CIS discipline specific areas.

The study is also limited in that it reviews student preferences, which are self-reported, rather than assessed outcomes. Further study is necessary to confirm these findings based on assessments.

In recent years, more courses have been offered in a hybrid or totally online environment. The findings in this study can also assist CIS educators in creating hybrid and online course content that actively engages students, which often leads to better academic performance within the course.

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