Education and Information Technologies (2023) 28:13969–13986
https://doi.org/10.1007/s10639-023-11721-9

Online Instructor Clusters: Implementation Frequency of Instructional Activities

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Received: 4 January 2023 / Accepted: 8 March 2023 / Published online: 3 April 2023

Abstract
The purpose of this study was to group instructors based on their patterns of implementing activities in their online courses, to examine factors that influenced differences within clusters, and to explore whether cluster membership affected instructor satisfaction. Data were collected from faculty at a university in the western United States with the use of three instruments that measure pedagogical beliefs, implementation of instructional activities, and instructor satisfaction. Latent class analysis method was used to identify instructor groups and examine how the groups differed in pedagogical beliefs, characteristics, and satisfaction. The resulting two-cluster solution includes two orientations: content and learner-centric. Of the covariates examined, constructivist pedagogical beliefs and gender were the significant predictors of cluster membership. Results also showed a significant difference between the predicted clusters pertaining to online instructor satisfaction.

Keywords Online Teaching Practices · Pedagogical Beliefs · Student Learning Activities · Latent Class Analysis · Instructor Satisfaction

1 Introduction

Distance or online education is widespread in the United States (U.S.). Seaman et al. (2018) reported that distance learning enrollments in the U.S. increased for 14 consecutive years. In fall 2016, 6.3 million students (31.6%) were enrolled in distance learning courses. With the advent of COVID-19, most institutions of higher education transitioned from campus-based learning to emergency distance or online learning (Martel, 2020).

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Experts point out that the role of instructors is shifting in online courses. The online instructor carries out many tasks including orienting students, grading and providing feedback, motivating learners, answering questions, directing students to support services, and facilitating student learning. Instructors are often responsible for designing content, integrating learning technologies, and maintaining the course platform, etc. (Moore & Kearsley, 2012). Therefore, instructors value content expertise, lesson design, and student assessment as key competencies for online teaching highly (Chang et al., 2014). Online instructors become facilitators of learning and shift some of the responsibility for learning to students. Instructors, rather than transmitting knowledge, are expected to create learning environments in which students engage, actively learn, and construct new knowledge (Barkatsas & Malone, 2005; Lee et al., 2013; Moore & Kearsley, 2012). Instructors may hold beliefs about the roles of instructors and students, where the responsibility for student learning lies, how learning should be structured, and the role of technology in learning (Cheng et al., 2021; Dirkin, 2008; Justus, 2017).

As roles change, the pedagogical beliefs of an instructor can guide their teaching methods and strategies used in the classroom, selection and integration of teaching tools and technologies, and assessment of learners. Along with the pedagogical orientation, the design of online learning environments is generally differentiated into two broad categories: student-centered/constructivist and teacher-centered/transmissive (Barkatsas & Malone, 2005; Gibbons et al., 2018; Niederhauser & Stoddart, 2001; Shah, 2020; Teo & Sing, 2008; Valckx et al., 2021).

2 Pedagogical Beliefs and Teaching Practices

In student-centered/constructivist online learning environments, instructors design courses with appropriate levels of communication and interaction between all course participants to stimulate discourse and encourage learner engagement. To facilitate learning in a comfortable environment, learners may be assigned to small groups to participate in discussions or share resources and ideas (Barkatsas & Malone, 2005; Karaseva et al., 2015; Lee et al., 2013). Instructors can utilize various tools for class meetings or make them available to learners to collaborate on projects or create artifacts with multimedia such as presentations, electronic portfolios, and so forth. Learners can share their drafts or completed products in forums or Web 2.0 spaces to obtain peer feedback. Instructors can support student learning by encouraging them to reflect formally or informally on processes or outcomes with the use of private journal assignments or open forums in the course management system (Cheng et al., 2021; Conrad & Donaldson, 2011; Valckx et al., 2021).

In contrast, in teacher-centered/traditional online learning environments, instructors often assign individual work and are in control of the learning process. Instructors mainly use online delivery platforms to present instructional content such as readings, recorded lectures, or exams (Gebre et al., 2014). Online lessons usually center around required readings such as textbooks or course packages (Inan & Bolliger, 2018). Learning is generally assessed with online quizzes and tests consisting of multiple-choice questions that address factual knowledge (Kearns, 2012). These

types of learner assessments tend to have a high level of validity and reliability, and students' answers can be graded by computer systems (Keuning et al., 2018). Other activities may include posting audio and video lectures that learners are required to listen to or watch (Yang, 2017). Learners may also complete tutorials or activities that allow them to individually practice skills and self-assess their knowledge (Ko & Rossen, 2017).

3 Online Course Activities and Strategies

3.1 Students' Perspectives and Preferences

The online instructional literature strongly supports student-centered instruction as an effective approach to learning, but it does not necessarily mean that students value these activities. There are a few studies pertaining to students' preferences and perceptions of usefulness or importance regarding online course content, activities, and strategies. Jackson (2014) conducted a study on student preferences pertaining to accessing course materials in an online course. Results indicated that some students liked being provided with different forms of course content (e.g., readings and videos) because they liked having options. Darius (2021), who conducted a study in the United Kingdom, found that animations, video lectures delivered by their instructors, and multiple-choice quizzes were helpful for student learning. Effective instructional strategies included direct interaction with instructors and small group collaborations. Results of a study conducted by Abdel-Rahim (2021) showed that the most useful non-interactive instructional activities were practice exercises and quizzes.

Students seem to value interactions with their instructors more than interactions with their peers. When considering interactive activities, virtual office hours and email exchanges with instructors were more helpful than discussion boards or group work (Abdel-Rahim, 2021). Martin and Bolliger (2018) who investigated students' perceptions pertaining to the importance of online engagement strategies found that students valued learner-to-instructor strategies more than learner-to-learner and learner-to-content. The three highest rated instructional strategies were regular announcements/emails sent by the instructor, the inclusion of grading rubrics for assignments, and the use of real-life, applicable assessments.

3.2 Instructor Practices

A limited number of studies have been conducted on instructors' use of various instructional strategies or activities in a variety of learning environments. Some prior work has examined this issue, but the focus was more on instructors' choices of content delivery methods. For example, Broussard and Wilson (2018) conducted a study of nursing faculty practices in online courses. They found that simulations and videos were used by 50% of participants, and online textbooks were only implemented by 5% of instructors. Another study (Buchanan et al., 2013) broadened the

focus by reporting on instructors' use of content delivery and learning tools in technology-enhanced and blended courses. Results showed that the majority of faculty (58.8%) used links to library resources. Forty percent used existing podcasts and 28.1% developed their own audio files. Discussion boards for class discussions were used by 18.4% of participating faculty members and Wikis for collaborative learning were used by 16.7% of respondents. Only 13.2% used formative assessments; 28.9% used summative assessment tools.

In the literature, fewer attempts are reported to examine the frequency of various course activities in online courses. Among them, Djajalaksana (2011) surveyed faculty teaching information systems courses in different environments at various higher education institutions. Results indicated that the three most frequently used online strategies were self-directed learning, online discussions, and online collaboration. However, a large percentage of instructors (45% or more) had never or rarely used these strategies. The least frequently used tools were blogs for reflection and e-portfolios. The most commonly used assessments were case studies, analysis/design projects, and term papers. One of the least frequently used assessments was peer assessment.

Instructors indicated that the availability of resources, the learning needs of the students, and their ability to use approaches with which they are familiar also influenced their practices. Steinbronn and Merideth (2008) conducted a survey of higher education instructors to determine which teaching methods and strategies they found most useful and least useful in online environments. Respondents ranked the following three methods as the most useful in online environments: questioning/feedback to students, email communication with the instructor, and online student discussions. The least useful approaches were collaborative work, games and simulations, and student presentations. Fletcher and Djajalaksana (2014) compared face-to-face and online instructors and found that online instructors were less likely to use teacher-centered strategies, discussions, and real-world scenarios but significantly more other online activities (e.g., blogs and quizzes) than face-to-face teachers.

4 Online Teacher Demographics and Background

Some differences in the choice of online activities and pedagogical orientations of instructors in relation to their demographics and background characteristics (e.g., gender, age, job status, and teaching experience) have been observed in the literature. A recent study conducted in the Philippines shows that female instructors were more student-centered than male instructors (D'Souza et al., 2021). Similarly, the results of a study conducted by Fletcher and Djajalaksana (2014) showed that female instructors used more student-centered strategies than male instructors. When making their choice, women used lectures, interactive lectures, and group discussions more often than men (Djajalaksana et al., 2013). Chang et al. (2014) also found significant differences between female and male instructors in terms of the importance of the instructor's role and actual practices (e.g., facilitating learning) in the online environment.

When examining the influence of age on instructors' practices, researchers found that the practices of older teachers reflect a more student-centered orientation. For example, Djajalaksana et al. (2013), who surveyed faculty in the area of information systems, found younger faculty members implemented lectures more often, whereas older instructors used classroom discussions more often. Similarly, age was a predictor of choice of course activities found when Fletcher and Djajalaksana (2014) surveyed faculty in career and technical education programs. Results showed that older instructors were less likely to use teacher-centered traditional approaches compared to younger instructors.

Researchers have also examined the effects of rank or employment status (part-time or full-time) on the implementation of classroom activities or tools. Chang et al. (2014) found no significant differences between online instructors' ranks in terms of their perceptions of online teacher roles and practices. In a study conducted by Djajalaksana et al. (2013), results showed that lower-ranked faculty used case studies, analysis/design projects, and classroom discussions more often than higher-ranked faculty. To examine technology integration practices, Justus (2017) collected data from online teachers including a large number of part-time instructors and found that employment status impacted participants' implementation of technology.

Prior research is limited and inconsistent regarding the influence of years of experience on the choice of teaching activities. Chang et al. (2014) found that instructors with less than 4 years of experience had significantly higher mean scores in their perceived ability to facilitate student learning than instructors with 4 or more years of experience. Other researchers, however, found that teaching experience was not a significant predictor of the use of a variety of instructional activities used in courses delivered in different modalities (Djajalaksana et al., 2013; Fletcher & Djajalaksana, 2014).

5 Online Faculty Satisfaction

Faculty satisfaction is an important element in the quality and success of online courses or programs (Hartman et al., 2000; Marasi et al., 2022; Wasilik & Bolliger, 2009). Researchers confirmed that there is a positive correlation between faculty satisfaction and student achievement (Fredericksen et al., 2000; Hartman et al., 2000; Kay & Pasarica, 2019). When faculty are satisfied, they believe their efforts are appreciated and feel that their online teaching experience is rewarding, useful, and beneficial on both a personal and professional level (Conceição, 2006). On the other hand, failure to eliminate the sources causing faculty dissatisfaction will result in faculty turnover (Dame & Inan, 2022). The Sloan Consortium included faculty satisfaction as one of its main pillars in their quality online education framework (Moore, 2005). Wasilik and Bolliger (2009) developed and verified a model for faculty satisfaction that included student-related, instructor-related, and institution-related factors. Without timely pedagogical support and instructional resources, online teachers can face design challenges and technical issues that lead to frustration and dissatisfaction (Oyarzun et al., 2018). Mentoring for faculty, especially those new

to teaching, could be useful as implementing such a program improves instructors' satisfaction with online teaching (Chen et al., 2016).

6 Purpose of the Study

The factors impacting instructors' teaching practices have been studied in various traditional educational settings. Studies in this area have provided some evidence that instructor demographics and environmental characteristics are relevant factors affecting teaching practices (Denaro et al., 2021; Djajalaksana et al., 2013). Previous research has typically involved predictions and has focused primarily on analyzing the effect of individual factors (e.g., teachers' self-efficacy) on teacher practices, rather than examining how the combination of different factors can affect their teaching practices. In this study, we utilized more sophisticated techniques that examined both the antecedents and outcomes of teaching practices to better understand the relationships between the covariates and the impact they had on distal outcomes (Bakk & Kuha, 2021; Spurk et al., 2020). Additionally, there is limited research on which factors influence instructor choices of course activities and strategies in online courses. However, research shows that there are contradictions between these factors and that teaching practices vary across modalities and educational settings (Vieluf et al., 2012). Therefore, it is important to understand instructors' choices for learning activities in online learning environments in order to provide relevant professional development opportunities for instructors.

Instructor satisfaction is considered a good predictor of the quality of the course materials, quality of instruction, and the overall success of students (Hampton et al., 2020; Howe et al., 2018). Trigwell and Prosser (2004) believe that instructors are more likely satisfied when they implement student-centered approaches. Therefore, it is important to understand instructors' satisfaction with their practices as they can affect the effectiveness and success of online courses. However, there are very limited studies investigating whether teaching activities affect the satisfaction of online instructors. Examining the relationships between pedagogical beliefs, the pattern of online learning activities, and instructor satisfaction in online courses will assist practitioners to improve professional development for online instructors. High quality online courses include relevant learning activites that may lead to higher instructor satisfaction and enhance online learning experiences for students (Marasi et al., 2022). Furthermore, by understanding the differences between the distinct groups of instructors in terms of teaching practices, administrators may tailor professional development activities to meet the different training needs of instructors. Therefore, this study was conducted to cluster online instructors based on their patterns of implementing activities in their online courses. After identifying instructor clusters based on their practices, the study examined factors influencing differences within clusters and explored whether cluster membership affected instructor satisfaction. The questions guiding this research are:

1. Are there distinct instructor clusters for the choices of student learning activities in online courses?

2. Do instructors' demographic, pedagogical beliefs, and professional variables predict the cluster membership?
3. Do these cluster memberships explain online instructors' satisfaction?

7 Methods

7.1 Clustering Method

Given the complexity of studying predictors of classroom practices and their impact on instructor satisfaction, clustering techniques to group instructros based on their online teaching decisions can be an efficient approach (Basaran & Yalman, 2022; Graves & Bowers, 2018; Scherer et al., 2023). Clustering is a type of data mining technique that can be used to identify different groups of online instructors who share similar characteristics and behaviors (Bauer, 2022; Wang & Wang, 2019). Among the clustering algorithms, latent class analysis (LCA) was the most appropriate choice compared to other clustering methods because it can create more interpretable clusters by constructing empirically derived classifications instead of arbitrary cutoffs to identify groups in the data (Nylund-Gibson & Choi, 2018; Schreiber & Pekarik, 2014). By applying LCA, online instructors were grouped into significantly different clusters based on their instructional practices, which are determined by indicator variables from instructors' responses to their choice of utilizing online course activities. This allowed researchers to further analyze the unique characteristics of each cluster, identify patterns of instructional activities implemented by instructors in each cluster, and examine covariates that predict cluster membership (Denaro et al., 2022; Kaqinari et al., 2022; Scherer et al., 2021). In addition, instructor satisfaction with their online teaching experiences was compared based on identified cluster membership (Bakk & Kuha, 2021; Nylund-Gibson et al., 2019).

8 Participants and Setting

The institutional review at all relevant institutions approved the research design and protocol for this study prior to data collection. The faculty recruited for the study were employed at a medium-sized, public university in the western region of the U.S. Email invitations with a cover letter and an embedded link for the online survey were sent to all faculty members at the institution. The sample size for the data analysis was 167, representing instructors who had data on the variables used in the analyses. Regarding the characteristics of the participating instructors, the proportion of female (51%) and male (49%) participants was approximately the same. Instructors' ages ranged from 26 to 70 years ($M = 51.5$; $SD = 10.5$), and their online teaching experiences ranged from 0.5 to 35 years, with an average of 7.5 years. Sixty-four percent of participants indicated that they were employed full-time, and 36% of respondents were part-time or adjunct faculty.

9 Instruments

In addition to instructor demographics and the background questionnaire, three instruments were used to collect data from online instructors: (a) a satisfaction survey, (b) a pedagogical beliefs survey, and (c) an online student course activities survey. After a research team had undertaken the initial item development process to determine the content validity of the instruments, the instruments were reviewed by a panel of four experts with extensive experience in teaching and administering online courses at a higher education institution. After receiving instructions and a draft of the instruments, the experts assessed the relevance and clarity of each item and construct, and made suggestions for revision. Based on their recommendations, a few scale items were modified. Pilot data was collected and an exploratory factor analysis was performed to examine the factor structure. After determining the factor structure, Cronbach's alphas were calculated to test the internal reliability of the instruments.

To gather instructor satisfaction, four subscales (instructor-student interaction, student–student interaction, institutional support, and course design, development, and teaching) of the Online Instructor Satisfaction Measure (Bolliger et al., 2014) were used. The instrument measures instructor satisfaction with online environments on a 5-point Likert-type scale that ranges from 1-*strongly disagree* to 5-*strongly agree*. Sample items from the instrument include "My interactions with online students are satisfying" and "I am pleased with the quality of student work in online courses". The reliability coefficients of the subscales ranged from 0.82 to 0.64. The subscale course design, development/teaching had the lowest reliability ($\alpha=0.64$). The Survey of Online Teachers' Pedagogical Beliefs has a two-factor structure and includes 12 Likert-type items ranging from 1-*strongly disagree* to 5-*strongly agree*. Example statements include "Teachers should give students choices in their learning" and "Teachers should decide what students need to learn". The instrument was administered to online instructors to gather data regarding their pedagogical beliefs about the nature of the teaching and learning process in two orientations: transmissive and constructivist. The reliability of the instrument was determined to be satisfactory for each subscale of the instrument, ranging from 0.65 to 0.69 (Inan & Bolliger, 2013). The Survey of Online Student Activities was used to collect data about online instructors' instructional practices in terms of choices of student learning activities (Inan & Bolliger, 2013). The survey presented participants with eight items listing a variety of online course activities (e.g., students create products, work on collaborative tasks, provide peer feedback, complete self-paced tutorials, etc.). Instructors were asked to respond to these items using a 5-point Likert-like scale ranging from 0-*never* to 4-*extensively* to rate their level of use for each instructional activity listed in the instrument. The internal reliability coefficient of the scale was 0.68.

10 Data Analysis

Latent class analysis (LCA) involves a set of similar statistical methods used to identify unobserved groups using a selected set of variables. Due to extensive feature reporting, Mplus 7.1 was initially used to identify the number of latent classes, the size of each

class, and the indices for model fitting. Determining the number of classes is considered to be one of the most difficult steps in LCA, due to the lack of a converged consensus on how to find a meaningful solution that balances statistical fit with model parsimony (Bauer, 2022). There are several commonly used fit indices such as Bayesian Information Criterion (BIC), Sample Size Adjusted Bayesian Information Criterion (SABIC), Lo Mendell Rubin Likelihood Ratio Test (LMRT), Bootstrap Likelihood Ratio Test (BLRT), and entropy value that provide suggestive but not conclusive information on the number of clusters to be selected (Basaran & Yalman, 2022; Bauer, 2022; Weller et al., 2020). Because the goal is to find a parsimonious cluster model that is interpretable, although the statistical criteria should be considered, the priority should be given to the theoretically best-fitting solution model (Bauer, 2022; Weller et al., 2020). Therefore, other critical content focused indicators such as relative sizes of the identified clusters, qualitatively distinct non-redundant cluster profiles, and alignment between the potential cluster to the theoretically meaningful solutions were evaluated (Spurk et al., 2020; Wang & Wang, 2019).

The suggested number clusters based on statistical criteria were ambiguous ranging from 2 to 4. By examining each model, two-tier models were retained based on interpretability and theoretical suitability. After identifying the number of clusters, a three-step automated LCA method (Asparouhov & Muthén, 2014) was performed with the identified clusters with covariates (e.g., gender, age, years of teaching, and pedagogical beliefs) and distal outcome (satisfaction subscales) separately. Although conventional statistical techniques (e.g., ANOVA) can be used for further analysis with the identified clusters, these methods could lead to biased results since the estimates ignore the classification uncertainty of the clusters (Bakk & Kuha, 2021; Bauer, 2022). Therefore, the three-step method in Mplus was used as it provides the ability to run latent cluster analysis with observed indicators (frequency of student activities) to examine whether the cluster prevalence was equivalent across levels of predictors (e.g., gender and pedagogical beliefs) and/or to test whether the latent clusters have statistically significant differences in distal outcome variables (e.g., instructor satisfaction) (Nylund-Gibson & Choi, 2018; Nylund-Gibson et al., 2019; Yukhymenko-Lescroart et al., 2021). The model guiding the data analysis is shown in Fig. 1.

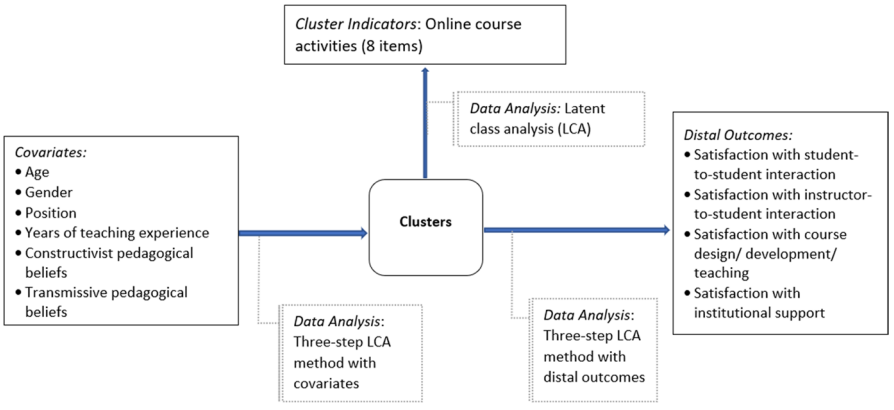

Fig. 1 Data Analysis Model

11 Results

11.1 Clusters Profiles

A two-cluster solution was found that best explains the differences between the instructors' choice of the use of activities in online courses. After identifying the clusters, each instructor was assigned to one of the classes based on the probabilities of eventual class membership. Examination of the marginal means showed that the differences in the predicted classes were evident for five activities: creating products and artifacts; working on collaborative tasks; providing peer feedback; reflecting formally on learning; and sharing ideas and resources (see Fig. 2). Consistent with theoretical support, these two clusters have been termed content-oriented and learner-centric.

12 Predictors of Clusters

Latent variable multinomial logistic regressions using the 3-step procedure examined whether instructors' covariates including demographics (gender, age), teaching background (position status, years of teaching experience) and pedagogical beliefs (transmissive pedagogical beliefs, constructivist pedagogical beliefs) predict

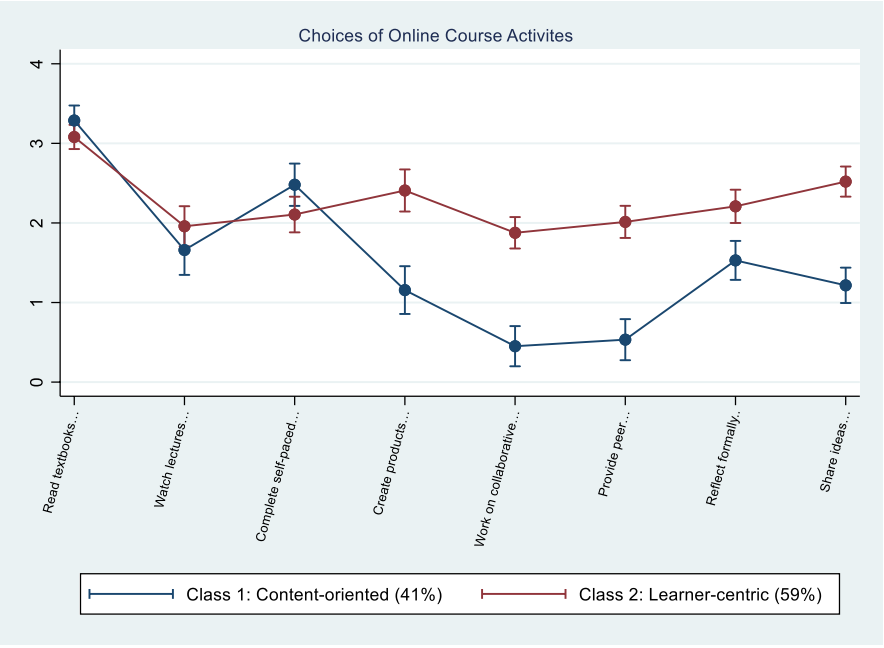

Fig. 2 Patterns of Instructors Cluster Memberships. *Note.* Items ranged from 0-*never* to 4-*extensively*

cluster memberships (student-centric and content-oriented). Results revealed that constructivist pedagogical beliefs were a significant cluster predictor. Similarly, the gender distribution is noteworthy among the clusters in that female instructors are more likely to be placed in the learner-centric cluster. However, position status, age, and years of teaching experience were not significant predictors of clusters memberships (Table 1).

13 Cluster Impact on Online Instructor Satisfaction

The 3-step method for estimating the clustering effects on the distal outcome in mixture modeling provides a useful way to test whether class membership could be a predictor of online instructor satisfaction. The results showed a significant difference between the predicted classes in terms of instructor satisfaction with online interactions. Examination of descriptive findings indicated that instructors assigned to the learner-centric cluster reported higher satisfaction regarding online interaction on two subscales: instructor-to-student interaction and student-to-student interaction (Table 2).

Table 1 Predicting Clusters by Instructor' Pedagogical Beliefs, Age, and Years of Teaching Experience

	Coefficient	*SE*	*p*
Constructivist pedagogical beliefs	3.034	0.892	0.001**
Transmissive pedagogical beliefs	-0.807	0.506	0.111
Years of teaching experience	0.031	0.070	0.656
Age	0.006	0.027	0.823
Position	-0.748	0.585	0.201
Gender	1.217	0.551	0.027*

**Statistically significant at the $p < 0.01$ level. *Statistically significant at the $p < 0.05$ level. Items ranged from 1-*strongly disagree* to 5-*strongly agree*

Table 2 Clusters With Subscales of the Online Instructor Satisfaction Measure

	Content-oriented ($N = 68$) *M (SE)*	Learner-centric ($N = 99$) *M (SE)*	X^2	*df*	*p*
Satisfaction with student-to-student interaction	2.887 (0.069)	3.715 (0.047)	96.818	1	0.000*
Satisfaction with instructor-to-student interaction	3.130 (0.075)	3.621 (0.056)	27.448	1	0.000*
Satisfaction with course design/development/teaching	4.252 (0.054)	4.249 (0.047)	0.003	1	0.960
Satisfaction with institutional support	3.825 (0.074)	3.664 (0.063)	2.763	1	0.096

*Statistically significant at the $p < 0.01$ level. Items ranged from 1-*strongly disagree* to 5-*strongly agree*

14 Discussion

The results suggest that we can identify different classes of instructors based on their choice of classroom activities for learners. Previous research on classroom practices in online learning has mainly focused on understanding the instructor's intent to use different tools and on the self-efficacy of teaching skills (Chang et al., 2014; Koszalka & Ganesan, 2004; Lawrence & Lentle-Keenan, 2013). Although such perspectives offer insight into the online teaching and learning process, examining the instructor's course activity choices could provide unique insights into understanding actual practices and have crucial implications for professional development and pedagogical support for online instructors (Denaro et al., 2021; Graves & Bowers, 2018; Tawfik et al., 2021). Therefore, the purpose of this research study was to group faculty members based on their choice of student activities in online courses.

We identified two distinct groups of instructors with different patterns in the implementation of course activities. In one cluster, instructors often integrated student-centered learning activities, whereas online instructors in the other group were less likely to use them. The pattern is consistent with the theoretical support for teaching practices, which are mostly divided into two categories, namely content-oriented and learner-centric (Barkatsas & Malone, 2005; Inan et al., 2010; Valckx et al., 2021). Instructors in the content-oriented cluster prefer content presentation and delivery activities in which students study text materials, watch video lectures, or practice computer-based instruction. Instructors in the learner-centric clusters also leverage content-focused activities; however, they also integrate activities where students create products, engage in collaborative projects, exchange ideas, and provide peer feedback.

One of the predictor variables was instructors' pedagogical beliefs. There were significant differences between participants' frequency of use of activities based on cluster membership. Several researchers have suggested that educators' epistemologies and pedagogical beliefs about teaching and learning influence their instructional practices in the learning environment (An & Reigeluth, 2011; Coker, 2018; Gibbons et al., 2018; Lawrence & Lentle-Keenan, 2013; Lee et al., 2013; Liu et al., 2020; Saadati et al., 2021). For example, Dirkin (2008) found that all three instructors with whom in-depth interviews were conducted designed and developed online courses that reflected their beliefs and values. Similarly, Steel (2009) observed that when designing online courses, instructors' pedagogical beliefs influence the use of tools and activities.

The results of the study can also assist in understanding the proportion of instructors assigned to each cluster by explaining cluster membership based on instructor characteristics. One of the interesting results was that a large portion of the learner-centric clusters consisted of female instructors. Several studies indicate that females are more likely to engage in teaching practices that involve student-centered strategies (Lane et al., 2019). For example, D'Souza et al. (2021) found that female online language instructors in the Philippines were utilizing more student-centered approaches compared to male instructors. Differences in instructor

perceptions pertaining to roles and practices based on gender were also observed by Chang et al. (2014).

There was no impact on the profile of clusters based on other instructor characteristics examined. Conflicting results have been reported in the literature with regard to the age, position status, and years of teaching experience of instructors (Denaro et al., 2022). For example, Chang et al. (2014) found no difference between faculty status but a difference based on years of experience. Other researchers found rank had a significant impact on course activity selection, whereas years of experience had no impact on teaching practices (Djajalaksana et al., 2013; Fletcher & Djajalaksana, 2014).

As for examining the differences between instructor clusters in terms of satisfaction, learner-centered instructors were significantly more satisfied with instructor-to-student interaction and student-to-student interaction. The results imply a relationship between constructive beliefs, teaching practices, and satisfaction. Constructive beliefs were a good predictor of cluster membership; however, cluster membership also explained differences in instructors' satisfaction with the interaction-related components of online instruction. This may be because student-centered activities allow instructors to observe the direct impact of these strategies through student engagement and performance leading to higher faculty satisfaction (Kay & Pasarica, 2019). In addition, these activities may lead to more interaction and promote social bonding, resulting in the online instructor's perception of less isolation. Isolation in the online environment can be a cause of instructor dissatisfaction (Golden, 2016).

15 Limitations and Future Research

It has been pointed out in the literature that the relationship between instructors' beliefs and practice is dynamic and bidirectional and pedagogical beliefs do not always align with classroom practices (Barkatsas & Malone, 2005; Owens, 2015; Scott, 2016). Researchers may examine in future studies how instructors' beliefs can lead to changes in practices or vice versa. Additionally, future studies could focus on how changes in beliefs and practice patterns evolve as instructors gain experience over time. The focus of this paper was on investigating pattern relationships between instructors' beliefs and the use of learning activities at one institution. Future studies could examine the quality and usefulness of learner activities in different geographical areas and disciplines. It would also be worthwhile to investigate how instructors make decisions regarding the selection of course activities, and their reasons for not incorporating student-centered or instructor-centered learning activities. Qualitative data collection approaches (e.g., in-depth interviews) could provide explanations for the underlying rationale for instructors' decisions. Because this study was based on self-reported data, future investigations may make use of other data collection methods (e.g., log data from a course management system or observation data from online courses).

16 Conclusion

It was the purpose of this study to identify clusters of online instructors based on their choice and frequency of implementing different student learning activities in online courses, to examine factors that influenced differences within clusters, and to explore whether cluster membership affected instructor satisfaction. Pedagogical beliefs are an important construct because they influence instructors' practices in the classroom, which in turn can impact students' behaviors and learning (Connell et al., 2016; Kay & Pasarica, 2019; Theobald et al., 2020; Trigwell et al., 1999). Our findings indicate instructors' pedagogical beliefs impact how frequently they use student-centered practices. Findings also show that the use of student-centered approaches had a positive correlation with instructor satisfaction. Therefore, professional development opportunities for instructors should include the practical application of student-centered strategies (Bice & Tang, 2022; Scott, 2016; Tawfik et al., 2021). These insights can be useful for online instructors, instructional designers who collaborate with faculty on the development of online courses, professionals who provide professional development opportunities for online faculty, and administrators who support faculty and staff involved in the development and delivery of online programs.

Data availability The datasets generated and/or analyzed during the current study are not publicly available due to the institutional data-sharing policy. However, permission may be obtained from the authors upon reasonable request and with approval of the institutions.

Declarations

Conflicts of interest We have no conflicts of interest to disclose.

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