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Factors Affecting Faculty Use of Video Conferencing in Teaching: A Mixed-method Study

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Abstract: *Teaching and learning can now utilize a variety of real-time technologies to build online social presence and learning interactions. However, teachers and students must effectively prepare for this experience; and the identification of contextual and perceptual influences become evolving and necessary (Lehman & Conceição, 2010; Liu & Kaye, 2016). In this paper, the authors explore factors that impact faculty use of synchronous video conferencing (VC) in teaching. The two-phase mixed-method study spanned a year, converging qualitative and quantitative approaches through observations and recordings during a 6-week faculty professional development program, a campus-wide survey, and focus groups. Thematic analysis was used for coding qualitative data (Guest, MacQueen, & Namey, 2012). Descriptive statistics, cross tabulation, logistic regression, and standard multiple regression were used to analyze quantitative data. A model with faculty demographic factors and perceived importance of technology features and quality for teaching was initially developed and tested, which explained 69.1% of the variance in predicting faculty use of VC technologies in teaching. The perceived importance of VC features and quality scale generated Cronbach's Alpha .866. The study then provides meaningful process and recommendations to define institutional support to the VC adoption in teaching.*

Keywords: video conferencing in teaching, adoption, pedagogy, value of integration, mixed-method

1. Introduction

As digital technologies become more ubiquitous, faculty members in higher education face the ever-blurrier distinction between face-to-face and computer-mediated pedagogy. The many choices of video conferencing (VC) software and platforms and their evolving features provide opportunities as well as challenges to the research and practice for teaching and learning in online environments (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; Cornelius, 2014).

VC systems have existed since the early 1980s and enable users to host a real-time conference across different geographic locations involving both sound and imagery (Bly, Harrison, & Irwin, 1993; Sabri & Prasada, 1985). As a learning tool, VC systems offer real-time classroom experience for teachers and students who cannot meet in the same brick-and-mortar classroom (Finkelstein, 2009; Wang, Chen, & Levy, 2010). Instant communication in audio and video formats between remote locations has great potential for building a learning community that otherwise could not develop; simultaneous presentation and screen sharing allow the remote connectivity among subject experts, students, and lab equipment in distributed locations (Bower et al., 2015). The effective use of VC in higher education, however, has a mixed trajectory regarding adoption and use (Cornelius, 2014; Huang & Hsiao, 2012; Martin & Parker, 2014; Park & Bonk, 2007a). This creates a need for continued investigation of usage facilitators and barriers.

2. Literature Context and Conceptual Framework

As mentioned previously, VC technology is not a new concept nor a new practice for teaching and learning (Martin, 2005; Sabri & Prasada, 1985; Wang, 2004; Wang et al., 2010). However, the co-existence of many options of VC technologies and the increased demand of collaborative teaching and learning across disciplines and institutions require new perspectives to maximize effective integration of these tools, particularly regarding faculty adoption (Bower et al., 2015; Capterra, 2017; Estes, Liu, Zha, & Reedy, 2014; Reid, 2017). In terms of innovative technology adoption in teaching, users are normally driven by a plethora of factors, ranging from values for acceptance, attributes of innovations, and other organization and personal traits. Values for acceptance can include the perception of usefulness and ease of use based on core purposes (Davis, Bagozzi, & Warshaw, 1989; Davis & Venkatesh, 1996; Venkatesh & Davis, 2000). Adopters also evaluate the

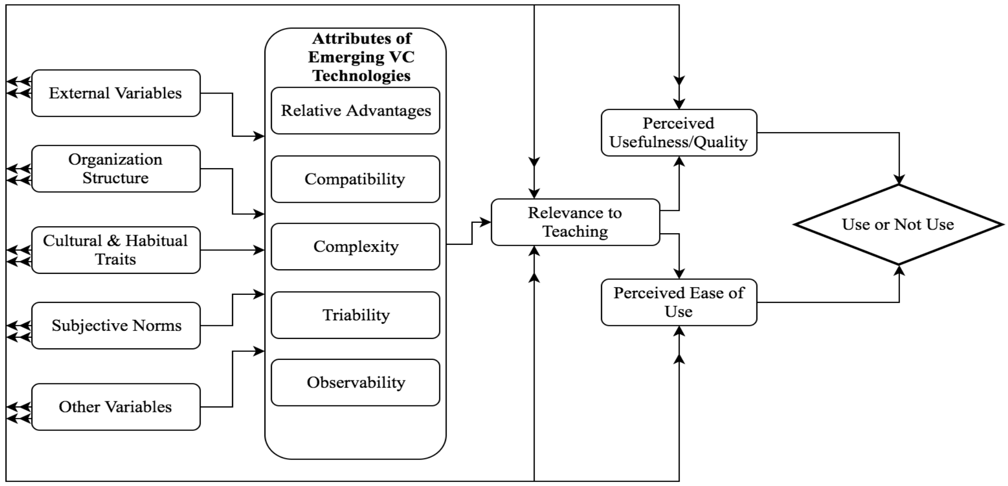

Figure 1. Conceptual framework.

teaching relevance of innovative attributes offered by emerging technologies, including relative advantages, compatibility, complexity, triability, and observability (Rogers, 2010).

Existing research identifies several facilitators for effective integration, such as adequate student preparation (Bliesener, 2006; Liu & Kaye, 2016; Park & Bonk, 2007b), sufficient faculty training regarding both use and pedagogy (Park and Bonk, 2007a), and addressing differential needs stemming from inherent demographic traits and organizational/cultural characteristics of faculty members that shape personal preferences of technology features and interfacing (Martin and Parker, 2014).

Multiple barriers also exist. These have been associated with the need to adapt to evolving pedagogical practice (Voogt & Roblin, 2012), academic culture and trend (Cornelius, 2014; Martin, 2005), organizational structure and supportive variables (Schneckenberg, 2009), and demographic factors of faculty members (Martin & Parker, 2014). Scholars applying the 'technology acceptance model' have identified perceived ease of adoption, perceived usefulness of adoption, and user attitude as key predictors of the integration for new teaching technologies (Davis et al., 1989; Davis & Venkatesh, 1996; Venkatesh & Davis, 2000). In addition, evidence tentatively points to additional and specific factors related to organizational structure, cultural and habitual traits, and subjective norms (Bagozzi, 2007; Mathieson, 1991; Schepers & Wetzels, 2007; Schneckenberg, 2009; Venkatesh & Davis, 2000). These have led to an evolving conceptual framework depicted in Figure 1. It is through this framework that the researchers implementing this study investigated the pedagogical decisions made by faculty at a US university regarding use of VC technologies.

3. Research Questions, Research Design, and Data Collection Methods

With the purpose of improving institutional support for faculty to effectively adopt new pedagogies enabled by technologies, the authors of this paper focus on the exploration of answers to the following research questions:

1. What is the potential of using VC technologies in teaching and learning? What are the limitations?

2. What factors affect faculty using VC technologies in their teaching?

The research described here coincided with an evaluation of university support services for instructional design and pedagogical support implemented during an overlap between multiple VC systems on the study campus. To serve the primary goal of conducting needs assessment for service improvement in the higher educational institution, the authors took the perspective from an action research (Fraenkel, Wallen, & Hyun, 2015; Gall, Gall, & Borg, 2007). In addition, the potential of multiple representations of VC technologies was found constantly evolving as well as faculty perception of pedagogical choices (Capterra, 2017; Hakkinen & Hamalainen, 2012). To meet the needs of educational research evidence to inform teaching practice (Borrego & Henderson, 2014; Means, Toyama, Murphy, Bakia, & Jones, 2009; Slavin, 2002), the researchers designed the study with a two-phase exploratory mixed-method design (Figure 2). The University Institutional Review Board approved this year-long study with its proposed data collection methods, as presented in Table 1.

The study started with an initial exploratory research design followed by a phase II of more deductive, explanatory approach (Creswell, 2014; Creswell & Clark, 2011). Phase I consisted of both qualitative and quantitative data collection. Qualitative data derived from several sources. One source was a six-week faculty professional development workshop where the research team documented faculty participant exploration of four unique VC systems with different computer operating systems and mobile devices. Six faculty members joined the workshop, representing six disciplinary areas, including Political Science, Chemistry and Biochemistry, Communication Studies, Africana Studies, Sociology and Anthropology, and Music. During the workshop series, both participants and coordinating faculty met 150 minutes per week and tested the VC systems with various devices.The four systems included Blackboard Collaborate, Zoom.us, Google Hangout, and CISCO WebEx. Among them, Zoom.us and Google Hangout in the research were the free version; Blackboard Collaborate and WebEx were procured by the higher education institution. The participants tested these systems with standard Windows or Mac laptops, Windows Surface Pro 3 or iPad air 2, and their personal smart phones in the university wireless environment. The researchers took observation notes at the 150-minute weekly sessions. Some of the sessions were recorded given the technology options and linked from the learning management system, Instructure Canvas. The literature on teaching with VC were also available on Canvas. The participants were expected to complete an online form for evaluating the VC system at the end of the day. Participants then ranked the perception of these VC systems with the online form and provided additional open-ended comments.

Phase I data were used to inform the development of a questionnaire administered to the larger population of university faculty during Phase II. The questionnaire was designed in two parts. One part for the action research was to inform the institution of programming needs in terms of instructional design, technology and pedagogy support for faculty and students; and the second part was for the investigation of factors that impact faculty use of VC in teaching. The questions were repeatedly checked by instructors who were experienced VC users to ensure the face validity.

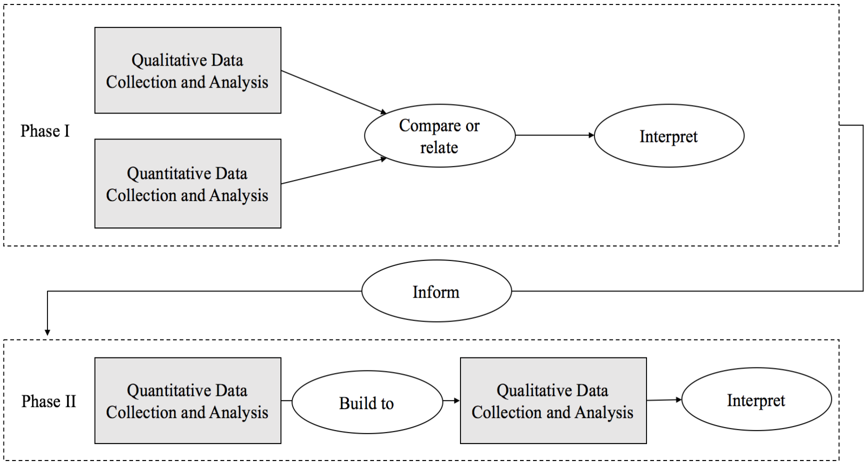

Figure 2. Research design diagram.

Among the twenty developed questions, eight were about demographics and device use, six were about institution-specific training and support needs, and one about open comments. As an action research, questions about demographics came from both literature and institutional context (Martin & Parker, 2014; Schneckenberg, 2009). For instance, employ status were listed as: 1) Full-time instructional faculty - tenured; 2) Full-time instructional faculty - pre-tenure; 3) Full time - non-tenure track; 4) Part-time instructional faculty; 5) Administrative and professional faculty.

To investigate factors that would impact faculty use of VC, the researchers developed a question about ranking importance of ten VC technology features and faculty perceived importance of ease, effectiveness, and efficiency of using VC in teaching, which is referred to as *quality of VC for teaching* in the following writing. See Appendix A for the portion of the instrument related to a 'Scale of Faculty Perception of Using VC in Teaching'. In addition, there were three more questions deployed for users and non-users to inform institutional support for teaching with VC. One question was used to differentiate users from non-users of synchronous VC technologies in teaching. For users, one question was about frequency of using VC and another about challenges when using VC in teaching; for non-users, one was about support for students and the other about open-ended reasons for not using VC in teaching.

Because of its action research nature to improve institutional practice, a purposeful sampling within the institution was used for this research (Creswell, 2014; Fraenkel et al., 2015). The Phase II questionnaire was administered to faculty through an online survey system with an email invitation through the campus faculty ListServ. Both quantitative and qualitative data were collected with the online questionnaire. These results were also used to build questions for focus groups that followed the questionnaire responses (Creswell & Clark, 2011).

During questionnaire implementation, the researchers applied measures to avoid possible survey fatigue as well as to control possible threats to internal validity (Christensen, Johnson, & Turner, 2010; Fraenkel et al., 2015). By communicating with other stakeholders on campus to plan the timeline of deploying technology-related surveys in the semester, the researchers developed a targeted

Table 1. Research data collection methods, phases, and formats

Data Collection Methods	**Data Formats**	**File Formats**
Phase *I*		
Observation notes	Qualitative	Notes in text
VC Recordings	Qualitative	Audio or Video
VC Evaluation Form	Quantitative & Qualitative	Qualtrics
Phase *II*		
Campus-wide Questionnaire	Quantitative & Qualitative	Qualtrics
Faculty Focus Group	Qualitative	Notes in text, audio

timeline for implementation. The questionnaire was then transferred to a web-based survey platform, Qualtrics, and remained active for 5 weeks in the spring semester of 2016 between mid-February and late March. Following the surveys and based on voluntary responses, the researchers conducted two faculty focus groups with five faculty members from Colleges of Business, and Arts and Letters. Finally, targeted member check was applied post-survey and post focus group with specific known users of VC technologies to clarify findings derived from the qualitative data (Creswell, 2014).

4. Data Analysis

Because of the diverse nature and purposes of the data collected, data analysis also occurred in two phases as follows.

4.1. Phase I Data Analysis

The data derived from the faculty development workshop series indicated the following technology features that would be important for teachers:

- Voice over IP (audio communication among class members) (TechFeature_1)
- Text chat (TechFeature_2)
- Video conferencing with camera view of class members (TechFeature_3)
- Video conferencing with camera view of lab/classroom facility (TechFeature_4)
- Online presentation with slides (TechFeature_5)
- Application sharing (TechFeature_6)
- Participation status (e.g. raising hands) (TechFeature_7)
- Ability to assign moderator role to students (e.g. sharing their screen, presenting from their computers) (TechFeature_8)
- Group work with break-out rooms (TechFeature_9)
- Recording of sessions (TechFeature_10)

Phase I qualitative data revealed several additional usage facilitators based upon the coding and reflection of the observation notes, online activities, and VC session recordings:

Ease of launching and using the VC program, with representative quotes as below:

I liked that I was able to make the interface work, with minimal frustration. I feel confident that I could figure out how to use many features just through exploring the many options available in the pull-down menus.

Record function is easy to use. Re-assigning moderator/host is simple to control, managing the participant list is straight-forward.

Classroom management with visual presence, with representative quotes as below:

Appears to be a comprehensive application in terms of capabilities for classroom management, with many useful tools embedded and easily accessed through the pull-down menu.

Streamlined organization of facial images through gallery mode, and no apparent issues with lag.

Specific technology features beyond those listed above, with representative quotes as below:

... the automatic conversion of video is

very useful

This application has full functionality of screen sharing, document sharing, and application sharing that are really easy to switch from one to the other. Also, the potential for students to be the 'drivers' of the session has potential.

I see it being useful for math and science applications where students can demonstrate calculations to the rest of the class

These data also revealed a few challenges regarding adoption of the reviewed technologies:

you would have to be very organized and intentional about using this feature

I find it very complicated and requires a big learning curve to understand

Finally, Phase I data indicated the following features important to faculty when considering the quality or value of integrating VC technologies into their pedagogical practices:

- Ease of scheduling a synchronous online class session (Quality_1)
- Ease of sharing class materials before the session (Quality_2)
- Ease of sharing class materials during the session (Quality_3)
- Spontaneity in communication (Quality_4)
- Immediacy with audio or video options (Quality_5)
- Ability to provide remote, live demonstrations with equipment not accessible to students (Quality_6)
- Ease of sharing class materials during the session (Quality_3)
- Cost saving in terms of commuting (Quality_7)
- Space saving in terms of physical classroom (Quality_8).

4.2. Phase II Quantitative Data Analysis

The online survey was administered through the university bulk email service and was active for 5 weeks, with two email reminders. A total of 105 faculty responses to the survey were received. A data screening was applied to clean missing data before further analysis was conducted, which resulted in 88 valid responses. Among these, 36.4% responses were from the age group of 41-50, which was followed by those of 51-60 with 22.7%, and those of 30-40 with 19.3%. 15.9% of responses were from the age group of 61-70, 3.4% from those over 70, and 2.3% from those under 30 (Figure 3).

The responses represented eight colleges across the university, representing unique disciplinary perspectives; 44.3% of responses came from liberal arts, followed by those from health sciences with 15.9% and science and math with 13.6%, 9.1% from business and management, 4.6% from education, 3.4% from fine arts, and 4.6% from other units of the university such as the libraries and university studies.

Examining a cross tabulation of age groups and VC use, 17 of the 41-50 age group indicated their use of VC in teaching, which was followed by 14 out of 20 from the 51-60 age group. Nine responses from both 30-40 and 61-70 age groups indicated the use of VC (Table 2). Among 50 female responses, 33 indicated use VC technologies in their teaching (Table 3).

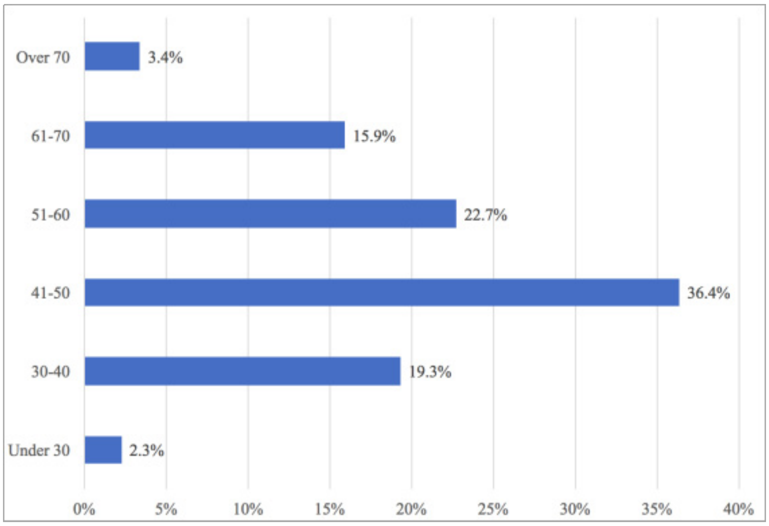

Figure 3. Age distribution of responses.

Table 2. Cross tabulation of age groups and use of VC

	Under 30	30-40	41-50	51-60	61-70	Over 70	Total
Not Use	1	8	15	6	5	0	35
Use	1	9	17	14	9	3	53
Total	2	17	32	20	14	3	88

Among the 88 complete responses, 44 indicated themselves as full-time instructional faculty-tenured as employ status, among which 25 used VC in teaching. 19 indicated as pre-tenured which counted toward 21.5% of the responses, among which 9 used VC in their teaching. The non-tenure track instructional faculty status counted for 17.1% of the responses with 12 using VC. Nine part-time faculty responded and 6 used VC in their teaching (Table 4).

Table 3. Cross tabulation of gender and use of VC

	Female	Male	Total
Not Use	17	18	35
Use	33	20	53
Total	50	38	88

Table 4. Cross tabulation of employ status and use of VC

	Full-time instructional faculty - tenured	Full-time instructional faculty – Pre-tenured	Full-time instructional faculty – no-tenure track	Part-time instructional	A/P faculty	Total
Not Use	19	10	3	3	0	35
Use	25	9	12	6	1	53
Total Count	44	19	15	9	1	88
% of Responses	50.0%	21.6%	17.1%	10.2%	1.1%	

Logistic regression was performed to predict VC use in teaching with the demographic factors of age, college, years of college teaching, employ status, perceived importance of VC technology features, and perceived importance of quality of VC integration in teaching. The criterion variable was coded as dichotomous,with *use of VC in teaching* = 1, *not use VC in teaching*= 0. A simultaneous logistic regression was performed for predicting a faculty member's intention to use VC in teaching. The predictor variables included 1) gender, 2) years of teaching, 3) age group, 4) college, 5) employ status, 6) perceived importance of 10 VC technology features rated from 1 = *not important at all* to 4 = *very important*, 7) perceived importance of quality in the use of VC for teaching with a set of 8 factors rated from 1 = *not important at all* to 4 = *very important*. The data of predictor variables were transformed to meet the requirements of logistic regression analysis.

Results of the logistic regression analysis indicate that the 23-predictor model provides a statistically significant improvement over the constant-only model.X^2 (23, N = 65) = 47.23, $p< .002$. The Nagelkerke pseudo R^2 indicated that the model accounted for 69.1% of the total variance. This suggests that the set of predictors discriminates between those who use VC technologies in teaching and those not using VC. Prediction success for the cases used in the development of the model was relatively high, with an overall prediction success rate of 84.6% and correct prediction rates of 86.1% for faculty member who use VC in teaching and 82.8% for those not using VC in teaching. Table 5 presents the regression coefficients (*B*), the Wald statistics, significance level, odds ratio [*Exp* (B)], and the 95% confidence intervals (*C.I.*) for odds ratio (*OR*) for each predictor.

A standard multiple regression was performed for the frequency of using VC and perceived challenges in using VC for teaching by users. Frequency of using VC in teaching was the dependent variable. The six challenges identified at Phase I were independent variables. As summarized with Table 6, the multiple R for regression was statistically significant, F (6, 33) = 2.45, $p< .05$, R^2adj = .18. However, the independent variables did not individually contribute significantly to the prediction of frequency of using VC in teaching.

Table 5. Logistic regression results for predicting whether a faculty member integrating VC in teaching by using 23 demographic and perception predictors

Step	Variable Entered	B	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
1	Gender	-.350	.073	.787	.705	.056	8.867
	Years of Teaching	.114	1.117	.291	1.121	.907	1.386
	Age	-.375	.273	.601	.688	.169	2.800
	College	.100	.075	.785	1.105	.539	2.266
	EmployStatus	1.557	4.742	.029**	4.747	1.169	19.283
	TechFeature_1	-.367	.193	.661	.693	.134	3.574
	TechFeature_2	.483	.366	.545	1.621	.339	7.758
	TechFeature_3	-2.276	4.551	.033**	.103	.013	.831
	TechFeature_4	1.340	2.385	.122	3.817	.697	20.892
	TechFeature_5	3.181	3.648	.056*	24.067	.920	629.573
	TechFeature_6	-1.758	3.126	.077*	.172	.025	1.210
	TechFeature_7	-1.583	1.396	.237	.205	.015	2.836
	TechFeature_8	-1.037	1.454	.228	.355	.066	1.913
	TechFeature_9	2.069	3.321	.068*	7.919	.855	73.312
	TechFeature_10	-1.065	2.077	.150	.345	.081	1.467
	Quality_1	2.921	2.936	.087*	18.558	.657	524.132
	Quality_2	.868	.550	.458	2.383	.240	23.632
	Quality_3	.692	.308	.579	1.997	.173	23.022
	Quality_4	-.972	.644	.422	.378	.035	4.069
	Quality_5	.713	.298	.585	2.041	.158	26.408
	Quality_6	-1.879	2.896	.089*	.153	.018	1.330
	Quality_7	-1.977	4.253	.039**	.138	.021	.906
	Quality_8	1.540	2.299	.129	4.666	.637	34.174
	Constant	-9.168	1.894	.169	.000		

(** = significant at the .05 level; * = significant at the .10 level)

Table 6. Regression analysis summary of predicting frequency of using VC in teaching by challenges perceived when teaching with VC

Variable	***B***	***SEB***	***ß***
Number of configuration steps	.611	.406	.283
Bandwidth requirement	-.600	.389	-.307
Lack of training	.065	.385	.032
Time required to practice	-.094	.354	-.051
Lack of time to incorporate	.638	.323	.371
Scheduling challenge	.480	.371	.215

The Scale of Perceived Importance in Technology Features and Quality of VC Technologies in Teaching (Appendix A) resulted with *Cronbach's Alpha* of .866 for the 18-question scale, with *Cronbach's Alpha* of .864 for the Technology Feature subscale, and .774 for the VC Quality for Teaching subscale.

4.3. Phase II Qualitative Data Analysis

Qualitative data were documented with the open comments from the surveys, notes and audio recordings from the focus groups. These were coded with the qualitative analysis software, Nvivo. Themes emerged from the coding and categorization as nodes (Fraenkel et al., 2015; Guest et al., 2012). Because of the nature of action research, the nodes were defined based on the literature and research context, as illustrated with the following examples:

Perceived value of integration

I think it's important to see members of a group to understand how people are reacting. It's just convenient to show slides (with a white board function).

Perceived value of integration - Collaborative teaching and learning possibilities

The chat works most effectively if the course is team taught with one faculty member monitoring chat (questions, entries, etc) while the other conducts the audio/visual synchronous session.

Students deliver presentations (both individual and group) in live sessions with classmates as audience members.

Technology features and perceived value of integration

Multiple cameras permit all members of a group 'face time' AND permit members of the class to serve as visible audience members. This enhances the transactional nature of communication we value.

The text box and raising hands permits those without the microphone to request a turn.

Limits of technology features

Since I am working to develop the ability *to use an iPad to facilitate high-quality synchronous sessions, it was disappointing that a) there is no record feature, meaning that one of the features that seems best, recording and then being able to share that on Canvas (or elsewhere) is not available*

iPad (and smartphone) users are not able to view shared web content that is viewed within WebEx. However, the iPad was able to view a shared browser.

iPad (and smartphone) users have limited functionality regarding interactivity with presentations. For example, I could not figure out how to contribute to the whiteboard, even when I was assigned the presenter role on the iPad.

Scheduling

scheduling in summer -- too many time zones and work schedules with 25 students

Ability to teach on snow days rather than schedule a Saturday makeup

Perceived value of integration - Sustainability of student-content interaction

Recording of sessions permits students not in attendance during the session to review the session.

Perceived value of integration -Options to allow critical thinking

recording student presentations allows self- critique.

The cluster analysis of nodes was performed to explore the word similarity associated with and between the nodes, as visualized with Figure 4. Pearson correlation coefficient was applied to calculate the similarity (QSR International, 2017). "Cluster analysis is a quantitative tool that has the

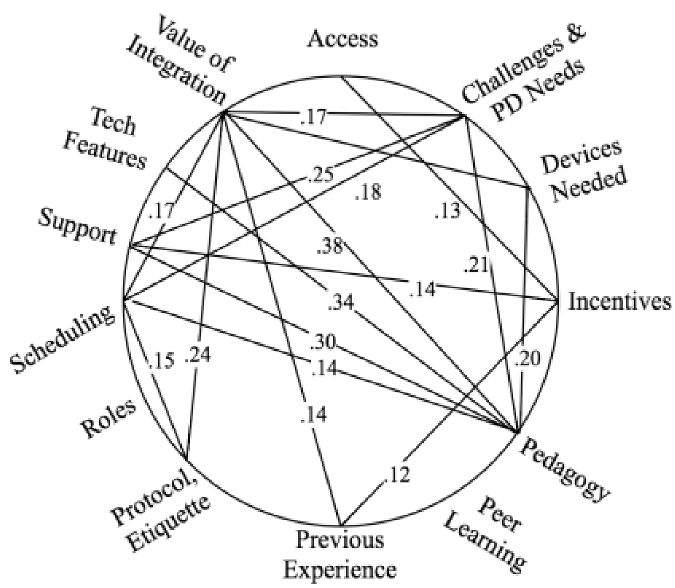

Figure 4. Cluster analysis diagram of nodes.

potential to help researchers working with the breadth and wealth of data that qualitative inquiry produces." (Macia, 2015, p.1092). The cluster analysis of nodes revealed that there was a high word similarity between anticipated pedagogy and perceived value of integration, with Pearson's correlation coefficient (r) =.38, between anticipated pedagogy and perceived technology features (r = .34), between anticipated pedagogy and support (r =.30), between anticipated support and perceived challenges with professional development needs (r =.25).

5. Results and Discussion

In this project, the researchers developed a mixed-method approach for understanding the potential of VC technologies for teaching and factors that shape faculty adoption and use of VC technologies.An immersive professional development for faculty that lasted several weeks and provided a variety of facility and platform options helped identify the technology potential, define the current context for pedagogy updates and related technology selection (Huang & Hsiao, 2012; Martin & Parker, 2014; Park & Bonk, 2007a, 2007b).The analysis of qualitative data identified the potential of VC technologies for teaching in the institutional context, which answered Research Question 1. The results also identified strong relationships between anticipated pedagogy and perceived value of integration, pedagogy and technology features, pedagogy and support, and between support and perceived challenges and professional development needs. This provided research-based information for the institution to modify programming and services.

The statistical results generated from a logistics regression initially provided a model to predict faculty members' use of VC based upon their gender, age, years of college teaching, colleges as disciplinary areas, employ status, perception of importance of technology features, and perceived importance of VC quality integration in their pedagogical practice. The set of variables as in the model accounted for 69.1% of the total variance, with statistical significance. The Wald test reported that three predictors, including employ status, video conferencing with camera view of class members, and cost saving in terms of commuting, were statistically significant ($p <$ .05) individual predictors of using VC in teaching.

These variables map to elements within our conceptual model presenting in Figure 1 related to organizational structure (employment status), subjective norms (cost savings/efficiency), and the relative advantages of seeing students via video features while realizing the advantages of cost savings from not commuting and not using physical classroom space and facilities. For instance, strategies for possible increase of faculty adoption can include increasing incentives or recognition for un-tenured faculty members to gain VC teaching competency, sharing learning community building with video views of remote class members, and return on investment (ROI) comparison between physical class facility use and VC-enabled synchronous classes.

This study extended the findings in previous studies (Martin & Parker, 2014; Park & Bonk, 2007a). The Scale of Perceived Importance in Technology Features and Quality of VC Technologies in Teaching (Appendix A)can be used to define specific ways to support faculty use of VC technologies through training that is sensitive to pedagogical selection. For instance, this current study has also identified the functionality of mobile devices, not including Windows Surface, as participatory (not moderating) tools of VC in teaching and learning. This finding provides specific recommendations for technology selections for teachers and students in a synchronous VC environment.

The study is not without limitation. The data collection had to utilize a purposeful sampling at one institution and with specific VC technology options, limiting the generalizability of results. However, the authors believe that these findings can inform future directions of research. For instance, future studies should aspire to further validate the data collection instruments used here. Also, future studies should continue to explore institutional decision-making in terms of VC technology selection and programming support for innovative teaching.

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Appendix A. Scale of Perceived Importance in Technology Features and Quality of VC Technologies in Teaching

Please rate the importance of the following video conferencing technology features when considering use of a specific technology for teaching.

	Not important at all (1)	Slightly important (2)	Moderately important (3)	Very important (4)
Voice over IP (audio communication among class members)	o	o	o	o
Text chat	o	o	o	o
Video conferencing with camera view of class members	o	o	o	o
Video conferencing with camera view of lab/classroom facility	o	o	o	o
Online presentation with slides	o	o	o	o
Application sharing	o	o	o	o
Participation status (e.g. raising hands)	o	o	o	o
Ability to assign moderator role to students (e.g. sharing their screen, presenting from their computer)	o	o	o	o
Group work with break-out rooms	o	o	o	o
Recording of sessions	o	o	o	o

Please rank the importance of the following qualities in a video conferencing technology for your teaching.

	Not important at all (1)	Slightly important (2)	Moderately important (3)	Very important (4)
Ease of scheduling a synchronous online class session	o	o	o	o
Ease of sharing class materials before the session	o	o	o	o
Ease of sharing class materials during the session	o	o	o	o
Spontaneity in communication	o	o	o	o
Immediacy with audio or video options	o	o	o	o
Ability to provide remote, live demonstrations with equipment not accessible to students	o	o	o	o
Cost saving in terms of commuting	o	o	o	o
Space saving in terms of physical classroom	o	o	o	o