

Evaluating Online Courses via Course-Related Competencies – A Mixed-Methods Quasi-Experiment Evaluation Study of an HIV Prevention Webcourses among College Students

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Abstract: This convergent mixed method quasi-experiment study evaluates the effectiveness of an HIV Prevention Webcourses on reaching HIV related competencies among college students at a large public university in Florida. College students in health majors participated in the study, experiment group were students enrolled in the HIV Webcourses and comparison group were students who enrolled in non-HIV related courses from the same college. Six HIV competencies along with HIV knowledge were measured. Qualitative comments on own learning were also gathered from the experiment group of students. A total of 944 students participated (508 experimental and 436 comparison students). The reliability of the 6-item HIV competency scale showed satisfactory internal consistencies (Cronbach alpha = .914; CITCs ranged .670-.804). Regression analyses, controlling for their baseline scores, showed that students in the HIV Webcourses scored significantly higher than comparison group (all $p < .001$) on all the six competencies. Regression analyses also showed significant differences on objective HIV knowledge test, perceived HIV knowledge in general and about HIV testing specifically between groups ($p < .001$). Students commented they genuinely loved this course as it was extremely well organized, very useful, interesting and informative, and enjoyed the professor's passion of the topics. Students also commented how the personal stories and videos gave perspectives and provided life-changing lessons. Both the quantitative and qualitative data on student learnings convergently demonstrated the impact of this online course. Current study suggested effective design strategies and provided data to support the effectiveness of Webcourses on reaching course-related competencies among college students.

Keywords: competencies, HIV Prevention, Webcourses, mixed methods research, quasi-experiment

Introduction

The introduction of this article is structuring the following way. First, I brief the growing trend of online education. Second, I discuss challenges and some current best practices of online education. Third, I summarize current research on evaluating the effectiveness of online education. Fourth, I point out the importance and feasibility of measuring course-related competencies as student learning outcomes, using an HIV Prevention Webcourses as a case study example. Finally, I summarize gaps from existing research, and delineate the current study purpose on providing empirical data to demonstrate the effectiveness of an online HIV Prevention Webcourses on reaching course-related competencies among college students, as well as identifying effective online course design features based on this case study.

The Growing Trend of Online Education

Online courses are defined as those in which most or all the course content is delivered online, typically with no face-to-face meetings (Allen & Seaman, 2013). Data show that students in higher education

taking at least one online class have significantly increased over years, from 1.6 million in 2002 to 6.7 million in 2011. This represents a compound annual growth rate of 17.3% (Allen & Seaman, 2013). While overall higher education enrollment has declined, many institutions have continued to add online learning programs. In fact, more than 60% of the higher education institutions viewed that online education crucial to their long-term strategic goals in the last five years (Allen, Seaman, Poulin, & Strut, 2016).

Challenges and Strategies for Online Education

Despite the growing trend of online education, barriers and challenges exist both among students and instructors. Some of the common challenges or barriers regarding online education from students' perspective include, perception of lower quality education, isolation, and detachment of peer and instructor interactions. Studies show that students strongly expressed the importance of the presence of teacher (Richardson & Lowenthal, 2017; Tichavsky, Hunt, Driscoll, & Jicha, 2015). Challenges from instructors' perspectives include, time commitment to course development, potential of student cheating and collaboration, and technology frustrations. (Tichavsky et al., 2015).

Moore (1997) introduced the concept of transactional distance, the psychological and communications space separating between the learner and instructors which will need to be crossed especially in online learning (Moore, 1997). Thus, selecting appropriate communication medium taking learner and content characteristics into consideration when delivering the teaching and learning are critical (Moore, 1997). Some recommended ways to minimize transactional distance in online learning include creating a communicative learning culture such as online discussion groups, identifying preferred delivery format meet learners' needs, providing self-paced online resources to empowers learner take charge of own learning, and offering regular personalized feedback (Pappas, 2017).

Baran and Correia identified some best practices for successful online teaching for instructors. These include that instructors know the course content, know the students, have clear course design and structure, facilitate teacher-student relationships, guide student learning, evaluate online courses, and maintain teacher presence (Baran & Correia, 2014). The Community of Inquiry (COI), one of the most frequently used online learning frameworks, notes that a meaningful educational experience consists of teaching presence, social presence, and cognitive presence (Garrison & Anderson, 2000). Thus, online courses should thrive to create opportunities to enhance spontaneity and emergent design, coach students how to learn online, explore the use of diverse technologies for enhancing communication and social presence, and articulate and manage the expectations of the online community (Stodel, Thompson, & MacDonald, 2006).

Effectiveness of Online Education

Recent studies have focused on evaluating the effectiveness of online education through comparing student's grades achieved between online learning and traditional classroom learning (Shotwell & Apigian, 2015; Stack, 2015; Tichavsky et al., 2015). These studies showed mixed results on student grades. While a meta-analysis study reports that on average, student performance is higher for online sections than face-to-face learning (Means, Toyama, Murphy, Bakia, & Jones, 2009), another study show that exam scores are higher for traditional classes than online classes (Figlio, Rush, & Yin, 2013). In particular, Figlio and colleagues found that Hispanic students, male students, and lower-achieving students, showed the greatest score differences on the mode of course delivery. A recent study, controlling for self-selection effects on delivery mode and the proctoring of exams, shows that the academic performance of online students was in fact the same as the traditional students (Stack, 2015).

Course related Curriculum Competencies Measures

Competencies learned can demonstrate how well the course experience aligns with the scope of the academic curriculum (Ezeonwu, Berkowitz, & Vlasses 2013; Hou, & Pereira, 2017; Hou, 2009). Due to the need of curriculum alignment between competencies and workforce related skills, competencies (instead of grades) are increasingly used as an important indicator by academic accreditation bodies to assess the quality of academic programs. Course learning objectives, on the other hand, describe the knowledge and skills a student is expected to demonstrate upon completion of a specific course. When carefully designed, these objectives are intended to relate, in some discernable way, to the competencies of the overall program of study.

A major challenge to demonstrate the impact of a course has been to measure student outcomes. Behavior change or skill acquisition takes time and may not always be realistic or sensitive outcome indicators for evaluation immediately after a course. Behavioral scientists have come up with various indicators to predict behavioral outcomes. Among these, the Social Cognitive Theory (Bandura, 1986) is arguably the most significant and widely used and accepted theory that has been applied to various learning outcomes. According to the Social Cognitive Theory, how people behave can often be better predicted by the beliefs they hold about their capabilities, which are called *self-efficacy* beliefs. These self-perceptions or judgment of a person's capability to accomplish a certain level of performance help determine what individuals do with the knowledge and skills they have. Self-efficacy (SE) and academic competencies are indicators that have been successfully used to assess the impact of student learning after courses (Hou, & Pereira, 2017; Hou, 2009).

HIV Webcourses Case Study

College students are at the life stage of engaging in HIV-risk behaviors. Studies showed many college students have oral, vaginal and/or anal sex, low condom-use, and have multiple partners (Caico, 2014, Calloway, Long-White, & Corbin, 2014; Hou, 2009a; Hou, 2007). Besides protective sex via condom use, HIV testing is another important preventive strategy. Both CDC and The U.S. Preventive Services Task Force (USPSTF) recommend regular HIV testing among all adults and young people so everyone can be aware of own HIV status (Branson et al., 2006; CDC, 2017). For college students, some major barriers towards testing have been the low perceived risk of HIV infection, lack of testing-specific knowledge, fear of finding out if positive, and HIV/AIDS related stigma (CDC, 2015; Hoppel, 2012; Hou, 2009b; Hou, 2008; Hou & Luh, 2007; Hou, 2007; Hou, 2004;). A number of systematic reviews and meta-analyses studies have shown web-based HIV programs are effective to change HIV related knowledge and behavioral outcomes (Muessig, Nekkanti, Bauermeister, Bull, & Hightow-Weidman, 2015; Hosseini, 2013; Noar, et al., 2009; Noar, et al., 2010).

However, limited studies have evaluated HIV education programs using teaching and learning related outcomes. There is a lack of validated HIV related competency measurement for learning. One study examined HIV/AIDS-related competencies among nursing students in South Africa (Modeste & Adejumo, 2014). Using a qualitative approach and systematic research synthesis, this study identified core competencies related to HIV and AIDS for nursing graduate students, including HIV related knowledge, ethics, policy, interdisciplinary care, professional development, holistic safe practice, and health education. Yet, quantitative measurement on key HIV-related competency are not available and needs to be developed and tested.

Gap

Although existing literature show that using web-based program to deliver HIV prevention information can be effective and has the potential to reach larger audience especially among young people (Muessig, et al., 2015), there are several important research gaps. First, there is a lack of HIV related competency measurements to assess student curriculum competencies beyond individual knowledge or behavior change. Given colleges students are our next generation of change agents in the larger society and community, developing these college-curriculum HIV related competency measurements are critical to ensure students can be a more effective change agent on HIV prevention and education efforts when they graduate. These could include, but not limited to comprehension on how HIV impact the global society, educate others about prevention, ethical-issues which are important for college students, in addition to behavior change outcomes. Second, effective web-based delivery education design and strategies needs to be identified for future program development and continue improvement. One major challenge of such web-based educational program was the difficulty to find the reliable and relevant health information on the web. In addition, it was hard to control the credibility and accuracy of the health information from the Web sites (Escoffery et al., 2005). Information delivered via academic Webcourse can be a credible way to provide organized and reliable information to educate college students. Third, online course like Webcourses has not yet been widely implemented or evaluated in terms of both the students learning outcomes and course design strategies. A gap exists because previous research has mostly provided a partial view by using either quantitative or qualitative approaches. There is a need for a more complete understanding through comparing and synthesizing both quantitative and qualitative data (Creswell & Clark, 2018). Mixed methods research studies can provide a more comprehensive picture to answer such questions, using data from both quantitative numbers and qualitative narratives to show evidence from a more holistic perspective (Creswell & Clark, 2018).

Purpose

The purpose of this mixed method research case study is to provide evidence to demonstrate the effectiveness of this HIV Prevention Webcourses on HIV related competencies and outcomes among college students at a large public university in Florida. In addition, this study aims to identifying effective design and learning strategies to deliver web-based educational information.

Quantitative measurements include a new 6 HIV Competency Scale, a previously validated HIV knowledge scale (Hou, 2008; Hou, 2004), as well as HIV testing and condom use intention and self-efficacy (Hou, 2009a; Hou, 2009b; Hou & Luh, 2007). Qualitative measures identify most helpful types of online course content, strategies and challenges in effective online learning, as well as learning impact among students. The integration of both quantitative and qualitative results can provide a value-added understanding on the impact and evidence-based learning outcomes to demonstrate the effectiveness of course, as well as identify effective design features of Webcourses to promote learning. Educators in higher education can see, using an HIV Prevention Webcourse as an example, how course-related competencies can be developed and validated to evaluate the effectiveness of student learning. In addition, online instructors can learn how some of the best practice of online education can be translated into concrete strategies from this HIV Webcourses case study, and apply or adapt to their own online courses. Finally, educators interested in scholarship of teaching and learning can see how mixed methods research design can be integrated with quasi-experiment study to evaluate online courses.

Methods

Design and Sample

A mixed-methods quasi-experiment study was conducted. College students in health-related majors participated in the study. Experiment group was students enrolled in the HIV Webcourses (n=508) and comparison group was students who enrolled in non-HIV related courses (n=436) from the same college during 2016-2017 academic years. Both groups of the students completed the same HIV prevention survey before and after their semester-long courses. In addition, students in the HIV Webcourses also completed course evaluation survey to provide comments and feedback regarding course design, content, and learning impact.

Design of the HIV Webcourse

The HIV Webcourses was a large semester-long fully online course (3-credits) offered to students in health service administration, health science (pre-clinical), or related programs. The average number of students enrolled is about 100-150 per course session. One key strength was the course instructor has extensive experience conducting HIV related preventive research and has deep passion and understanding of related issues. The instructor used the Understanding by Design framework (UbD framework) in the process of developing the HIV Webcourse (Mctighe and Wiggins, 2012). The course design was planned backward with the end or desired outcomes, course learning competencies, in mind. In addition, the design was focused on teaching and assessing for understanding, as well as continual improvement process (Mctighe and Wiggins, 2012). Based on the UbD framework and considering minimizing the transactional distance concept discussed earlier, the HIV Webcourses incorporates the following key unique design features to facilitate online learning:

(1) *Weekly announcement to keep students on track of module progression.* Weekly announcements were set up to be released on each Monday morning to help students get the weekly rhythm of the online course, as well as to facilitate the presence of course instructor (Richardson & Lowenthal, 2017; Tichavsky et al., 2015). The announcements outline the content activities, as well as noted the assignments or activities of the week to keep students on track.

(2) *Easy-to-learn modules with up-to-date resourceful websites and multiple content sources to support different learning styles.* Each module uses the same structure to facilitate students know what to expect and where to find information for clear course design and structure (Baran & Correia, 2014). Each module starts with an overview, module objectives, module content with required readings, required videos to supplement or complement required reading contents, required stories, then module assessment (assignment activities). The variety of multiple online sources aims to support different online learners' needs (Moore, 1997; Pappas, 2017). Due to the rapidly changing HIV/AIDS epidemics globally, all the module content and readings were based on the most current HIV/AIDS epidemics and statistics, via credible official webpage or reports from CDC, WHO, HIV.gov, etc.

(3) *Instructor avatar throughout the online modules to provide guidance, online persona, and direction among module components.* An instructor video was used to introduce the professional and personal background with an aim to close the online distance and increase accessibility to instructor (Moore, 1997; Pappas, 2017). In addition, various instructor avatars were created to increase online persona presence of the instructor, and to provide guidance and directions among module components. Such persona image icons also help break the text and paragraphs to facilitate student navigating the module contents.

(4) *Real-life stories to humanize the disease & increase relevance.* To keep students continuously engaged in the online module, personal stories from real people were provided in each module to help students

understand and emphasize the struggles faced among individuals living with HIV/AIDS (Mctighe and Wiggins, 2012). These stories were all hand-picked to deepen or complement the issues discussed in corresponding module content. For each personal story, a catchy heading was created to highlight the central theme of the story, with content edited to protect privacy and identify. Stories were meant to help engage the emotional dimension of the course content which is critical in addition to gaining factual knowledge. HIV related stigma and struggles can be conveyed more effectively in a relatable way through the power of real-life stories.

(5) *Variety of assignment to keep students engaged and thrive.* A total of four 25-item *online quizzes* were given throughout the semester to help hold students accountable and engaged in the course content (Mctighe and Wiggins, 2012). In addition to these automatically graded quizzes, three additional manually graded assignments were incorporated to encourage deeper thinking and reflections on student learning (Moore, 1997; Pappas, 2017). (1) A *current event article* was incorporated to help students further research on a course related current issues and share back with the class. (2) The *discussion post and respond assignment* was provided to encourage students discuss controversial topics, practice share perspectives with supporting evidence or citations, and exchange thoughts and comments with peer fellow students. The large online class was intentionally divided into 5-6 smaller groups for this discussion assignment. This allows each student being more comfortable with discussing issues and perspective in a smaller group of 20-25 student environment. This helps students reading and responding other students' posts and responses in a more manageable and less overwhelming online environment. (3) Each student was also given the choice to choose one of the 5 recommended books to read and reflect as their *book review project assignment*. All book choices are personal stories, ranging from the naked truth of HIV from a newly diagnosed young woman, how a celebrity with HIV promote combating stigma through advocating love is cure, personal journey of an AIDS doctors, to how varies characters cope with HIV in what looks like crazy in an ordinary day, etc.

(6) *Prompt communication and feedbacks.* Taking advantage of the online environment, students can communicate with the instructor via multiple channels (email, messages, chats, posts, etc.) whenever having questions or needing clarifications on content or assignments. Timely communications and feedback were provided throughout the course, along with grades and feedbacks for each assignment (Pappas, 2017; Mctighe and Wiggins, 2012; Moore, 1997).

Data Collection

This study used a mixed methods quasi-experiment study design. An anonymous online HIV Prevention survey via external link was conducted before and after the course among both experiment and comparison groups. Details of the survey measurements were described below. Students rated anonymously their agreement level with the HIV competency statements on a 5-point Likert-type scale, ranging from strongly agree (coded as 5) to strongly disagree (coded as 1), along with other survey items. To ensure anonymity of the participants, no personal information, such as name or student ID, were asked. Students were reminded that how they rated their confidence level on the course competency statements or other HIV-related knowledge items would NOT influence the grade they would receive. The survey took about 15 min. to complete, and extra bonus points were provided by course instructors to encourage survey participation among students in both experiment and comparison groups. A student self-generated ID was used to link students' before and after responses for comparison purposes. IRB approval was obtained at the PI's university before the study was conducted.

Measures

Quantitative measurements include a new 6-item HIV Competency Scale, a previously validated HIV knowledge scale (Hou, 2008; Hou, 2004), as well as HIV testing and condom use intention and self-efficacy (Hou, 2009a; Hou, 2009b). Qualitative measures identify most helpful types of online course content, strategies and challenges in effective online learning, as well as learning impact among students.

HIV Competency Scale (6-item). Item of the HIV Competency Scale were drafted based on the HIV Webcourses course competencies developed and approved by the PI's university curriculum committee. HIV Competency items ask students to rate, on a 5-point Likert scale, their perceived self-confidence levels for the following statements: discuss the global impact of the HIV/AIDS, its epidemics and prevention strategies, empathize the difficulty of maintaining treatment schedule, identify the needs of specific groups, recognize societal psychological and medical impacts among people living with HIV/AIDS, and describe related ethical and legal issues (see Table 1).

HIV knowledge. Hou's 14-item objective HIV knowledge test scale, which was validated among multiple samples of college students with satisfactory internal consistencies ($\alpha=.70$), was adapted in the current study (Hou, 2008; Hou, 2004). Two subjective HIV knowledge items asked participants to rate on a five-point Likert scale to assess perceived levels of HIV knowledge, "How would you rate your knowledge about HIV/AIDS in general?" and "How would you rate your knowledge specifically related to HIV testing?" (Hou, 2008; Hou 2004).

HIV testing and intention. HIV testing intention measures intention, on a five-point Likert scale, towards obtaining an HIV test in the next 6 months. HIV testing behavior were yes/no items. At baseline asked whether students have ever had an HIV test. At post-survey, students were asked whether they had gotten HIV tested in the past 3 months (during the HIV Webcourses intervention period) (Hou, 2009b).

Condom use intention and self-efficacy. Condom use intention measures students' intention to use condom during next sexual activity. Self-efficacy asked participants' confidence of using condom or communicate condom use with partners (Hou, 2009a).

Qualitative items. Qualitative feedback on the Webcourses features, as well as reflections on own learning were gathered among students in the experiment group to gain deeper understanding. Responses from four main qualitative items were analyzed, including "most helpful types of HIV Webcourses content" "strategies in online learning" "challenges in own leaning" and "one thing I will remember in 5 years". These data were meant to complement the quantitative data collected to provide a more holistic picture of the students' learning, as well as to identify most effective course components of the HIV Webcourses.

Analyses

Data from the baseline survey were used to assess the reliabilities of the 6-item HIV course competency scale (HIV-Competency). Descriptive statistics, item-total correlation, and Cronbach's alpha coefficients were calculated to evaluate the internal consistencies. Data from before and after courses were used to compare HIV-Competency between experiment and comparison groups. In addition to HIV-Competency, other HIV-related outcomes including objective and subjective HIV knowledge (general and testing specific), testing intention and behavior, as well as condom use intention and self-efficacy were also compared before and after, and between the two groups of students. T-tests were used to compare continuous variables while chi-square tests were used to compare dichotomous variables between groups. Furthermore, for continuous variables, linear regression analyses were conducted to compare HIV related outcomes between experiment and

comparison groups, while controlling for baseline levels. Logistic regression analyses were conducted to compare dichotomous variables between the two group, while controlling for baseline levels. For qualitative feedback and narratives, top three most frequently mentioned responses were highlighted, with student comments or reasons provided side-by-side via a joint-display table to illustrate quantitative and qualitative findings.

Results

Sample Characteristics

A total of 944 students participated (508 experimental and 436 comparison students), about 76% were females, and 94% indicated themselves as heterosexual. Over one-thirds (36%) were single but has boy or girl friends, another one-thirds (30%) were single and not in any relationship. There were about 6% indicated themselves have friends with benefits. About 20% were married or engaged, and the rest were others. The study sample involved diverse student racial/ethnicity, with only 42% were white, 22% self-identified as African Americans, 21% Hispanics, 9% Asians, and 7% multi-racial.

Overall study participates were active in sexual activities, with over 80% reported having had both oral and vaginal sex, and about 30% also reported ever had anal sex. Only about 40% have been tested for HIV. Only about one-third reported often or always use condoms using (vaginal) sexual behaviors. Almost half (48%) reported they have had sex with someone who has more than one sex partners. About 13% reported a sexually transmitted infection (STI) history.

HIV Competency

The reliability of the 6-item HIV competency scale (on 5-point Likert scales) showed satisfactory internal consistencies (Cronbach alpha = .914; CITC s ranged .670-.804). There were no significant differences between groups on any of the competencies, except that students enrolled in the HIV Webcourses scored a little higher on describing the epidemiology of HIV/AIDS competencies at baseline.

Table 1. Reliabilities of the 6-item HIV Course Competency Scale (HIV-Competency) (n=944).

Item Description	Mean (SD)	CITC	Alpha if deleted
(HIV-Competency 1). Discuss the global impact of the HIV/AIDS epidemic among developed and developing nations.	3.16 (1.20)	.738	.902
(HIV-Competency 2). Describe the epidemiology of HIV/AIDS, as well as prevention, clinical and treatment strategies.	3.20 (.124)	.772	.897
(HIV-Competency 3). Empathize with the difficulty of maintaining a treatment schedule and locate reliable sources for HIV/AIDS.	3.33 (1.20)	.670	.911
(HIV-Competency 4). Identify the needs of specific populations affected by HIV/AIDS.	3.18 (1.23)	.789	.893
(HIV-Competency 5). Identify societal, psychological, and medical impacts among people living with HIV/AIDS and their families.	3.25 (1.20)	.804	.893
(HIV-Competency 6). Describe social, ethical, and legal issues related to HIV/AIDS.	3.20 (1.24)	.771	.897
HIV-Competency Scale (6-item)	Item mean = 3.22	Cronbach's Alpha = .914	

- CITC = Corrected Item-Total Correlation

After controlling for baseline competency scores, regression analyses showed that students took the HIV Webcourses (experiment group) scored significantly higher than those who did not take the HIV Webcourses (comparison group) on all the six HIV Competencies (all p-value <.001). Overall students in the HIV Webcourses scored between 4.27 and 4.41, while comparison group of students scored between 3.34 and 3.49 per competency at post-test.

Table 2. HIV course competencies before and after the HIV Webcourses among experiment (n=436) and comparison (n=508) groups.

	HIV course competency		C-Mean (SD)	E-Mean (SD)	P-value
1	HIV-Competency 1.	before	3.13 (1.24)	3.21 (1.15)	.291
		after	3.36 (1.20)	4.27 (.79)	<.001**
2	HIV-Competency 2.	before	3.08 (1.29)	3.35 (1.15)	.001*
		after	3.37 (1.22)	4.36 (.78)	<.001**
3	HIV-Competency 3.	before	3.27 (1.23)	3.39 (1.15)	.111
		after	3.48 (1.21)	4.37 (.81)	<.001**
4	HIV-Competency 4.	before	3.15 (1.28)	3.23 (1.17)	.298
		after	3.34 (1.25)	4.30 (.82)	<.001**
5	HIV-Competency 5.	before	3.22 (1.26)	3.28 (1.14)	.419
		after	3.49 (1.17)	4.41 (.76)	<.001**
6	HIV-Competency 6.	before	3.19 (1.28)	3.21 (1.19)	.848
		after	3.44 (1.21)	4.33 (.80)	<.001**

- ** p<.001; *p<.05
- C = Comparison Group; E=Experiment Group

Objective and Subjective HIV Knowledge

At post-survey, objective HIV knowledge test scores were higher among students in the HIV Webcourses than students in the comparison group (11.03 vs. 9.47, $p<.001$). Similarly, data showed that students in the HIV Webcourses also perceived higher HIV knowledge than comparison group, with 3.82 on subjective HIV knowledge in general and 3.42 on testing specific knowledge among students in the experiment group, comparing with 3.06 and 2.89 respectively among students in the comparison group at post-survey ($p<.001$). After controlling for baseline differences on objective and subjective knowledge between groups, linear regression analyses result still showed significant differences on both objective and subjective HIV knowledge after the HIV Webcourses intervention ($p<.001$) (Table 3).

Table 3. Objective and subjective HIV knowledge, HIV testing, and condom use (CU) intention and self-efficacy, before and after the HIV Webcourses among experiment (n=436) and comparison (n=508) groups.

HIV-related outcomes		C- Mean (SD)	E- Mean (SD)	P-value	
1	Objective HIV knowledge test (14-item).	before	9.36 (2.96)	9.97 (2.67)	<.001**
		after	9.47 (3.65)	11.03 (2.91)	<.001**
2	Subjective knowledge (HIV/AIDS in general).	before	2.85 (.847)	2.99 (.768)	.007
		after	3.06 (.822)	3.82 (.666)	<.001**
3	Subjective knowledge (HIV testing specifically).	before	2.61 (.963)	2.61 (.925)	.974
		after	2.89 (.985)	3.42 (.824)	<.001**
4	HIV testing intention in the next 6 months.	before	2.56 (1.22)	2.67 (1.22)	.145
		after	2.52 (1.21)	2.73 (1.22)	.096
5	HIV testing (Yes%)	before	40.0%	36.8%	.347
		after	11.3%	13.6%	.629
6	CU intention (Yes%)	before	50.6%	58.7%	.015*
		after	49.4%	60.0%	.054
7	CU self-efficacy (Yes%)	before	66.8%	66.0%	.834
		after	56.3%	66.9%	.048*

- Condom use intention – intention to use condom next time during sexual activity.
- Condom use self-efficacy – confidence of using condom or communicate condom use with partners.
- HIV testing – (before) Ever had HIV test when taking the baseline survey. (after) Whether students had gotten HIV tested in the past 3 months (during the intervention period).
- ** p<.001; *p<.05
- C = Comparison Group; E=Experiment Group

HIV testing intention, condom use intention, and self-efficacy

Bivariate analyses showed no or borderline significant differences on HIV testing and condom use intention, or self-efficacy at baseline (Table 3). After controlling for baseline variables, regression analyses showed that students in the HIV Webcourses were 1.9 time more likely to have confidence on using condom or communicating condom use with partners ($p=.009$). Yet neither HIV testing nor condom use intention showed significant differences between groups (data now shown)

Qualitative comments and feedback

Four main qualitative questions were used to gather student feedback on the course components and reflections on own learning. The top three *most helpful types of HIV Webcourses content* identified by students were all story-based components including personal stories (33.3%), videos (18.0%), and the book project (12.8%). Students commented these contents gave the HIV survivor's perspective, and helped them better understand and emphasize personal real-life situations which individuals with HIV/AIDS face and going through. Such online course components help increase personal relevance, were easy to learn, and provided further insights and added emotion dimension to keep students

interested. These real-life accounts help students relate to personal experience, and deepened their engagement in learning even in an online environment.

The top three *strategies students used in online course learning* were reading all course materials (28.2%), independent research on the course topics (9.9%), as well as taking notes as students reading through the online modules (9.9%). Students stated that reading all course contents was key to understand the topic, gain more related information, better perform in assignments, and clarify various concepts. In an online learning environment, reading to learn becomes even more critical; while taking notes can assist with fast recall.

Regarding *challenges in the learning process*, almost 40% of the students indicated none because the course setup was clear, logic, organized, interesting and informative. About 20% indicated time management was a challenge due to busy life schedule, procrastination, personal priorities, or not used to online learning. About 15% of the students indicated the extensive content was a challenge and time consuming.

Finally, top three *things students stated they will remember in five years* were all course information (28.5%), HIV stigma (14.1%), and the book project (12.8%). Students comments the course information was memorable, insightful, and can help close friends. HIV stigma was the most outstanding concept throughout the course, and the book project relates to personal experience and changed own perspectives (see Table 4).

Table 4. Qualitative comments from students' comments and feedback on the HIV Webcourses

A. Top three most helpful types of the HIV Webcourses contents ... because						
1.	Stories	33.3%	Personal relevance	Kept me interested	Real Life	New to me
2.	Videos	18.0%	Easy to learn	Added emotion	Visual	Extend the issue
3.	Book project	12.8%	Personal experience	Further insight	Stigma	
B. My top three strategies in learning ... because						
1.	Reading all course materials	28.2%	Help understand the topics	Helpful in assignments		
2.	Research the topics	9.9%	Help understand the topics	Understand people with HIV		
3.	Taking Notes	9.9%	Help with fast recall	Helpful in assignments		
C. Top three challenges in my learning process ... because						
1.	None	38.2%	Great			
2.	Time management	20.6%	Busy life schedule	Procrastination	Personal priorities	Not used to online courses
3.	Extensive content	14.7%	Time consuming	Personal priorities		
D. Top three things I will remember in 5 years ... because						
1.	All course information	28.3%	Memorable	Insightful	Informative	Can help close friends
2.	HIV stigma	14.1%	Most outstanding concept	How to stop stigma	Understanding people	Loving human
3.	Book project	12.8%	Personal experience	Changed my perceptions	Amazing	

Overall student course evaluation ratings were very high (4.5 on a 5-point Likert scale) on effectiveness of the course organization, explanation and communication, environment to conducive learning, provided useful feedback, helping students achieve course objectives, and overall instructor effectiveness. Students commented they genuinely loved this course as it was extremely well organized, information was very useful, interesting and informative, and enjoyed the passion of the professor. Students overwhelmingly voiced the need for all college students to be educated on HIV related issues. Students also commented how the personal stories and videos of those affected with HIV/AIDS opened their eyes and gave perspectives and provided life-changing lessons. In addition, students commented that the course had opened their eyes and really taught the impact of the disease and stigma people are facing, the professor truly cares for her students and provided wonderful and timely

feedback, and everything was mapped out clearly from the beginning with perfect execution and instructions as if the instructor was instantaneous with her response to questions.

Discussion

Data from the current study show that the HIV Prevention Webcourses was effective in reaching both HIV-related competencies and HIV-related psychosocial outcomes related to behavioral change. Study showed that students took the HIV Webcourses (experiment group) scored significantly higher than those who did not take the course (comparison group) on all the six HIV Competencies (all p -value $<.001$) at the end of the semester. In addition, findings show students enrolled in the HIV Webcourses also scored significantly higher on both objective and subjective HIV knowledge, comparing with those who did not enrolled in the Webcourses ($p<.001$). Although intention towards HIV testing and condom use did not reveal significant differences, experiment group of students were 1.9 time more likely to report having confidence on using condoms or communicating condom use with partners ($p=.009$), compared with the comparison group.

The 6-item HIV competency scale also revealed satisfactory reliability with Cronbach alpha of .914, demonstrating good internal consistencies. The competencies measured in the current study share some of the key aspects of the competencies identified from a previous research using a qualitative approach among nursing students in South Africa (Modeste & Adejumo, 2014). These shared competencies including HIV/AIDS basic scientific knowledge, policy, and ethics related competencies. There are also some differences between key areas identified as the current competencies focus more from the broader public health and HIV prevention perspectives, such as HIV/AIDS global impact, epidemiology, social stigma, and special populations; instead of clinical care perspectives such as interdisciplinary care, professional development, or holistic safe practice related competencies emphasized in the previous study (Modeste & Adejumo, 2014).

Overall, the student evaluation for the HIV Webcourses was very high (4.5 on a 5-point Likert scale) in terms of the effectiveness of the course organization, the online learning environment and communication, as well as the overall instructor effectiveness. Specifically, students indicated the setup or design of the Webcourses was clear, logic, organized, interesting and informative, supporting the clear design structure best practice principle (Baran & Correia, 2014). The weekly announcement in particular help keep students on track and facilitate the presence of course instructor (Richardson & Lowenthal, 2017; Tichavsky et al., 2015), and the timely communication and feedback via discussion boards, assignment chats, and emails further demonstrated the instructor social presence (Stodel, Thompson, & MacDonald, 2006). About 40% indicated no challenges in their online learning for the course, while 20% indicated time management was a challenge due to own busy life schedule, procrastination tendency, or personal priorities.

Among the various design features, the top three favorite components identified were mostly involved with emotional engagement such as personal stories, videos, and the book project. Students indicated that videos and stories gave them more vivid feelings and understandings of the struggle from the HIV/AIDS patients' perspectives. These qualitative comments supported that the HIV Webcourses provided a good platform to address some of the key challenges identified from previous studies, including providing health information which is reliable, relevant, credible, engaging, and at appropriate depth (Escoffery et al., 2005). In addition, studies show that students can gain more information from the web, and were more motivated and willing to engage in learning. Current findings show that college students prefer such flexibility and independence during the learning process. In consistent with existing literature, the web-based learning model can also further enhance coordination, communication collaboration among students, and facilitate distance learning (Hosseini, 2013).

The current study is limited to its convenience sample. Study participants were invited from one college within a large public university, thus generalization of study findings may warrant attention. It would also be beneficial to compare the HIV course delivered as webcourse and non-webcourse, using the same base materials and resources. Unfortunately, the author's institution does not currently offer in-person HIV course sessions, and this could be an area for future research. Despite not being able to compare webcourse vs non-webcourse delivery, the current quasi-experiment research design with an equivalent online comparison group from the same college provided was a stronger design, as opposed to a commonly used single group before-after test. Furthermore, the clear and well-organized HIV Webcourses help ensure the quality and consistency of the online learning delivery. The convergent evidence from both quantitative statistics and qualitative narratives add values to the credibility of the effective learning outcomes observed.

Using Webcourses to deliver HIV Prevention knowledge can be effective and reach more college students (Muessig, et al., 2015; Hosseini, 2013; Noar, et al., 2009; Noar, et al., 2010). College students normally have busy schedule for classes and extra-curriculum activities, so their time is limited and less flexible. Webcourses can address their limited attention and time while allow flexibility and convenience in learning at own pace and location. Continuous attention is needed to ensure such Webcourses continue to provide updated information and address different student engagement issue. The reliable HIV Competency scale can be used in future study to assess the effectiveness of teaching and learning.

Conclusion

In short, findings show that the HIV Webcourses was well designed and effective in building students' HIV related competencies and HIV related outcomes, comparing with the comparison groups. Both the quantitative scores and qualitative comments on student learnings convergently demonstrated the impact and effectiveness of this online course, providing stronger and more robust evidence than either quantitative statics or qualitative narratives alone. Furthermore, the qualitative data highlighted some key design features for online learning, suggesting emotional involvement via personal stories or video are as critical as the factual information itself. Lessons learned have implications on translating best practices into concrete strategies for effective online education delivery, as well as incorporating mixed methods research design to evaluate online courses via course-related competencies.

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