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Authors

Coyle, Karin K
Chambers, Brittany D
Anderson, Pamela M
et al.

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Blended Learning for Sexual Health Education: Evidence Base, Promising Practices, and Potential Challenges

Karin K Coyle[1], **Brittany D Chambers**[2], **Pamela M Anderson**[1], **Regina Firpo-Triplett**[3], **Emily A Waterman**[4]

[1]ETR, 100 Enterprise Way, Suite G300, Scotts Valley, CA 95066

[2]Preterm Birth Initiative-California, University of California, San Francisco, 550 16th Street, 3rd Floor, San Francisco, CA 94158

[3]100 Enterprise Way, Suite G300, Scotts Valley, CA 95066

[4]Prevention Research Centerm The Pennsylvania State University, 119 Health & Human Development, University Park, PA 16802

Abstract

Background—Blended learning is a combination of online learning and face-to-face instruction, and is increasingly being used in K-12 settings. A meta-analysis conducted for the Department of Education suggests blended learning is more effective than either group-based or online learning alone, particularly in K-12 settings.

Methods—This paper provides a narrative review of the literature from 2000 to 2017 on blended learning as it applies to sexual health education programs, and discusses outcomes, best practices and potential challenges of blended learning that may be important for practitioners and researchers considering this approach.

Results—Blended learning approaches are being used successfully in sexual health education programs, including school-based programs, and have yielded positive behavioral and psychosocial changes. Similar to traiditional group-based programs, not all outcomes tested in these programs showed positive impact. Designing blended learning programs can be challenging, but there is a large best-practice literature that can inform practitioners interested in using it.

Conclusions—Blended learning approaches are viable for sexual health education and offer numerous advantages to group-based only programs, such as confidential personalization and an instructional approach that is familiar and engaging for participants.

Keywords

Blended learning; HIV/STI and pregnancy prevention; adolescents; online learning; school-based

Blended learning, a combination of online learning and face-to-face instruction to enhance the learning experience,[1–4] is increasingly being used in education as an

HUMAN SUBJECTS' APPROVAL STATEMENT

This study was a narrative review and did not involve human subjects directly.

additional pedagogical strategy because of its many benefits to learning, such as flexibility, convenience, improved participation, augmented learning experiences, and greater outcomes.[2–5] This approach is used across a range of settings, including K-12 schools, colleges and universities, and health care, among others. K-12 schools use blended learning across subject areas, and some suggest blended learning may become a dominate teaching model of the future.[6] To date, there are nine studies of HIV/STI and pregnancy prevention programs that have used a blended learning approach, which highlight its potential for teaching sexual health in multiple settings, including schools.[7–15]

There are four categories of blended learning models being used in K-12 schools today, some of which have been used in sexual and reproductive health programs: 1) the rotation model; 2) the flex model; 3) the a la carte model; and 4) the enriched virtual model.[1] Within a rotation model students transition from online to face-to-face instruction within a given subject on a fixed schedule or at a teacher's discretion. The rotation model consists of four sub-models: *flipped classrooms*, which involves face-to-face instruction at school and online instruction at home; *station*, which features a rotation between face-to-face and online instruction within the same classroom; *lab*, or the rotation of face-to-face and online instruction between different rooms; and *individual* where each student has a personalized rotation schedule between face-to-face and online instruction. The rotation model is the only one that exists within a traditional classroom without disruption, a sustainable method for traditional school schedules. The flex, a la carte, and enriched virtual models are considered disruptive, as they do not fit within a traditional school schedule. For example, the flex model is done primarily online, with some face-to-face instruction, where each student is allowed to customize their own schedules. Within the a la carte model some courses are done entirely online through guided lectures and activities from one instructor. However, students can still have some face-to-face learning experiences with instructors. Lastly, the enriched virtual model is when an entire school community divides instruction equally between face-to-face instruction and independent learning through online modules and activities. Both sustaining and disruptive blended learning models have been effective in increasing student engagement and learning capabilities.

A meta-analysis conducted for the Department of Education suggests blended learning is more effective than either group-based or online learning alone, particularly in K-12 settings,[2–3] and indicates that students learn more in collaborative settings where they are able to work independently online and interact with instructors and peers through guided activities. This paper provides a summary of the literature on blended learning as it applies to sexual health education programs, and discusses outcomes, best practices and potential challenges of blended learning that may be important for practitioners and researchers considering this approach. More specifically, this paper addresses the following questions: 1) How has blended learning been used thus far in sexual health education programs, and with what outcomes? 2) What are the evidence-based elements and/or promising practices of blended learning that could be applied to sexual health education programs? 3) What are the potential challenges of the blended learning model that may be important for sexual health education programs?

We used a narrative review to identify sexual health education studies using blended learning, as well as promising practices and pitfalls of blended learning more broadly, with the goal of addressing our three review questions.

METHODS

Review Criteria

Studies for review question #1 were identified using the following criteria: a) published during the period of January 1, 2000 to December 31, 2017; b) included a sexual and reproductive health intervention with an interactive online component where students had control of time, place, path and/or pace; and c) had at least one component in a supervised brick-and-mortar location away from home. Studies for review questions #2 and #3 fell within the date range of January 1, 2000 and July 31, 2016 and could discuss blended learning within any subject area, not just sexual health education.

Search Process

Studies were identified through a search of the following electronic databases: Google Scholar, PubMed, and the Cumulative Index of Nursing and Allied Health Literature using a pre-established set of search terms including blended learning, sexual and reproductive health, sexual health, comparative effectiveness research, prevention research, prevention science, innovation, flipped classroom, and/or computer-assisted education.

Information Extraction and Organization of Studies for Question #1

The search yielded 161 articles, 9 of which met all study criteria. These nine studies were summarized in a table based on the following factors: date, study site, research design and demographic information of study participants, blended learning model used, program description and theoretical base of interventions, outcome measures used in studies, and findings as reported by authors.

RESULTS

How has blended learning been used thus far in sexuality education programs, and with what outcomes?

Nature of studies reviewed.—As noted in Table 1, six of the nine studies were conducted in the United States,[7,8,10–12,14] one in Europe[9] and two in the United Kingdom.[13,15] Most (seven of nine) used a randomized controlled trial to examine program effects. Study populations spanned from middle school age (11-13 years) to adults (over 25 years) drawn from different settings; five studies were implemented in middle or high schools, three in clinics or treatment facilities, and one in a university setting (Table 1).

All interventions were classified as blended learning because they consisted of a combination of online and face-to-face instruction and/or discussion, where participants had some control of pace, time, and/or space with the online component.[1] All interventions used a rotation model; five used a station or lab rotation approach, three used a flipped classroom approach, and one used a combination of station rotation and flipped classroom approaches.

Interactive virtual activities used in these studies included interviews, storytelling, wikis, videos, photos, websites, chatting, group forums, worksheets, quizzes, gaming, personal reflections, role plays, and factsheets. These activities complimented in-class lectures, discussions, activities, assignments, and group work. The interventions were developed with behavior change theories commonly used in health promotion (eg social cognitive theory, theory of planned behavior, and integrative model of behavior); one study used the theory of situated learning and another used a precision teaching approach. Key sexual and reproductive health content addressed ways to prevent teen pregnancy and STIs, including HIV, such as choosing not to have sex, reducing sexual partners, using condoms and using contraception for pregnancy prevention, and assessing and avoiding risky situations; sexual coercion; alcohol and other substance use; healthy and unhealthy relationships; normative influences on sexual decisions, and sexual health resources. The content foci and depth varied by study and study population.

All of the studies included process and/or outcome data collection. Process indicators examined the acceptability and feasibility of program delivery. Behavioral outcomes included initiation of vaginal, anal and/or oral intercourse and other sexual risk behaviors, such as consistent condom use, acting to stop coercion, and dating violence victimization and perpetration (Table 1). Some studies also assessed psychosocial outcomes consistent with underlying behavioral change theories such as knowledge, attitudes, beliefs, perceptions, self-efficacy, and behavioral intentions (Table 1).

Study outcome: Initiation of sexual intercourse.—Two of the nine studies evaluated the impact of It's Your Game…Keep It Real (It's Your Game) on sexual initiation, which was defined to include vaginal, oral, or anal intercourse, among middle school students in the United States.[8,12] Findings from these studies indicate that students who participated in It's Your Game were more likely to delay the initiation of sexual intercourse compared to students in a control condition. None of the other studies reported data on sexual initiation.

Study outcome: Other sexual risk behaviors.—Four studies assessed the impact of blended learning sexual health education programs on other sexual risk behaviors, including consistent condom use and communication frequency,[11] condom use skills,[10] frequency of sex,[8,12] unprotected sex,[8,12] number of sexual partners and number of partners with whom had sex without protection,[8,12] and frequency of using alcohol or other substances during sex.[8,12] Studies found significant effects favoring the blended learning programs for some outcomes, but not all. For example, among participants who were sexually active, those in blended learning sexual health education programs were more likely to report greater condom use and condom use consistency compared to those in control groups.[8,11,12] Conversely, studies found no significant differences on outcomes such as communication frequency,[11] condom use skills,[10] or sexual risk behaviors among sexually active students, such as number of sexual partners or frequency of alcohol or substance use during sexual intercourse among sexually active participants.[8]

Study outcome: Sexual coercion or dating violence-related outcomes.—Two studies examined the long-term impact of blended learning sexual health education programs in reducing sexual coercion and dating violence or psychosocial outcomes related

to dating violence. Specifically, Peskin and colleagues[14] found that students receiving the It's Your Game program reported fewer occurrences of physical and emotional victimization than students in the comparison group who received usual health education; they also reported less emotional perpetration. Arnab and colleagues[13] found that students who participated in their blended learning sexual health education program were more aware of personal risks and appraisals related to sexual coercion compared to students who participated in a traditional program.[13]

Study outcomes: Sexuality-related psychosocial factors.—Six studies examined the impact of their blended learning programs on other psychosocial outcomes.[7,8,10–13] Collectively, adolescents and young adults who participated in blended learning sexual health education programs were more likely to report positive attitudes, beliefs, and perceptions regarding abstinence and protection compared to those in control or comparison conditions.[7,8,10–12] For instance, Marsch and colleagues[10] found adolescents who participated in their blended learning program reported greater increases in perceptions about the significance of cautiously selecting intimate partners compared to those who participated in a traditional program (Table 1). Similarly, Card and colleagues[11] found that adolescents and young adults who participated in a blended learning version of SiHLE (Sisters Informing Healing, Living, and Empowering) reported higher STI/HIV knowledge and condom use self-efficacy compared to those in a control condition. As another example, two studies of It's Your Game showed that students receiving the program reported fewer intentions to have oral and vaginal sex compared to students who were in the control group.[8,12] Not all psychosocial outcomes studied reached statistical significance (Table 1).

Study outcomes: Perceived satisfaction and usability.—Three studies explored the satisfaction and usability of blended learning sexual health education programs in school settings in the United States, Europe, and the United Kingdom.[7,9,13] Findings suggest that adolescents and young adults prefer to obtain information in an integrative virtual format.[7,9,13] Students reported long-term knowledge and interest in health information obtained through interactive activities.[9] For example, approximately 78% of participants reported "yes" or "in part" that stories viewed online made it easier for them to understand the health information, and 84% report "yes" or "in part" that they can still remember health issues addressed in these stories.[9] Similarly, students and teachers reported interest in continuing to discuss health topics after completion of the intervention and/or refer the intervention to a friend or family member.[7,13]

What are evidence-based elements and/or promising practices of blended learning that could be applied to sexual health education programs?

Currently, there are few studies that look at evidence-based elements of *blended* learning that could be helpful for developers designing blended sexual health education programs. In one, Stockwell, Stockwell, Cennamo, and Jiang[16] used a randomized controlled trial to examine varying blended learning strategies and found that using pre-class video assignments to introduce new material (versus just assigning reading of the new material) increased attendance and satisfaction among a small sample of college-level science students, but not exam performance; they also found that having students do active problem

solving in-class (as opposed to as having a teacher review the problems and solutions) increased exam performance. The combination of pre-class video assignments and in-class problem solving yielded the highest exam performance than either alone. Other evidence-based elements stem from a small literature examining *online* learning. These elements are described in much greater detail in a meta-analysis conducted for the Department of Education,[2] which identified four practices (Table 2) with sufficient and consistent data suggesting they promoted stronger learner gains compared to online learning without them. While the research is still limited, it provides preliminary guidance for shaping the online portion of blended learning programs.

In addition to these evidence-based practices, researchers and practitioners using blended learning approaches have identified numerous promising practices stemming from lessons learned when using blended learning approaches (Table 2). Though these practices have not been tested in randomized controlled studies, they serve as another source of input to inform blended learning program development efforts while research on evidence-based elements of blended learning continues to expand.

What are the potential challenges of the blended learning model that may be important for sexual health education programs?

The literature on potential challenges and solutions in using blended learning in any content area provides a rich starting point for those interested in employing this approach. Our review surfaced three primary areas of challenges, including program development and preparation, technology, and participant engagement (Table 3).

Program development and preparation.—Key challenges in program development and preparation include: 1) deciding on the blended learning model and the right blend of online and in-class activities, 2) addressing students' different and varied learning styles, and 3) preparing and supporting teachers. Making decisions on the blended learning model to use, and finding the ideal blend of online and face-to-face instruction are important considerations for those interested in developing a new blended learning sexual health education program or adapting an existing program to blend. Though there is no single evidence-based strategy to guide these decisions, two critical tips repeated in the literature include blending based on the objectives and the needs of the learners,[17] and making decisions that optimize the strengths of each pedagogical approach (in-person versus online) given the context of the learning environment.[18] For example, one of the benefits of blended learning is taking advantage of face-to-face time for application;[5] thus, one way to review program objectives and make decisions on what content gets blended is to ensure objectives devoted to application are supported through face-to-face activities. Similarly, others have found video and simulations to be effective in conveying online content; thus, those strategies could be used to address content-heavy objectives. Another important part of the program development is pilot testing before scaling. Kenney & Newcombe[19] suggest starting small and pilot testing plans before committing extensive resources toward a full course or program. In their work, they started by using blended learning for one unit in a larger course to get started more quickly, secure feedback from students, and modify their plans before scaling to their entire course.

As with face-to-face learning, developers are challenged by ensuring blended approaches resonate and motivate learners. There are a multitude of implementation techniques used in blended learning, including online activities such as discussion boards, online quizzes, iMovie, and wikis, among others.[4] One strategy for selecting approaches is using universal design learning principles to ensure the programs use flexible designs and customizable options for addressing learner variability.[2,5] Key universal design learning principles center on *representation*, such as providing information in different modalities, *expression*, for example, varying methods of how learners respond or navigate material, and *engagement*, such as allowing for varying ways to engage and find motivation in learning through choice and autonomy—the guidelines (available at www.udlcenter.org) provide strategies to optimize these principles, thereby increasing access and learning.

Teacher training is another critical program development and preparation task. Trainings for sexual health education blended learning programs ought to include technology training as well as training on the sexual health content, with an emphasis on using the blended learning tools and integrating the two instructional approaches.[20] Those developing training should also consider addressing managing the online portions of the class,[5] the potential impact on the educators' workloads,[21] and educators' fears of loss of control.[22] Teachers benefit from practicing the online activities and accessing embedded brief tutorial videos showing how to use key features of the system. Other critical evidence-based training design features include 1) learning objectives that address the identified needs of participants and adequate time to realize objectives; 2) pre-work or homework to supplement limited face-to-face time; 3) opportunities for active learning; 4) demonstrations related to the knowledge and skills being covered; 5) opportunities for participants to practice their new skills; and 6) follow-up support for implementation of complex skills.[23]

Technology.—Some of the key technology challenges include the need to optimize the program to display across different screen sizes, such as tablets and mobile devices; navigate Internet connections, which are not universal or consistently of high quality (eg some rural educators have noted this as a challenge); and deal with other computer glitches, such as out of date hardware/software. Those advocating for blended learning note that these all reflect the reality of technology use and require planning ahead to anticipate potential problems as well as dealing with them calmly when they do arise.[4] Educators using blended learning programs will ideally have tech support and training to troubleshoot some of the basic technology challenges likely to arise.[24,25]

Participant engagement.—One of the primary challenges of some blended models, like the flipped classroom model, is that they require students to complete work outside of class. For some disciplines, such as health education, this may create more difficulty because students may prioritize homework for other classes over health class. We found this to be the case, for example, in a pilot project we conducted on a flipped classroom, blended learning version of the pregnancy and STI prevention program called *Reducing the Risk*.[26] Students noted that they were not used to homework in health and would do other homework first over health homework. Participant engagement using other models that are centralized at school, such as station or lab rotation, is typically higher because most young people attend

school regularly. For example, Tortolero et al.[8] reported that the majority of students in their study attended at least 20 of the 24 It's Your Game lessons that were offered over the course of two years--7th and 8th grade.

DISCUSSION

Blended learning approaches are being used successfully in STI and pregnancy prevention programs, including school-based programs, and have yielded some positive behavioral and psychosocial changes. Similar to traditional group-based sexual health programs, not all outcomes tested in these blended learning programs showed positive impact.[7,8,11] Most blended learning sexual health programs use a station or lab rotation model that allows learners to alternate between group-based and online activities. The studies reviewed in this paper that examined satisfaction with the blended learning approach found that participants favored blended learning over traditional education approaches, although others note that face-to-face instruction is often students' favorite aspect of blended learning experiences.[5,27]

Designing blended learning programs is difficult because of the numerous options of blends between face-to-face and digital content.[28] Further, there is limited research on evidence-based elements of blended learning programs.[3] None of the sexual health education studies reviewed in this article used a research design that tested the impact of specific components of the blended learning programs. Other literature highlights a small number of experimentally-tested elements of either blended learning or online learning that provides an important starting point for sexual health professionals interested in developing blended learning programs. Features like learner reflection, allowing user control of learning, including simulations, and providing opportunities for individualized learning are considered evidence-based, although the body of evidence is generally limited.[2]

There is also a significant best-practice literature based on experiences using this pedagogical approach that can inform practitioners interested in blended existing programs or developing new ones. One critical piece of advice includes starting and ending a multi-session program in the classroom. We found this to be important in our pilot-test of a blended learning version of the *Reducing the Risk* curriculum. One of the pilot test teachers felt very strongly that starting in the classroom provided the structure, modeling, and motivation for students to engage in the online activities.

Blended learning is not without challenges. Indeed, the selected model (eg flipped classroom or station rotation), use of technology, the process of navigating between group-based and online activities and monitoring completion of online activities add to the complexity of this approach. Individuals using blended learning note that these can be addressed through pilot testing new programs, training teachers and participants on the technology, employing learning management systems already familiar to users, and through planned technology support. Despite these challenges, blended learning approaches are viable for sexual health and offer numerous advantages to group-based only programs, such as confidential personalization, a familiar context that can be more highly engaging for young people, paced learning, and easy access and re-access to important health content.

IMPLICATIONS FOR SCHOOL HEALTH

How might one go about developing a blended learning course? There are numerous resources focused on the process of intervention development that are beyond the scope of this article, such as intervention mapping[29] or the Understanding by Design framework.[30] There are also a multitude of resources online supporting the development and implementation of blended learning, such as the Clayton Christensen Institute and its Blended Learning Universe (www.blendedlearning.org). One particular approach that may be well suited for the problem of designing blended learning sexual health education programs is design thinking--a process for developing innovative products and service. Design thinking is a set of methodologies used by expert designers[31] that involves creative and integrative thinking,[32] and iterative experimentation with program users.[33] There are five general phases to the design thinking process as it relates to program development: 1) Empathize—gain understanding of the program users, 2) Define—develop an actionable problem statement, 3) Ideate—generate a wide range of possible solutions to the problem, 4) Prototype—create a low-cost prototype of a program, and 5) Test—test the program with users to gain further insights and make improvements.[33.34] The design thinking process also highlights methods for working within contraints.[31–33] Design thinking has had massive success in industry and in the healthcare field,[33] and a similar process, design-based research, has had success in the education field.[35] Additionally, blended learning has had efficacy in teaching students the design thinking process,[36] and conversely, may be a successful process for creating blended learning programs. Regardless of approach, when developing blended learning programs, it is critical to focus on the learning goals and select technology that will help achieve those rather than allow technology to drive decisions, which is consistent with sound practice in curriculum development more broadly.

Health teachers could start small with existing programs that are already blended, or work to adapt their courses using a blended model. Determining which blended learning model to use is an important consideration, as some models, like the flipped classroom, may present challenges in getting students to complete the out-of-class work for health education. The literature is rich with promising practices to guide schools and teachers interested in adopting this approach. The in-class and online segments should align, and should draw on evidence-based online strategies to the extent possible, such as including reflection in online activities, building online activities that allow user control and are responsive to learner needs, including simulations, and building in problem solving or other application strategies during in-class work. Of note, many of these evidence-based and best-practice elements were used in the sexual health education programs discussed in this paper. It’s Your Game, for example, uses online reflection, allows participants to explore different topics in a virtual world based on their interests, tailors some of the online content, uses online simulations to present content, and ensures participants practice skills in-class.

Activities should be designed to address a range of learning styles, and pilot testing is critical to get feedback from students, continually refine the program, and uncover technical glitches. Teacher training and support for content and technology are also essential for success with blended learning approaches. Those using this approach should think of it

as a way to combine the best of both in-class and online instructional strategies to create powerful learning opportunities for students that are relevant, engaging, and impactful.

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Table 1.

Summary of Studies Using Blended Learning for Topics in Sexual Health Education: 2008 to 2017

Studies (Ordered by Year)	Research Design and Study Participants	Blended Learning Model	Program Description	Key Outcome Measures	Key Findings
Ito et al.[7] 2008; US; Clinic	**Design** ● RCT with 2 data collection points (baseline & immediate follow up—same day) **Participants** ● 47 adolescent females ● 55% African American; 19 % White; 17% Hispanic ● Mean Age: 16.1	Station Rotation Model	**2 component intervention** ● One 30-minute educator-led didactic session in clinic ● Interactive CD-ROM with 4 sections (Why should you care, know the facts, protecting yourself, sex and the media); included games, video clips, cartoons, simple language, self- selected host; used before or after didactic session **Theory base** ● Integrative model of behavioral prediction (Fishbein, 2000; Fishbein & Yzer, 2003)	**Primary outcomes** ● Acceptability ● Feasibility **Secondary outcomes** ● Intention to have sex ● Intention to use condoms ● HIV/STI knowledge ● Normative beliefs ● Attitudes ● Barriers ● Self-efficacy regarding abstinence ● Self-efficacy regarding condom use	**Primary outcomes** ● Acceptability + ● Feasibility + **Secondary outcomes** ● Intention to have sex NS ● Intention to use condoms NS ● HIV/STI knowledge NS ● Normative beliefs NS ● Attitudes NS ● Barriers — ● Self-efficacy regarding abstinence NS ● Self-efficacy regarding condom use NS
Tortolero et al.[8] 2010; US; Schools	**Design:** ● GRT (N=10 schools) with 3 data collection points (baseline, end of 8th and end of 9th) **Participants** ● 1,193 students; Grades 7th – 8th ● 58% female ● 39.1% African American; 44.6% Hispanic ● Mean Age: 13.0	Station or Lab Rotation Model	**2 component intervention that spans 2 years** ● Group-based ● classroom lessons—8 in 7th grade and 7 in 8th grade ● Computer-based lessons—4 in 7th grade and 5 in 8th grade **Theory base** ● Social cognitive theory (Bandura, 1986) ● Social influence models (McGuire, 1972) ● Theory of triadic influence (Flay & Petratis, 1994)	**Primary outcomes** ● Initiation of any sexual intercourse (defined as vaginal, anal, or oral) **Secondary outcomes** ● Initiation of specific sexual behaviors (vaginal, anal, or oral) ● Initiation by sex and race/ ethnicity ● Risk behaviors for sexually active students ● Psychosocial variables from underlying theory	**Primary outcomes** ● Initiation of any sexual intercourse (defined as vaginal, anal, or oral) + **Secondary outcomes** ● Initiation of specific sexual behaviors + oral & anal; NS vaginal ● Initiation by sex and race/ethnicity + or NS—varies by sub-group and specific type of sexual behavior ● Risk behaviors for sexually active students + Number of times vaginal sex last 3 mo. Rest NS ● Psychosocial variables from underlying theory + 11 of 17 at 8th grade follow up and 7 of 17 at 9th grade follow up
Apfelbacher et al.[9] 2010; Europe; Schools	**Design:** ● Design:-based research approach (N=4 schools) with one summative data collection point **Participants** ● 117 participants; 12% Italian, 25% Romanian, 63% German; ● 74% secondary school, 26% vocational school ● Mean age: 16.5	Flipped and Station Rotation Model	**Learning environment called "In Touch with Health"** ● Learning area for students with 4 modules (acne, sun, dermatitis, STI) featuring storytelling, videos, interactive activities ● Teaching area with activities for classroom based instruction (cross disciplinary) ● Applications for web-based communication and cooperation (group forums, chats, video conferences) **Theory base** ● Salutogenesis model (Lindstrom & Erikisson, 2005; Antonovsky, 1987) ● The Ottawa Charter of WHO, 1986	**Primary outcomes**: ● Acceptance of "In touch with health" module (acne, sun, dermatitis, STI) stories used in online learning ● Self-reported learning effects	**Primary outcomes**: ● Acceptance of "In touch with health" module (acne, sun, dermatitis, STI) stories used in online learning+ ○ Approximately 61% of students liked very much or liked the stories ○ All students preferred anchor story to be in digital format ● Self-reported learning effects +/− ○ STI module showed positive learning effects across all groups of students ○ Other modules varied by group

Studies (Ordered by Year)	Research Design and Study Participants	Blended Learning Model	Program Description	Key Outcome Measures	Key Findings
Marsch et al.[10] 2011; US; Outpatient treatment facilities	**Design:** ● RCT with 4 data collection points (baseline, immediately after intervention and 1and 3 months after intervention) **Participants** ● 56 adolescents in substance abuse treatment, 69.5% male; ● 59 % African American, 10.5 % white, 30.5% Other; ● Mean age: 16	Flipped Classroom	**2 component intervention** ● 1 hour educator-delivered session to small groups (2-4 participants) ● Access to 25 online modules related to drug- and sex-related factors related to risk for HIV/STI infection **Theory base** ● Not stated in article	**Primary outcomes** ● HIV/Disease prevention knowledge ● Behavioral intentions ● AIDS risk reduction model constructs ○ Attitudes toward condoms ○ Importance of carefully choosing sex partners ● Condom use skills	**Primary outcomes*** ● HIV/Disease prevention knowledge+ ● Behavioral intentions NS ● AIDS risk reduction model constructs ○ Attitudes toward condoms NS ○ Importance of carefully choosing sex partners + ● Condom use skills NS **Note*: Comparison group received 1-hour educator-delivered session
Card et al.[11] 2011; US; Clinics	**Design:** ● RCT (clinic) with 2 data collection points (baseline and 3-month follow up) **Participants** ● 135 participants ● 100% female ● 100% African American ● Mean age: 24	Flipped Classroom	**2 component intervention** ● 2-hour online multimedia program (2 modules) ● 20-minute group-based review session (in person with health educator) **Theory base** ● Social learning theory (Bandura, 1977) ● Theory of gender and power (Connell, 1987)	**Primary outcomes** ● Consistent condom use past 90 days **Secondary outcomes** ● HIV knowledge ● Condom use self-efficacy ● Communication frequency ● Condom barriers	**Primary outcomes** ● Consistent condom use past 90 days+ **Secondary outcomes** ● HIV knowledge+ ● Condom use self-efficacy+ ● Communication frequency NS ● Condom barriers NS
Markham et al.[12] 2012; US; Schools	**Design:** ● GRT (N=15 schools) with 3 data collection points (baseline, end of 8th, end of 9th) **Participants** ● 1,258 students, Grades 7th – 8th, 59.8% females, ● 39.3% African American, 48.4% Hispanic ● Mean age: 12.6	Station or Lab Rotation Model	**Two 2-component interventions that span 2 years (one risk avoidance—RA, and one risk reduction—RR)** ● Group-based classroom lessons—8 in 7th grade and 7 in 8th grade ● Computer-based lessons—4 in 7th grade and 5 in 8th grade **Theory base** ● Social cognitive theory (Bandura, 1986) ● Theory of planned behavior (Azjen, 2011)	**Primary outcomes** ● Sexual initiation **Secondary outcomes** ● Sexual behaviors (five different outcomes) ● Psychosocial measures (23 measures)	**Primary outcomes** (total group results only) ● Sexual initiation ○ RA: NS ○ RR: + **Secondary outcomes** ● Sexual behaviors (five different outcomes) ○ RA: + for 1 behavior and – for 1 behavior ○ RR: + for 4 behaviors ● Psychosocial measures (23 measures) ○ RA end of 8th: + for 10, − for 1, and NS for 12 ○ RA end of 9th: + 5, NS for 18 ○ RR end of 8th: + for 10, − for 1, and NS for 12 ○ RR end of 9th: + for 7, NS for 16
Arnab et al.[13] 2013; UK; Schools	**Design:** ● GRT (N=3 schools, 17 classes) with 2 data collection points (baseline and immediate post intervention) **Participants** ● 505 students in 9th grade, 50% female ● Data on race/ethnicity not reported ● Mean age: 13.5	Station Rotation Model	**2 component intervention** ● Digital game ● Classroom-based instruction **Theory base** ● Not specifically stated; used Intervention mapping approach for development, which uses theory-based strategies to address change objectives (Bartholowmew et al., 2011)	**Primary outcomes** ● Confidence to recognize coercion and act to stop ● Knowledge and positive attitudes toward refusals ● Understanding of personal risk and consequences	**Primary outcomes*** ● Confidence to recognize coercion and act to stop NS ● Knowledge and positive attitudes toward refusals — ● Understanding of personal risk and consequences + **Note*: Comparison group received standard classroom-based instruction

Studies (Ordered by Year)	Research Design and Study Participants	Blended Learning Model	Program Description	Key Outcome Measures	Key Findings
Peskin et al.[14] 2014; US; Schools	**Design:** ● GRT (N=10 schools) with 3 data collection points (baseline, end of 8th and end of 9th) **Participants** ● 766 students, Grades 7th – 8th ; 60% female; ● 44.3% African American, 42.2% Hispanic ● Mean age: 13	Station or Lab Rotation Model	**2 component intervention that spans 2 years** ● Group-based classroom lessons—8 in 7th grade and 7 in 8th grade ● Computer-based lessons—4 in 7th grade and 5 in 8th grade **Theory base** ● Social cognitive theory (Bandura, 1986) ● Social influence models (McGuire, 1972) ● Theory of triadic influence (Flay & Petratis, 1994)	**Primary outcomes** ● Physical dating violence victimization ● Physical dating violence perpetration ● Emotional dating violence victimization ● Emotional dating violence perpetration	**Primary outcomes** ● Physical dating violence victimization+ ● Physical dating violence perpetration NS ● Emotional dating violence victimization+ ● Emotional dating violence perpetration+
Brook et al.[15] 2015; UK; University	**Design:** ● Pre-/post-test **Design:** with surveys at 2 time points (for nurses who completed 1 module) or 3 time points (for nurses who completed both modules) **Participants** ● 49 nurses seeking continuing education; 98% female; ● Mean years since qualified as a nurse: 17 ● Mean age: 43	Flipped Classroom	**2 component intervention that spans 2 years** ● Foundation module with in-person approach ● Integrated module with blended learning approach **Theory base** ● Not specifically stated	**Primary outcomes** ● Self-efficacy about evidence base ● Self-efficacy about communication	**Primary outcomes** ● Self-efficacy about evidence base + ● Self-efficacy about communication +

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Table 2.

Evidence-Based or General Promising Practices in Blended Learning[1]

Evidence-Based Practices in Blended or Online Learning
● Include in-class problem solving by students during class lectures (e.g., have students actively apply material being presented in combination with in-class lecture of material) to maximize comprehension[16]
● Use a combination of pre-class video assignments to introduce new and/or complex content plus in-class problem solving to maximize comprehension[16]
● Include opportunities for reflection of online content learned[2]
● Build online activities that allow participants to control their learning[2]
● Use simulations in online activities[2]
● Create online activities that allow for individualized learning that is responsive to individuals' answers or questions[2]
Promising Practices from SRH Studies or Other Blended Learning Literature
Program Structure
● When creating blended instruction, start with learning goals and objectives and use those to inform technology tool choice rather than selecting technology tools first[17,20]
● Ensure online and face-to-face instruction are integrated complementary by developing the entire blended plan before developing components[5]
● Deliver first and last lesson in the classroom[5]
● Have a plan for teachers' online availability[5]
Activity Types
● Use a variety of interactive virtual activities[7–9,11–14]
● Account for varied learning styles when planning online and face-to-face activities[27]
● Include opportunities for modeling and feedback in online activities[7–9,11–14]
● Include opportunities to observe real-life scenarios and stories[7,9,12,14]
● Use quizzes to check for learning[37]
Access and Confidentiality
● Assess technology environment to ensure participants can access online course content[11,13]
● Discuss and plan for protecting confidentiality with online work[8,11,12,14]

[1]Evidence-based practice is defined in this paper as one that has been shown to be efficacious in controlled research; promising practice is a practice derived from experience and lessons learned, but has not been tested through controlled research.

Table 3.

Challenges and Solutions of Using Blended Learning for Sexual Health Programs

Challenge	Solutions
Development and Preparation Challenges	
Finding the right blend--integrating face-to-face and online components	● Use literature to guide process[18] ● Start small and pilot test[19] ● Blend based on the objectives and needs of learners and which objectives can be best met in class[17]
Addressing varied learning styles	● Employ an universal learning course design to ensure there is a variety of interactive activities that appeal to different type of learners[2,5]
Preparing and supporting teachers on using a blended learning program	● Include technology training as part of the teacher sexual and reproductive health training with a focus on how to use the blended learning tools and integrating the online and in-class components[5,20] ● Have teachers complete the online portion of the program to immerse themselves and experience what their learners will experience[20] ● Provide brief “how to” videos and site orientation videos to address key features and most common challenge areas[20] ● Provide technical support services for teachers[25] ● Ensure educator training designs are evidence-based to maximize impact[23]
Technology Challenges	
Addressing platform incompatibility	● Optimize for multiple platforms, including mobile devices ● Pilot test in target settings to help identify and address technology gaps before scale up ● Provide clear guidelines on technology needed to deliver the program to allow schools to assess the fit ● For a flipped classroom approach, provide teachers with a small number of tablets that students can use in classroom for those not able to access information at home
Handling variation in computer literacy among participants	● Create an online training module for learners to orient them on expectations of course and online navigation[5,11,] ● Introduce online component in class by showing the course assignments and navigation, and providing an opportunity for students to try out any tools that are new to them[17]
Addressing technical use-related issues	● Monitor online content and materials consistently[5] ● For blended learning experiences in classroom settings, provide for onsite technical support, and online office hours during evening hours for online work done away from school[5]
Participant Engagement Challenges	
Tracking and managing student engagement and progress	● Use interface and tools that allow teachers to monitor progress (e.g., Gradebook in Moodle)[20] ● Review quality of online responses, prompting students as needed
Ensuring student engagement in online components	● Build in visual demarcation for students to self-track[19] ● Provide reminders on due dates on the online site and in-class[19] ● Provide a student orientation to the site (e.g., as part of an in-class lesson and a brief video)[19] ● Provide technical and learning support for students on all tools used in program[19]