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Author manuscript

*AIDS Behav.* Author manuscript; available in PMC 2018 January 31.

Published in final edited form as:

*AIDS Behav.* 2012 October ; 16(7): 1949–1960. doi:10.1007/s10461-011-0106-9.

## The Promise of Multimedia Technology for STI/HIV Prevention: Frameworks for Understanding Improved Facilitator Delivery and Participant Learning

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### Abstract

There is increasing excitement about multi-media sexually transmitted infection (STI) and HIV prevention interventions, yet there has been limited discussion of how use of multimedia technology may improve STI/HIV prevention efforts. The purpose of this paper is to describe the mechanisms through which multimedia technology may work to improve the delivery and uptake of intervention material. We present conceptual frameworks describing how multimedia technology may improve intervention delivery by increasing standardization and fidelity to the intervention material and the participant's ability to learn by improving attention, cognition, emotional engagement, skills-building, and uptake of sensitive material about sexual and drug risks. In addition, we describe how the non-multimedia behavioral STI/HIV prevention intervention, Project WORTH, was adapted into a multimedia format for women involved in the criminal justice system and provide examples of how multimedia activities can more effectively target key mediators of behavioral change in this intervention.

## Keywords

Multimedia; Prevention; Behavioral interventions; STI; HIV

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## Introduction

There is increasing excitement that multimedia interventions may advance the feasibility, fidelity, and effectiveness of STI/HIV prevention interventions. Current use of the term “multimedia STI/HIV prevention” has referred to interventions that use technology, such as computers, graphics, videos, and interactive games and narratives to promote learning in STI/HIV prevention. A recent meta-analysis documented the efficacy of numerous multimedia HIV prevention interventions in promoting condom use [1]. Other promising multimedia interventions for STI/HIV prevention include computer-based interventions that deliver interactive exercises that teach participants about sexual risk behaviors and STIs [2], virtual reality simulations in which participants navigate a risky sexual encounter and negotiate safe sex [3], or web-based skills-building and motivational programs [4]. While some multimedia interventions use computer technology as the sole or primary medium from which to deliver intervention content, other formats may retain a human facilitator but use multimedia technology to improve the facilitator’s ability to deliver standard intervention content and dose. Although currently there is limited empirical evidence to indicate that multimedia STI/HIV prevention interventions are more effective in reducing STI/HIV-related behaviors than non-multimedia interventions that offer the same intervention content and dose, current evaluations suggest the potential importance of multimedia technology for STI/HIV prevention.

Despite the promise of multimedia interventions, there has been limited discussion of how and why multimedia interventions may improve STI/HIV prevention. The purpose of this paper is three-fold. First, we present two novel conceptual frameworks that describe how multimedia technology may enhance the effectiveness of STI/HIV prevention interventions by: (1) providing tools to facilitators to better ensure standard delivery of the intervention as it was designed and/or (2) improving the participant’s ability to engage with, understand, and apply intervention content. Second, we present a case study of the development of a multimedia STI/HIV prevention intervention that has been guided by multimedia delivery and learning frameworks. Specifically, we describe how the non-multi-media STI/HIV prevention intervention Project WORTH was adapted into a multimedia format and provide examples of how multimedia activities can effectively target key mediators of behavioral change (e.g., knowledge, skills, and self-efficacy) to reduce drug and sexual risk behaviors and to increase STI/HIV testing and, if appropriate, linkage to care. Finally, we conclude by describing the gaps in knowledge about multimedia interventions and the future directions for research on such interventions.

## Conceptual Frameworks of Multimedia Technology for Improved STI/HIV Prevention

### Conceptual Framework of Multimedia Technology for Improved Delivery of STI/HIV Prevention Interventions

We present a conceptual framework to describe how use of multimedia technology can improve delivery of STI/HIV prevention interventions; the framework was developed based on existing evidence that multimedia programs can improve standardization of intervention delivery and tracking and, in turn, intervention efficiency, cost-effectiveness, and accessibility [5]. Computer technology enables the establishment of well-developed multimedia intervention infrastructures in which the core content is integrated into the multimedia format. Improved intervention infrastructure improves the standardization and, hence, the quality of intervention delivery, in a number of ways (Fig. 1). First, highly structured activities, including step-by-step menus prompt participants—or, in the case of facilitated interventions, facilitators—to move sequentially through activities to minimize the likelihood of skipping or shortcutting activities. For example, the intervention may have pre-programmed text fields that must be filled in by the facilitator before progressing to the next screen. Second, facilitator notes that are organized in a computer-based format enable facilitators to search and retrieve information more efficiently than notes provided in a paper manual. This ensures easy access to STI/HIV transmission and prevention information and improves the likelihood that, at any point in the intervention, facilitators and supervisors can access accurate information in case a question arises. Third, multimedia interventions may include built-in electronic measures that can help facilitators track time spent and aid in assessment of intervention dose. For example, some interventions may include an electronic timer to signal the end of an activity, better ensuring that standard intervention doses are delivered.

Multimedia technology also enables intervention facilitators and researchers to systematically monitor participant progress and provide feedback to participants based on process measures (Fig. 1) [1, 6, 7]. For example, electronic logs of participants' progress in intervention sessions can facilitate systematic monitoring of participant progress over time. Based on review of these logs, facilitators may work individually with participants who demonstrate persistent gaps in knowledge or skills. In addition, the intervention supervisor can review electronic process measures to provide more specific corrective feedback to intervention facilitators to ensure proper and consistent intervention implementation.

By providing improved infrastructure, computer-based multimedia technologies can also reduce the time and resources needed for facilitator training in accurate intervention delivery [1, 5–7] (Fig. 1). Though multimedia interventions generally require greater technology infrastructure than non-multimedia interventions—an important limitation to consider—many multimedia interventions are portable and, thus, can be replicated easily while maintaining intervention quality. Improved efficiency and cost-effectiveness can enable widespread dissemination of quality instruction, including to resource-poor areas where there are limited funds for intervention dissemination. While non-multimedia interventions delivered by well-trained, skilled facilitators may be equally or more efficacious than

multimedia interventions, we suggest that incorporating multimedia technology can enhance overall intervention facilitation by providing greater infrastructure for intervention delivery and hence improving the likelihood that all facilitators, regardless of prior training, skill, or motivation, systematically adhere to delivery of the intervention as it was designed. Further, improved intervention infrastructure can make possible accurate intervention delivery by qualified and passionate community members who have limited formal training but who have high capacity for intervention delivery if provided the proper tools.

### **Conceptual Framework of Multimedia Technology for Improved Learning in STI/HIV Prevention Interventions**

Existing theories of multimedia learning indicate that multimedia technology improves participant learning [8, 9] and suggest that use of multimedia technology in STI/HIV prevention interventions will improve targeting of key mediators of behavioral change, including improved knowledge, skills, and self-efficacy over non-multimedia interventions alone [10]. Figure 2 presents a novel conceptual framework of multimedia learning for STI/HIV prevention that was developed based on existing theories of multimedia learning. The framework describes how specific characteristics of multimedia interventions may improve attention, cognition, emotional engagement, skills-building, and uptake of information about sensitive topics such sexual and drug risks, all of which contribute to active learning during STI/HIV prevention programs.

**Novelty Improves Attention**—Learners must pay attention to learn. Use of multimedia in STI/HIV prevention interventions facilitates delivery of diverse and fun activities, which is likely to improve participant attention during the program [11–13] (Fig. 2). Multimedia STI/HIV prevention sessions can include game-like intervention activities, such as interactive games that test STI/HIV knowledge; audio and video clips that depict culturally tailored characters or avatars who, for example, describe their experiences facing unsafe sexual encounters; and interactive exercises with multiple menu choices, such as ones that guide participants through risky situations. Delivering information via a diversity of methods may keep participants active and engaged.

**Visual and Verbal Learning Improves Cognition**—Comprehensive STI/HIV prevention interventions place a high cognitive demand on participants by requiring them to concentrate on diverse topics ranging from the biology of STI/HIV to problem solving skills when facing risky social situations (Fig. 2). The Cognitive Theory of Multimedia Learning [8, 9] indicates that because humans have both visual and verbal working memory systems [14], interventions that use visual and verbal methods improve information processing. Use of both visual and verbal channels increases the amount of information that can be processed and enables learners to process a diversity of information [8]. That is, words may be more effective in representing certain types of material, such as representations that are more formal and require more effort to translate, while pictures may best represent other kinds of material, such as those that are more intuitive, natural representations. For example, text may be used to effectively communicate about STI/HIV transmission risks, while videos may be used to depict narratives of characters who must negotiate condom use, in which the emotions and the subtleties involved in decision-making processes are easily represented by

non-verbal cues that participants intuitively understand. Furthermore, since some people are verbal and others are visual/spatial learners, multimedia interventions are more likely to engage a diversity of learners than interventions that are delivered using primarily verbal methods [8, 9].

### **Narrativity, Individualization, and Interactivity Improve Emotional Engagement**

—Emotional engagement during the learning process is thought to improve integration of knowledge and its application during real life situations [3] (Fig. 2). For example, if a participant walks through a simulation of a safer sex negotiation that is very lifelike and that evokes similar emotions as a real life situation and he or she manages to negotiate safer sex, this may promote self-efficacy and confidence when he or she encounters this situation and these emotions in reality. Multimedia technology can increase emotional engagement with intervention material by improving individualization, narrativity, and interactivity of intervention activities, as discussed below.

First, multimedia technology may improve emotional engagement and active learning by improving individualization of interventions [9, 15] (Fig. 2), a factor that has been shown to be an important component of intervention effectiveness in STI/HIV behavioral intervention trials [1]. When interventions are individualized, learners are encouraged to reference their own experiences and prior knowledge during the learning process, hence facilitating active learning. Computer-based multimedia interventions can improve individualization in a number of ways. Branched programming technology allows tailoring of interventions; during a multimedia STI/HIV prevention intervention, a computer-based assessment may be administered to assess each participant's knowledge base about STI/HIV transmission. Based on the assessment, the intervention leads each participant through a customized educational program about STI/HIV transmission risk. Even within group-delivered interventions, multimedia techniques are capable of providing structured opportunities for individualized learning within a group setting. For example, interactive multimedia STI/HIV interventions may engage participants in computer games in which they must each provide answers to questions about STI/HIV transmission risks individually and then participate in a group exercise to review responses and commonly reported misconceptions. In addition, multimedia technologies can enable participants to easily and systematically track personal progress through the intervention over time, such as through the creation of electronic journal logs that can be printed for participants to take home and review.

Multimedia interventions also may improve emotional engagement by improving the narrativity of the intervention [3] (Fig. 2). Education-entertainment (EE)—programming such as through radio or television platforms designed to increase knowledge or change attitudes—is a well-established multimedia format that has been applied in multiple intervention settings, including in the field of STI/HIV prevention. A primary element of EE is to absorb the learner in a narrative; learners' response to characters in a narrative is thought to improve learning of novel topics [16, 17]. Narratives featuring characters with whom participants identify may engage participants, because they feel that intervention material is relevant to their own life circumstances. Multimedia interventions that use audio, video, and narrative may more effectively present lifelike situations than non-multimedia interventions that use narrative alone. For example, an STI/HIV multimedia intervention

may include a video of a fictional character played by an actor or avatar of the same race, age, and socioeconomic situation as intervention participants in which the character faces a risky situation and must negotiate safe sex. Compared with reading or listening to a narrative of a similar character who faces the same situation, watching the video may have greater potential to create an environment in which participants feel as if they are walking through the situation themselves, thus providing a more realistic sense of having walked through a safer sex negotiation. Designing narratives that are culturally relevant as well interesting and visually appealing is of primary importance to best engage participants. For example, an STI/HIV prevention intervention that includes a video designed for young African American women in urban settings may not be appropriate for implementation in populations characterized by different socio-demographic backgrounds and geographic settings. In fact, use of culturally inappropriate media may lead participants to be less engaged than if the material were presented in a non-multimedia, generic format.

In addition, multimedia technology may improve emotional engagement by improving interactivity [3] (Fig. 2). For example, multimedia interventions can include interactive games such as those that elicit participants to respond to questions about STI/HIV transmission risks and that provide immediate feedback about whether the answer was correct along with further explanation of the highlighted transmission risk. By offering interactive exercises in the context of lifelike situations, participants take active roles in the learning process.

**Scaffolding Improves Skills-building**—A primary goal of STI/HIV prevention interventions is to build participants' skills, including problem solving skills, to avoid risky situations or negotiate condom usage (Fig. 2). An important element of behavior change and learning is scaffolding, which is support to participants in the learning process. Scaffolding can be provided through demonstration/modeling of key skills (e.g., providing participants example language they can use to persuade partners to use condoms); infrastructure to help participants reflect on intervention material and formulate responses (e.g., probes that encourage reflection on prior risky situations and generation of their own ideas about how to avoid these risky situations); and feedback or cues to emphasize key messages or help participants reframe ideas [3]. The interactive technology of multimedia interventions can enable scaffolding for participants by providing standardized, segmented modeling of core skills followed by participant role play and feedback on role play. For example, in a multimedia intervention activity designed to improve self-efficacy in negotiating safer sex, facilitators could show a video that depicts a woman facing a risky situation in which there is a standardized, segmented demonstration of condom negotiation strategies. Facilitators could then encourage participants to role play safer sex negotiation, borrowing from the demonstration. Additionally, multi-media interventions increase efficiency of facilitator training through scaffolded learning and can enhance fidelity to the intervention through adherence to the media-based format of the intervention [10].

**Confidentiality Improves Uptake of Sensitive Information**—While topics such as sexual practices, drug use, and violence in relationships must be addressed in STI/HIV prevention, individuals may feel uncomfortable learning about or engaging with this

information in non-anonymous settings (Fig. 2). Multimedia technology can allow participants to participate anonymously in activities that address sensitive topics [2, 3, 18]. For example, by watching a video in an STI clinic waiting room or playing individualized interactive computer exercise, individuals can learn information about STI/HIV transmission risks in an engaging but anonymous setting. In addition, computer technology allows participants to record intervention materials and personal information in a private file that can be accessed over time, so that participants can reflect privately on their intervention progress. Computer technology also allows participants to anonymously share personal information with the group, which enables group participation while maintaining participants' privacy. Reducing social desirability concerns in the STI/HIV prevention intervention settings better enables participants to appraise their risks and actively engage in learning sensitive material. It is important, however, that participants in multi-media interventions are made aware of when and how the information they provide is shared with other participants and staff.

## **Description of an Intervention Adaptation Guided by Conceptual Frameworks of Multimedia Technology for Improved STI/HIV Prevention: Multimedia Worth**

Project WORTH (Women on the Road to Health) is an STI/HIV prevention intervention designed by members of our group to prevent STI/HIV among women by promoting safer sexual behavior and STI/HIV testing and linkage to care by addressing drug use, intimate partner violence, and other gender-specific risk factors for STI/HIV. Project WORTH has been found to be effective in increasing condom use among 145 drug-involved female inmates incarcerated at Riker's Island in New York City [19] and in reducing the number of unprotected sex acts among 512 women in drug treatment in a NIDA Clinical Trials Network study [20]. We currently are testing the efficacy of a multimedia adaptation of Project WORTH ("Multimedia WORTH") in increasing condom use and decreasing incidence of sexually transmitted infections (STIs) versus Traditional Project WORTH ("Traditional WORTH") and versus a four-session general health and wellness promotion intervention (Control), among women with drug use histories who currently are enrolled in alternative to incarceration programs.

### **Project WORTH: Content and Delivery Format**

Traditional WORTH is a multi-session group-based intervention that is informed by empowerment [21, 22] and social cognitive [23] behavioral change theories. The intervention aims to promote behavioral change by targeting mediating pathways at the intrapersonal level (improved STI/HIV knowledge, coping skills, condom use intentions, outcome expectancies, and self-efficacy); interpersonal level (improved sexual communication skills and negotiation self-efficacy and reduced intimate partner violence); and community level (improved social support and access to services including improved STI/HIV testing and assistance to stay in treatment). Over the course of a number of intervention sessions, facilitators lead group-based activities in which participants learn

about STI/HIV transmission, practice problem solving skills to avoid risky situations, and rehearse safer sex negotiation skills.

In Traditional WORTH, groups of 4–9 women sit in a circular formation with facilitators. Each participant has a WORTH workbook, with relevant information on each activity (i.e., if a role play is in the activity, the instructions will be in the workbook). Participants also record information in their workbook, such as session goals and intervention-related information. Facilitators lead activities either from their seats or, for some activities, standing at a flip chart, where group information is recorded.

### **Multimedia Adaptation of Project WORTH: Content and Delivery Format**

Multimedia WORTH contains the same content as Traditional WORTH but employs computer-based interactive tools and culturally tailored multimedia elements that are designed to enhance intervention delivery by maximizing individual learning opportunities and feedback, while at the same time optimizing the group format to build positive peer norms and social support for STI/HIV risk reduction. To ensure that the multimedia tools were culturally relevant, the translation of Traditional WORTH to Multimedia WORTH involved an intensive, interactive process between the researchers and a team of “community consultants”—women who, at some point in their lives, met inclusion criteria for the study. We found this process of engaging community consultants in the multimedia translation of WORTH to be a valuable opportunity to ensure that the intervention was appropriately tailored to WORTH’s target audience. Because there is evidence that multimedia technology may improve intervention delivery and uptake, we hypothesize that Multimedia WORTH will be more efficacious in increasing condom use and reducing STI/HIV than Traditional WORTH and the Control.

In Multimedia WORTH, groups of 4–9 women sit around a table, with a facilitator also seated at the table. While each participant has a workbook in Traditional WORTH, in the multimedia version, each participant has a laptop for her personal use during the session. Behind the facilitator is a SMART board (a large, interactive “white-board” with built-in touch screen capabilities), the content of which is controlled by the facilitator using the SMART board touch screen or by her own laptop. The system programmed into the facilitator’s laptop has a graphical user interface that functions as a road map, prompting the facilitator to move sequentially through activities without the need to rely on notes, memory, or previous experience. The majority of the Multimedia WORTH intervention content is delivered via the SMART board. In between activities, participants’ laptops will be in the “waiting room” (i.e., the laptop is “locked” temporarily) and will read “Hi, (name)! Welcome to WORTH! The title “WORTH” stands for Women On The Road To Health, a fun and interactive HIV prevention program for women about women. You’ll follow the stories of four women and get the opportunity to tell your own. Relax, have fun, and remember you’re WORTH it!” The multimedia tool tallies group-derived responses for the SMART board. Participants also enter individual information on their laptops; the required laptop skills are minimal, and a technical support staff is available in case participants have difficulties navigating through laptop exercises. At the end of each session, each participant receives an individualized printed journal, which has selected standardized information,



selected group-derived information, and information entered by the individual participant. While the journal log serves as a reference for participants, it also serves as an important tracking tool for the facilitator. As part of the informed consent procedures for Multimedia WORTH, participants are informed that individual information they provide via the laptop may be used by research staff for supervision purposes, but that this identifiable information will not be shared with other group members. With the participants' consent, facilitators can access individual information entered via the laptop to identify particular social needs of participants (e.g., intimate partner violence) that can lead to appropriate referrals. They also reference individualized entries over the course of the intervention to track participant progress and persistent unmet needs. Other than a risk rating form, the facilitators of Traditional WORTH do not have such a record of participants' needs and progress, which limits their ability to provide the same level of individualized attention.

### Examples of How Multimedia Technology May Improve Project WORTH

In Table 1 and below we describe the ways in which multimedia technology is hypothesized to improve Project WORTH by more effectively targeting behavioral change mediators including knowledge, perceived risk, skills building, self-efficacy, and service utilization.

**Improved STI/HIV Knowledge**—One key mediator of behavioral change that is addressed by the WORTH intervention is increased knowledge of STI/HIV transmission risks, sequelae of STI/HIV, and ways of preventing STI/HIV [19].

In Traditional WORTH, participants gain knowledge of STI/HIV during an exercise called 'STI/HIV: Myth/Fact.' The facilitator stands at the front of the room and asks participants, as a group, a series of Myth/Fact questions about STI/HIV transmission, symptoms, sequelae, prevention, and STI/HIV testing and treatment. After each question, the facilitator asks participants to raise their hands and volunteer answers. The facilitator affirms correct answers and true statements, corrects misconceptions, delivers a lecture to provide additional information about STI/HIV, adds more detail on STI sequelae to further expand on the topic, and answers any of participants' questions on STIs. For example, the facilitator may ask "Myth or Fact: Women suffer more severe sequelae of STIs than men." After asking participants to respond, the facilitator indicates that the statement is true and says, "This is a fact. STIs in women can be associated with pelvic inflammatory disease, ectopic pregnancy, infertility, and cancer."

In Multimedia WORTH, the 'Myth/Fact' activity is composed of a computer-based interactive game that tests knowledge and a culturally tailored, gender-specific interactive video exercise that provides information on STI/HIV transmission. The facilitator stands in front of the SMART board, and each participant sits in front of her laptop. A question such as "Myth or Fact: Women suffer more severe consequences of STIs than men" is presented on the SMART board. The facilitator asks participants to respond to the question by clicking on an icon on their laptops to select either 'Myth' or 'Fact.' The results are aggregated and the most commonly named answer is presented on the SMART board. The facilitator then asks participants to watch a video clip on the SMART board for the answer to the posed question. In the clip, participants hear narration of information about STI sequelae and see

an image of a model of the female human body, in which animation is used to highlight the sites on the body that are affected by untreated STIs. To further highlight key STI sequelae, the sequelae are written in text on the SMART board next to the sites on the body that are affected. After the video clip, the facilitator stops the video and reviews participants' answers. The facilitator affirms correct answers and true statements, corrects false statements, and emphasizes key messages from the video on STI sequelae in women.

**Intervention Elements Improved by Multimedia:** The activity is designed to improve standardization and aid facilitator delivery of the material (Table 1). In Traditional WORTH, the facilitator needs to memorize or read a text about STI/HIV. In Multimedia WORTH, the pre-recorded video provides a rigorous infrastructure for the activity and better ensures that correct information is conveyed. In addition, the activity may improve participant learning in a number of ways. Novel and diverse activities—interactive games and videos that uses narration, images, and text—are used to maintain participants' attention. Use of animated verbal and visual tools that teach participants about STI/HIV may improve cognition by increasing the amount and diversity of information processed and by reaching both visual and verbal learners. Interactivity, in which participants are asked to respond to questions and actively listen to the video for the answer, facilitates emotional engagement and active learning.

**Improved Perceived Risk**—As a means of preventing unsafe sex including unprotected sex or sex with new and multiple partners, WORTH teaches women to identify the 'triggers'—places, things, people, and feelings—that may lead them to situations in which unsafe sex is a risk [19].

In Traditional WORTH, the facilitator conducts an exercise to explore triggers of unsafe sex in a group format using a flip chart that provides categories of common triggers. The facilitator asks questions such as "How has your drug or alcohol use influenced you when it comes to engaging in risk behaviors, like having sex without a condom or having sex with outside partners?" The facilitator elicits additional triggers from the group and asks if group members would be willing to share personal experiences in which triggers lead to situations of unsafe sex in the past. After volunteers share their stories, the group reviews the stories and helps the participants problem solve to devise a plan to avoid future risky situations.

In Multimedia WORTH, to identify triggers, each participant works individually to play a confidential interactive computer game on her laptop. A list of icons that represent the people, places, things, and emotions that trigger unsafe sex is provided (i.e., alcohol and drugs; going out to certain bars or clubs; hanging out with certain people). Each participant clicks on the icons that best represent her own triggers of unsafe sex. Based on the icons chosen, the computer generates a narrative that describes what people, places, things, and emotions contribute to unsafe sex for each participant. Participants may decide to present their stories to the group. For each person who shares a story, the group reviews the story on the SMART board and helps the participant problem-solve to devise a plan to avoid future risky situations. At the end of the activity, each participant's 'trigger narrative,' along with suggestions for problem solving, is included in her journal.

**Intervention Elements Improved by Multimedia:** In Traditional WORTH, participants are asked to share a story with the group (Table 1). Participants who do not volunteer are not encouraged to reflect on their prior experience and generate a story. In contrast, Multimedia WORTH provides a structure (scaffolding) that helps participants reflect on their prior experience with risky situations and build personal stories about prior risky situations that can be saved in their journal for future reflection or that can be shared with the group. Providing scaffolding may improve participation and emotional engagement in the learning process by all participants and participants' ability to create their own narratives and more completely reflect on their risks. Individualization of the intervention improves emotional engagement and active learning, because each participant reflects on her own situation. Finally, improved confidentiality by allowing the participant to engage with the activity in a group setting without requiring her to share identifiable information with the group improves engagement with sensitive information.

**Improved Safer Sex Negotiation Skills and Self-efficacy—**WORTH seeks to improve participants' skills and self-efficacy in safer sex negotiation by including activities in which condom negotiation techniques are described and modeled for participants, and participants are then asked to practice these techniques through role play [19].

In Traditional WORTH, the facilitator writes the steps of condom negotiation on the board and provides handouts on the same information. The facilitator reads a vignette illustrating a resistant partner and asks the group to suggest possible responses to the resistant partner. The facilitator then models additional condom negotiation techniques and leads a discussion about the negotiation. Participants are then asked to role play condom negotiation with a partner. After the role play, the facilitator summarizes the condom negotiation techniques discussed.

In Multimedia WORTH, a simulated video vignette is shown on the SMART board in which a fictional female character representative of the women in the group applies problem solving to negotiate protected sex with her partner. Specifically, the video depicts the woman on a date with a man, during which she must convince her date to go to the nearby market to purchase condoms. At the end of the video, the steps of condom negotiation are displayed on the SMART board and the facilitator reviews the steps with the group. The facilitator then may replay segments of the video and prompt participants to identify different steps of the negotiation in the video. At the end of the exercise, each participant is asked to find a partner and role play condom negotiation using the steps of the negotiation demonstrated in the video and highlighted by the facilitators. After the role play, the facilitator summarizes the condom negotiation techniques discussed.

**Intervention Elements Improved by Multimedia:** In Traditional WORTH, the facilitator reads a scenario or may role play a resistant partner and model condom negotiation tactics; each facilitator may perform the demonstration differently, and the demonstration takes place in the intervention setting rather than in a more lifelike setting (Table 1). In Multimedia WORTH, a video provides a standardized model of condom negotiation. The video also keeps participants emotionally involved in learning condom negotiation skills and self-efficacy in a number of ways. First, the activity presents a video depicting condom

negotiation by a character whose demographic background, setting, and experience represents that of intervention participants. This narrativity makes the problem solving process lifelike and believable, so that participants are more likely to be emotionally engaged and active in the learning process. The condom negotiation clip also provides scaffolding to participants by modeling how condoms are negotiated in a lifelike setting. Finally, the interactivity of the exercise prompts participants to identify steps of the negotiation in the video vignette.

**Improved Access to Services**—WORTH aims to improve participants' access to services in the community [19]. This includes improved access to programs that address co-occurring issues of poverty, food insecurity, housing, drug use, health care, mental health needs, and intimate partner violence that may be contributing to STI/HIV risks among women in the criminal justice system.

In Traditional WORTH, participants take part in a 'Service Check-In' in which the facilitator provides participants with a Resource Manual that lists community service providers for a number of service needs. The facilitator reviews the Resource Manual and appointment card handouts and highlights the phone numbers that can be used to contact service providers. The facilitator then asks participants to identify one or two priority needs and to identify service providers who can assist them with these needs. The facilitator encourages participants to take home the Resource Manual and make appointments with the service providers to address priority needs.

In Multimedia WORTH, as is done in Traditional WORTH, participants take part in a 'Service Check-In' in which the facilitator provides participants with a Resource Manual that lists services provided in the community. In addition, participants take part in an interactive laptop exercise that prompts them to confidentially report concerns about issues including poverty, food insecurity, housing, drug use, health care, mental health needs, and intimate partner violence. Participants are prompted to narrow down their service needs to their priority needs, and they are led through guided and open-ended web searches to find services in their community to meet their priority needs. Participants are directed to the website of the agency and are encouraged to make contact with the agency via their web search during the intervention session. The services found during the exercise are filed in participants' journal logs, which are printed to enable easy access to information about their service needs outside of the intervention setting. The facilitator can access journal logs to monitor whether services are matched to needs appropriately and to follow up with participants to assure needs are met. Another important component of this exercise is exploration of potential negative experiences when attempting to access services and groups brainstorming of ways to effectively address priority needs.

**Intervention Elements Improved by Multimedia:** Instead of simply reading a photocopied list of services, the multimedia activity provides a greater degree of scaffolding; the activity is designed to help participants to identify needs, prioritize needs, and learn how to address these needs (Table 1). Interactivity and individualized information keep participants emotionally engaged and active in the learning process about services in the community. Exposure to web searches embedded in the intervention tool, as well as instruction on using

browsers provides participants with skills they can use on their own to obtain information about services in the community. The electronic journal serves as a useful record for participants and helps the facilitator identify each participant's key service needs and better monitor participants through the intervention to ensure these needs have been met. While participants are informed that facilitators have access to their journals so that facilitators can best identify and address participants' needs, participants also are assured that information is kept confidential and hence will not be shared with other participants in their group or with other members of the study team.

## Conclusions

The purpose of this paper was to describe the mechanisms through which multimedia technology may work to improve both the delivery and the uptake of STI/HIV prevention intervention material. While some multimedia formats may be delivered without facilitators, other formats may use multimedia technology not to replace but to standardize and to enhance intervention delivery. Specifically, we have described how multimedia programs, particularly those that use computer-based technology, may improve the ability of intervention facilitators to deliver standard intervention content and dose and to monitor participant progress in order to provide tailored feedback to participants. Our review of multimedia learning theories has suggested that multimedia technology may improve participant learning in the context of STI/HIV prevention interventions in a number of ways. Multimedia interventions may improve participants' attention by offering diverse and fun activities. Because information is communicated through text, images, and sounds, multimedia interventions are developed taking into account that we learn through both visual and verbal channels. Individually tailored and interactive activities and narratives of characters with whom participants can identify can help keep participants emotionally involved and active in the learning process. Multimedia technology also can facilitate scaffolding during the learning process by including culturally sensitive videos to model core skills in a lifelike setting and by incorporating an infrastructure to guide participants in reflection on intervention material and formulation of responses. Finally, multimedia technology enables presentation of sensitive material in a confidential or anonymous format. This better enables participants to engage with the material that is central to STI/HIV prevention such as sexual experiences, illicit drug use, and violence in relationships.

There is a growing body of evidence to suggest that multimedia STI/HIV prevention interventions are effective in promoting safer sexual behaviors [1–4, 24]. However, because the vast majority of multimedia interventions have not been compared to non-multimedia interventions that deliver the same content and dose, currently there is little evidence to suggest that the multimedia format itself improves STI/HIV prevention or that adoption may occur across cultures [10]. One study directly compared a multimedia intervention in which participants played a 1-h computer-based interactive game about STI/HIV transmission versus a non-multimedia, lecture-based intervention that delivered the same content and dose [2]. The study found that the multimedia intervention was more effective than the lecture intervention in increasing STI/HIV knowledge and self-reported motivation and intention to practice STI/HIV preventive behaviors. Data collected during the study described above in which Multimedia WORTH is compared with Traditional WORTH will

provide evidence of the influence of the multimedia format itself. In addition, members of our team also are conducting a multimedia dissemination study examining adoption of an adapted multimedia version of Connect, a couples-based STI/HIV prevention intervention chosen as a CDC DEBI for dissemination, against the traditional paper-based format of this intervention in 80 agencies in New York State [10, 25]. To further assess whether the multimedia technology itself improves STI/HIV prevention, additional studies are needed that compare multimedia versus comparable non-multimedia interventions and that measure outcomes such as indicators of behavioral change or biologically confirmed STI/HIV infection.

There is a need for additional research on multimedia interventions. While this paper describes mechanisms through which multimedia interventions may work to enhance delivery and uptake of interventions, we are not suggesting that multimedia interventions should replace human facilitation; the research base on the range of multimedia versus human-facilitated HIV prevention interventions is too narrow to draw such conclusions at this point. Hence, it will be important to assess the relative impact of the multimedia format versus human facilitation that does not involve multimedia technology. In addition, future studies also should attempt to isolate the mediating pathways through which multimedia interventions work to improve STI/HIV prevention. Further, there is a need to identify the settings and the populations for which multi-media interventions are most feasible and effective, so that use of multimedia technology can be effectively targeted. For example, in some settings, including in some criminal justice settings, use of computers is prohibited, thereby making implementation of computer-based multimedia interventions difficult. It has been suggested that multi-media programs may improve learning, in particular, among those with low levels of prior knowledge on the subject being taught and/or those with developmental disabilities, as multimedia components can help learners generate mental models of situations or events [8, 26–28]. Hence, it is possible that multimedia programs may be particularly useful among those who are affected by factors that may impede learning, such as populations affected by poverty and substance use [29, 30], groups that may also experience greatest need of STI/HIV prevention. In addition, multimedia interventions also may be particularly effective among younger populations who are well accustomed to and who enjoy multiple forms of media technology.

Preliminary evidence of the effectiveness of multimedia interventions is encouraging, especially given the urgent need for interventions that can be replicated and disseminated on a wide scale while maintaining intervention fidelity. To inform future development of multimedia STI/HIV prevention interventions, studies are needed that identify whether multimedia formats improve STI/HIV prevention over and beyond non-multimedia interventions of the same content and dose, that isolate the particular mediating elements of multimedia interventions that will advance behavioral change, and that identify factors that may moderate the efficacy of multimedia interventions.

## Acknowledgments

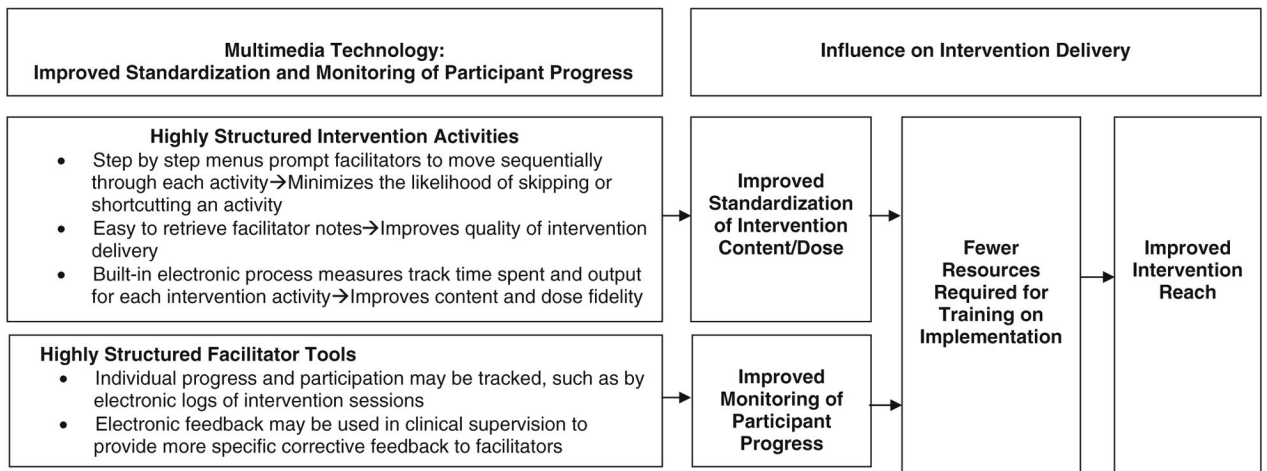
This research was supported by the NIDA grant Multimedia HIV/STI Prevention for Drug-Involved Female Offenders (Nabila El-Bassel, PI, R01DA025878-03).

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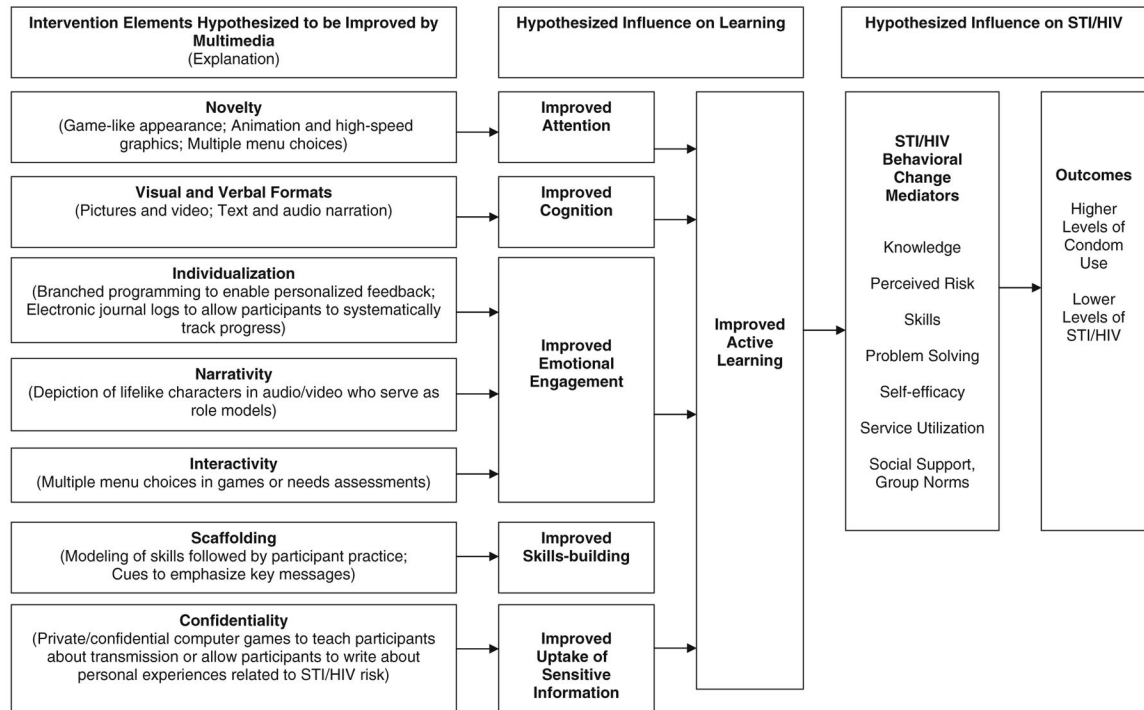
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**Fig. 1.**  
 Conceptual framework of multimedia technology for improved delivery of STI/HIV interventions



**Fig. 2.** Conceptual framework of multimedia technology for improved learning in STI/HIV interventions

**Table 1**

**Multimedia learning for HIV prevention: application to project WORTH**

Behavioral change mediator targeted	Aim of multimedia/traditional WORTH activity	Traditional WORTH activity	Multimedia WORTH activity	Multimedia element	Influence of multimedia element on facilitator delivery and/or participant learning
STI/HIV knowledge	To learn about STI/HIV transmission, symptoms, sequelae, prevention, and STI/HIV testing and treatment	The facilitator leads a group exercise during which she reads statements about STI/HIV and asks participants to volunteer to answer whether each statement is myth or fact. The facilitator corrects misconceptions.	Participants play a computer-based interactive game and watch a culturally tailored video that provides information about STI/HIV transmission. Specifically, each participant is asked to indicate whether the statement is myth or fact by entering a response on her computer screen. On a screen displayed at front of the room for the group to view together, the most common answers are presented and a culturally tailored video that provides the correct answer is played. After the video, the facilitator reviews participants' answers.	Standardization Novelty Visual/verbal learning Interactivity	Improved facilitator delivery Improved attention Improved cognition Improved engagement
Perceived risk	To identify and avoid situations of unsafe sex	The facilitator leads a group exercise during which she asks the group to name triggers of unsafe sex. She then asks a volunteer to share a personal experience in which a trigger lead to a situation of unsafe sex in the past. The group reviews the story and helps the participant problem solve to devise a plan to avoid future risky situations.	Participants play a confidential, interactive computer game. Specifically, participants are asked to review a list of icons that represent the people, places, things, and emotions that trigger unsafe sex and then click on the icons that best represent their own triggers. Based on the selected icons, the computer creates a narrative that describes the triggers that lead each participant to unsafe sex. The group discusses shared stories to help participants problem solve to devise plans to avoid future risky situations.	Scaffolding Individualization Confidentiality	Improved skills-building Improved engagement Improved uptake of sensitive information
Safer sex negotiation skills and self-efficacy	To practice sexual negotiation skills in a high risk situation	The facilitator writes steps of condom negotiation on the board and reads a vignette that demonstrates how to apply sexual negotiation skills in a high risk situation and then facilitates a role play exercise.	A simulated, interactive video vignette demonstrates how to apply sexual negotiation skills in a high risk situation. Facilitators then replay portions of the video and prompt participants to identify stages of condom negotiation. Participants then role play condom negotiation based on modeled negotiation that was presented in the video.	Standardization Scaffolding Narrativity Interactivity	Improved facilitator delivery Improved skills-building Improved engagement Improved engagement
Service utilization	To improve participant access to community services that target poverty, food insecurity, housing, health care, mental health, etc.	The facilitator provides each participant with a resource manual, asks her to identify 1-2 priority needs, and encourages her to use the resource manual to obtain contact information of appropriate service providers and make appointments with them.	A computerized assessment gauges needs, and guided and open-ended web searches aid participants in searching for appropriate service providers. Electronic journal logs allow participants to record key service needs for easy access outside of the intervention setting. Facilitators can access journal logs to monitor whether services are matched to needs and can follow up with participants to assure needs are met.	Electronic process measure Interactivity Individualization Narrativity	Improved facilitator monitoring Improved engagement Improved engagement Improved engagement