Incorporating Technology in the iCook-4H Intervention Program for Youth and Adults

Original Paper – Randomized Control Trial

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Abstract

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Objective: Describe challenges and facilitators to incorporating technology into the iCook-4-H intervention program.

Design: Randomized control trial.

Setting: Community-based participatory childhood obesity prevention program.

Participants: 288 dyads; youth (9.4±0.7 years old) and adult primary meal preparers (39.0±8 years).

Intervention(s): Six in-person sessions to increase families cooking, eating and playing together with online between-session technology components of curriculum.

Main Outcome Measure(s): Baseline, 4, 12, and 24-month assessments included measured anthropometrics for youth and online surveys about camera and website skill and use for dyads. Session leaders and participants completed open-ended process evaluations after each session about technology components.

Analysis: Chi Square analysis computed for gender differences in technology variables. Relationships between video posting frequency and outcomes of interest (cooking frequency, self-efficacy and skills; dietary intake; and body mass index [BMI]) were tested with Spearman correlations. Process evaluations and open-ended survey responses were thematically analyzed for beneficial and inhibiting factors including technology components in the curriculum.

Results: Only 78.6% of youth and 68.3% of adults reported always being comfortable accessing the internet post-intervention. Male youth reported being more comfortable with technology tasks than females (p< 0.05). Youth who posted more videos had higher cooking skills at 4-months post-intervention (r=0.189, p=0.05). Barriers to website usage reported most frequently by youth included lack of accessibility, remembering, interactivity, motivation, time, and lack of parental encouragement.

Conclusions and Implications: Incorporating technology supports, like cameras and websites, into youth programs may help produce improved outcomes. Identifying barriers to and patterns of technology usage need to be considered when developing future youth health-promotion interventions.

Key words: Technology; videos; youth; intervention; cooking
Introduction

Unhealthy dietary patterns in childhood are associated with less optimal growth, cognitive performance, emotional wellness, and disease prevention.\textsuperscript{1-7} This is of concern because few youth meet all dietary intake recommendations.\textsuperscript{1} Healthier dietary behavior established in childhood has been associated with decreased lifelong risk of many chronic diseases including obesity, diabetes, cardiovascular disease, and some cancers.\textsuperscript{8-11} With current dietary patterns potentially increasing risk for chronic disease later in life, it is important to develop effective intervention strategies to improve dietary behaviors among youth.

While there is varying success with interventions designed to improve diet patterns of youth, technology-based interventions have been found to be more effective than non-technology based interventions.\textsuperscript{12-14} Researchers have found that interventions designed with both face-to-face and technology strategies are more effective than those with only face-to-face components.\textsuperscript{15} However, technology strategies and supports, can include a wide range of approaches.

Social media technology is a tool that can be used in health promotion interventions for youth because they are one of the earliest adopters.\textsuperscript{16-18} Although there is limited research on health-related interventions utilizing social media, it is an increasingly used strategy and more research is needed regarding effectiveness and influence on programmatic outcomes.\textsuperscript{19,20} Many successful social media sites (e.g. Facebook, Snapchat, Twitter, Instagram, and YouTube) have user-generated content (UGC) as the primary source of content.\textsuperscript{21} The use of online UGC in interventions designed for youth, including user created videos posted to a website, may have the potential to increase program engagement leading to success. However, it is currently a largely under-researched intervention strategy. The purpose of this study was to describe the
incorporation of technology, including uses and barriers, in a youth/adult dyad intervention program focused on cooking, eating, and playing together, called iCook 4-H.

Methods
Design, Participants, and Recruitment
The iCook 4-H intervention program was a pre-post, follow-up intervention study conducted over two years for 9-10-year old children and their primary adult meal preparer across five states (Maine, Nebraska, South Dakota, Tennessee, and West Virginia). After a year of curriculum development and pilot testing, 228 youth-adult dyads were recruited in August 2013 using flyers, newspaper and radio advertisements, posters, emails, and postings on social media. Participants recruited for this study were to be free from life-threatening illness or conditions, food allergies and/or activity-related medical restrictions that would prevent participation in a face-to-face nutrition and fitness program, willing to eat meat and dairy, and have regular access to a computer with internet. Participant recruitment efforts targeted low-income, rural, and/or diverse populations by distributing recruitment materials in communities in the five intervention sites. Those who met the inclusion criteria were randomly assigned to the control group (n=77) or intervention group (n=151), using a pattern of one control for every two treatment dyads. All participants completed baseline (0 month), post intervention (4 month) and follow-up (12 and 24 month) assessments. Assessments at these timepoints included measuring youths’ height, weight, waist circumference, and blood pressure as well as completing surveys. Survey questions included demographics, dietary intake, food security, cooking frequency, and cooking self-efficacy; program evaluation questions focused on cooking skills, family meals, physical activity and goal setting. Additional questions were added after 12 months of the project to include engagement with technology self-efficacy (i.e., accessing the internet, creating and uploading digital photos and videos to a study website). At 24 months, open-ended questions were added.
about website usage, barriers to, and preferences for technology. Stipends of $80 were provided to dyads, evenly distributed among the four assessment periods for those who completed each assessment period.

Technology Incorporated in the Intervention

Treatment dyads participated in six, two-hour sessions held every other week, over a period of 12 weeks. Session leaders were Extension personnel and/or graduate students in nutrition and health related fields. At the end of each session, leaders and dyads completed online process surveys, which included open-ended feedback questions on technology. Leaders also participated in monthly phone calls with researchers for process evaluation. Each two-hour session included dyad-centered focus areas on culinary skills, food preparation, physical activity, family mealtime and communication, and goal setting.

A password protected website was developed for participants to use to reinforce session content and increase connections between participants across the five states through status updates and comments. Participants were asked to post videos, recipes, status updates about personal goals, and reactions to other participants postings between sessions. Videos were to be three to five minutes in length and reflect topics learned in sessions. Video cameras were provided to the treatment group, and technology training on cameras and the study website was provided at session one.

Beginning one month after the 12-week program concluded and continuing for 18 months, participants received an additional 21 months of website activities, monthly newsletters, and quarterly in-person “booster” sessions. For the website activities, dyads were asked to continue to create and post cooking, family meal time, and physical activity videos. There were also weekly physical activities and monthly food challenges posted on the website. An example physical activity challenge was “the plank challenge,” which was a balancing pose to strengthen
arms and spine while toning abdominal muscles. The challenge was to hold the plank pose longer each day over the week of the challenge.\textsuperscript{31,32} An example of a monthly food challenge was \textquotedblleft the purple food challenge\textquotedblright where participants were asked to cook with a new purple food. Posted status updates made by youth about their physical and food challenges were used as entries into monthly drawings to receive monetary awards ranging in value from $10-$50, depending on the type and length of the challenge. In addition to having access to the website, youth also received an age-appropriate newsletter through the mail. The newsletters contained the same content posted on the website by researchers. Quarterly booster sessions encouraged participants to continue study goals of cooking, eating, and playing together. Activities at the booster sessions included bowling, field days, and picnics for sharing new recipes.

**Statistical Analyses**

Frequency statistics were calculated for demographics, technology variables, and website usage/preferences for youth and adults in the treatment group. Participants were grouped by video posting frequency [none (0 videos), low (1-3 videos), moderate (4-7 videos), and high (8 or more videos)]. Chi Square analysis was used to determine if differences existed by gender for technology variables, website usage/preferences, and video posting frequency. Spearman correlations were used to investigate relationships between video posting frequency and outcomes of interest (cooking skills, dietary intake [fruit, vegetable, whole grain, dairy, and saturated fat], and body mass index [BMI]) at 4 months.

To determine the issues related to website usage, the participants’ and leaders’ open-ended process survey responses were reviewed by one researcher to develop a codebook for thematic analysis.\textsuperscript{33,34} Two independent researchers then coded the open-ended survey responses using the provided codebook. Finally, a third researcher compared the codes and resolved any discrepancies that existed between the coders. The codes were then collapsed into larger groups.
of findings that became the themes. These themes were used to develop understanding of facilitators and barriers related to the iCook website. The Institutional Review Boards at all participating Universities approved the study procedures.

**Results**

Youth participants were primarily white (69%), with over half being female (55%). Almost 33% of participating households were food insecure, and 26% of adults reported participating in at least one food assistance program (Table 1). At 12 months, 100% of the participants reported having access to the internet with 83% accessing the internet through a personal computer, 15% using mobile devices, 1% relying on accessing the internet through work or school, and 1% using a gaming console; 78.6% of youth and 68.3% of adults in the treatment group reported they were always comfortable accessing the internet (Table 2). The only differences identified in the Chi Square analyses were with youth gender and the following activities: accessing the internet [$X^2(4) = 10.16, p = .038$], downloading videos onto a computer [$X^2(4) = 10.94, p = .027$], and putting videos online [$X^2(4) = 12.54, p = .014$]. More male youth than female youth reported being very comfortable with accessing the internet (48% vs. 52%), downloading videos (35.8% vs. 14.0%) and putting videos online (34.6% vs. 12.2%).

Table 1. Adult participant demographic information at baseline for control and treatment groups in the iCook 4-H intervention program (n = 209).

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
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<tbody>
<tr>
<td>Female</td>
<td>90% (188)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10% (21)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity/Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>82% (155)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>8% (16)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>7% (13)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>9% (17)</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>70% (145)</td>
<td></td>
</tr>
<tr>
<td>Not Married</td>
<td>30% (63)</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Treatment participants’ self-efficacy for technology skills related to the iCook intervention program.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Most of the Time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
</tr>
</tbody>
</table>

**I can….**

**Accessing the internet**
- Youth (103): 1.0 (1) 1.9 (2) 11.7 (12) 6.8 (7) 78.6 (81)
- Adult (104): 2.9 (3) 1.9 (2) 8.7 (9) 18.3 (19) 68.3 (71)

**Taking Digital Pictures**
- Youth (102): 3.9 (4) 2.9 (3) 4.9 (5) 11.8 (12) 76.5 (78)
- Adult (104): 2.9 (3) 1.0 (1) 7.7 (8) 19.2 (20) 69.2 (72)

**Downloading Digital Pictures onto a Computer**
- Youth (102): 28.4 (29) 16.7 (17) 20.6 (21) 8.8 (9) 25.5 (26)
- Adult (104): 5.8 (6) 9.6 (10) 18.3 (19) 20.2 (21) 46.2 (48)

**Recording Digital Videos**
- Youth (101): 6.9 (7) 5.0 (5) 13.9 (14) 9.9 (10) 64.4 (65)
- Adult (103): 2.9 (3) 9.7 (10) 11.7 (12) 29.1 (30) 46.6 (48)

**Downloading Videos onto a Computer**
- Youth (103): 31.1 (32) 15.5 (16) 17.5 (18) 10.7 (11) 25.2 (26)
- Adult (101): 11.9 (12) 18.8 (19) 15.8 (16) 24.8 (25) 28.7 (29)

**Uploading Videos to a Website**
- Youth (101): 38.6 (39) 12.9 (13) 17.8 (18) 6.9 (7) 23.8 (24)
- Adult (102): 19.6 (20) 24.5 (25) 20.6 (21) 15.7 (16) 19.6 (20)

Although all treatment group youth were asked to access the website and submit postings of their videos, only 48% reported going on the iCook website and 37.9% posting videos throughout the entire project. Of those that did post videos, 34.8% posted 1-3 videos, 15.7% posted 4-7 videos, and 11.6% posted 8 or more videos. One person posted 26 videos and one person posted 29 videos. The most commonly reported reason why youth visited the website was
the videos, followed by functionality, recipes, information, challenges, cooking ideas and
activities. Top barriers youth reported to using the website included accessibility issues,
forgetfulness, lack of interactivity, motivation, time, and lack of parental encouragement. Top
barriers adults reported for youth using the website paralleled youth reports, which included
forgetfulness, accessibility, lack of interactive games, time, along with parental restriction on
youth’s computer time. Of the 53 treatment adult participants that completed the 24-month post
surveys and reported receiving the newsletters, 37 (70%) preferred the newsletter over the
website. Reasons for preferring the newsletter included that receiving the physical newsletter
provided a reminder to look at the content and that it was easy to take with the family out of the
house.

Session leaders identified four main technology issues, barriers, and/or limitations in
process evaluations. The four issues were: 1) changing participant preference for recording
device from cameras to cell phones; 2) access to adequate upload speeds which were
disproportionally slower for lower income families; 3) lack of technology knowledge and skills
for youth, adults, and session leaders; and 4) difficulties creating motivation and habit to use the
program website.

At 4 months, youth who posted more videos also had higher reported cooking skills
(rho=.232, p=.016). No relationships were found between frequency of posting with any other
outcomes of interest (youth’s dietary behaviors, cooking self-efficacy, family togetherness, or
BMI).

Discussion

Although increased posting of videos was not related to changes in youth’s dietary
behaviors, cooking self-efficacy, family togetherness, or BMI, it was associated with increased
cooking skills. It is possible that posting of videos was only an indication of how engaged the
youth were overall in the program and not causally associated with improving cooking skills. It is also possible that as youth cooked more while making videos (and experienced repeated exposure to the cooking concepts while reviewing videos), they increased their cooking skills. Future experimental research is needed to assess the impact of making cooking videos on youth’s cooking skills to determine causality.

The main purpose of this study was to describe the uses and barriers of technology in the iCook 4-H intervention program. The impact of students creating UGC was not specifically tested in this study design since there was not a group that received the face-to-face intervention without the incorporation of technology. Most online UGC videos related to learning have been developed and tested for college populations. Although researchers investigating the effectiveness of youth creating videos to increase the effectiveness of class-based learning experiences was largely lacking, it was anticipated that children creating their own UGC videos might have created more excitement and engagement in program activities in part because youth have an affinity for technology and online activities. When youth create UGC videos based on information they are exposed to during an in-person class, it would require that they reflect on content, synthesize information, and reinforce learning through repetition. The exercise of reflection provides youth with a clear connection between the new material and previous knowledge. Synthesizing requires a deeper understanding of the learned information to successfully translate and communicate material. Repetition and reintroducing content is important in the learning process; not only did youth repeat and practice skills as they made videos, but they were also repeatedly exposed to the information when they shared the videos they created and watched them with friends and family. When youth created videos they also became ambassadors of the message thereby increasing the likelihood of them adopting the
behavior because of social desirability to be in congruence with what they were saying to others; if they “walked the walk” then they were more likely to “talk the talk.”\textsuperscript{41,42} When they were physically creating the videos they were utilizing kinesthetic and active experiential learning techniques which have also been found to improve learning outcomes.\textsuperscript{43} If future research is developed to investigate the impact of this video creation strategy, many aspects related to technology need to be considered. Limited technological self-efficacy of participants in this study needs to be considered. Even after technology training and participation in a six-session program that included technology as a continuous component, many participants were not comfortable with basic technology skills (such as accessing the internet). Many researchers developing interventions may be immersed in a world in which technology has saturated most aspects of daily life. These researchers may not be aware of the technology disparities that may exist in less affluent communities. As data are presented that indicate most individuals in the United States (U.S.), despite economic status, have access to the internet, this may not accurately reflect technology disparities in self-efficacy and skills.\textsuperscript{44,45} Although all participants in this study did have access to the internet, the true reflection of individuals that have access in these communities may not be represented. Access to the internet was an advertised requirement for participation in this project. Thus, the actual access to skills and self-efficacy with technology in these communities may be overrepresented in this sample. This concept of technology disparities may be similar to health disparities and health literacy disparities, and deserves further investigation. Additionally, specific to this study, participants were asked to create videos showing themselves at home cooking, eating, and being active with their families. Participants were advised to keep videos to a short length of time (three to five minutes). Because cooking takes
place over a longer period than was recommended for the video length, participants needed to be able to edit cooking videos. The ability to edit a video is an advanced technological skill. With 15% of the participants accessing the internet through mobile devices, this may have added an additional barrier to participation that needs to be considered. As mobile devices become easier to use and more on par with other computing technologies, this may become less of a barrier. The ability to test experimentally the effectiveness of this technological approach in the future would likely be limited by technology skills. After technology training and participation in this program, many participants were still not comfortable with skills needed to effectively participate in the technological aspects of the program (creating and uploading videos to a website). Interestingly, youth were a little more comfortable than adults in making videos and adults were a little more comfortable than youth in downloading the videos to a computer and uploading them to a website. This may reflect roles the participants self-selected to complete during their participation in the project. It is also worth noting that both youth and adults were more comfortable in taking and uploading digital photographs to a website than working with videos. These differing levels of technology skills should be considered when developing future research programs.

Although limited technology skills were not identified by participants as a reason for preferring the newsletter over the website, it is interesting that participants preferred printed materials over web-based material. However, caution is needed when interpreting the preferences reported for the newsletters over website material found in this study. It is possible what was observed was not because of differences in preferred communication strategies but instead was specific to materials developed for this study. Researchers have found that although online technologies are beginning to be used in interventions, many websites are lacking components
necessary to be effectively used. Another possible explanation for the preference of print materials is that if participants were saturated with information from a variety of other electronic formats in other aspects of their life, receiving a printed newsletter in the mail might have been a novelty. It is also possible that participants might have had negative experiences with technology when trying to create and upload videos, and those frustrations impacted their overall feelings toward use of the website. These strong preferences for printed material found in this study were unanticipated. Other researchers have found that 90% of parents surveyed wanted online interventions to help manage childhood obesity. More research is needed to understand the communication preferences observed in this study. Research related to technology also needs to be continuously and frequently reinvestigated because type, access, familiarity, comfort, and skills related to technology changes rapidly. The participants in this study may have had very different experiences, skills, and preferences for technology even a few years later.

There were many lessons learned about issues related to the incorporation of technology and UGC in this youth health promotion intervention that may be valuable to other researchers as they design future interventions. When this project was originally planned, “smart” phones were less ubiquitous and cameras were provided to participants so that they could make their videos. By the end of the project, more participants had and preferred using their own smart phones over other camera recording equipment. Future programs incorporating UGC videos may not need to incorporate the cost of providing cameras to participants (even when working with low income communities).

Although many participants had internet access at home and download speeds were not a reported barrier, upload speeds were found to vary. Limited upload speeds were found to be a barrier to uploading videos for many families. Without adequate upload speeds, the time required
to upload videos was found to be impractical for many participants. It is anticipated that with technological advances, access to sufficient upload speeds will become more widespread; however, the timeline for that progression is unknown and this barrier to uploading UGC (specifically videos) needs to be considered when developing interventions that incorporate these technological strategies. This is an especially important consideration when working with low-income communities that may not be able to afford more expensive internet services that have faster upload speeds.45

Some of the community sites where sessions were taught also had limited or no access to the internet. This barrier made the incorporated technology instruction challenging and prevented the participants from being able to have lesson leaders assist with video uploading before or after the in-person sessions. Mobile hotspots were used to overcome this issue for technology training in some locations but were not adequate to overcome the barrier of upload time requirements. Although with expanding internet access, it is likely that this will be less of a problem in future interventions, internet access is an area that needs to be considered when developing technology-based community interventions.

When the project began, there were no widely used existing social media platforms that allowed youth and parents to interact in password protected or closed-online environments; thus, a password-protected website was created for use in this study. The password-protected site was needed to increase safety for the youth and to alleviate concerns parents and session leaders voiced about youth interacting in online environments. However, encouraging participants to visit a newly created website and use it on an on-going and frequent basis was challenging. Also, since videos needed to be uploaded as private YouTube files and the link then transferred to the iCook 4-H site, there may have been too many steps for participants to deal with to complete the
A website community which would be self-generating did not happen probably due to the relatively small number of participants available for website interaction. If a mobile application were available, it may help to increase youth and adult participation in creating and uploading videos.

By the end of the study there were options available for creating closed-communities on many popular social media platforms. Some researchers have had success initiating observations of successful, naturally occurring social media communities established for specific health conditions. However, other researchers have reported limited success in their efforts to start and maintain communication about health topics on similar sites. Despite conflicting research, it may be beneficial to avoid creating new websites for future interventions due to the financial and time costs needed to develop and maintain the site. Instead, future interventions using UGC online may benefit from incorporating their program into existing, familiar, and highly-trafficked sites; many of these commonly used sites now have the option to have closed/private, child specific, and/or moderated groups.

Although contributions of novel perspectives in an emerging area of research, there were limitations in the study design. Effectiveness of incorporating UGC into the study design was not tested. Most participants did not participate or participated minimally in creating UGC. Because of the small sample size, this was not a representative sample of a larger national audience and the results cannot be generalized.

**Implications for Research and Practice**

Overall the researchers have provided valuable perspectives on use and barrier issues that may be encountered when incorporating technology and UGC videos into programs designed to promote health for youth. The effect of specifically incorporating UGC in youth health promotion interventions needs to be tested with a randomized control trial design to isolate and
test the impact of the youth creating content on behavior outcomes. In this future research, the preferred communication strategies of the target population and barriers to participation in the technological components of the program need to be assessed and addressed prior to intervention implementation. This would allow for the development and implementation of an intervention that would have adequate and consistent levels of participation in the development of UGC material. This future research is needed to establish the impact of youth creating videos on health-related behavior.

Abbreviations
BMI – body mass index
UGC – user-generated content
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