

“What’s important to you, Max?”: The Influence of Goals on Engagement in an Interactive Narrative for Adolescent Health Behavior Change

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Abstract. Interactive narrative technologies for preventive health care offer significant potential for promoting health behavior change in adolescents. By improving adolescents’ knowledge, personal efficacy, and self-regulatory skills these technologies hold great promise for realizing positive impacts on adolescent health. These potential benefits are enabled through story-centric learning experiences that provide opportunities for adolescents to practice strategies to reduce risky health behaviors in engaging game-based environments. A distinctive feature of interactive narrative that promotes engagement is players’ ability to influence the story through the choices they make. In this paper, we present initial work investigating engagement in an interactive narrative that focuses on reducing adolescents’ risky behaviors around alcohol use. Specifically, we consider how the short-term and long-term goals adolescents choose as being important to the protagonist character relates to their engagement with the interactive narrative. Leveraging interaction log data from a pilot study with 20 adolescents, we conduct a cluster-based analysis of the goals players selected. We then examine how engagement differs between the identified clusters. Results indicate that adolescents’ choices for the protagonist’s short-term and long-term goals can significantly impact their engagement with the interactive narrative.

Keywords: Interactive narrative, health behavior change, alcohol use.

1 Introduction

Many adolescents engage in behaviors that increase morbidity and mortality during adolescence [1]. In the United States, automobile accidents and unintentional injuries are the most prominent causes of adolescent deaths, often occurring in conjunction with using alcohol or other substances [2]. The majority of adolescent health problems are amenable to behavior change interventions and a wide array of health information technologies are being explored to promote improved health outcomes in adolescents [3-8]. Given the popularity of digital games as a source of entertainment for adolescents,

recent years have seen growing interest in leveraging games to help address health care challenges [e.g., 9-12]. Interactive narrative technologies enable the creation of rich, story-centric game experiences in which players are active participants shaping the events of an unfolding story [e.g., 13-17]. Designing game-based interactive narratives to enhance adolescents’ knowledge, personal efficacy, and self-regulatory skills holds significant potential for bringing about positive impacts on adolescent health [8].

INSPIRE is a game-based interactive narrative for adolescent health behavior change that targets reducing risky behaviors in high school students (ages 14 to 18) [8]. INSPIRE features a storyline with gameplay that is grounded in social cognitive theory for behavior change [18]. By situating players in a prototypical high school party setting, INSPIRE provides players with relatable characters that model a broad range of behaviors to promote learning, challenging situations to practice strategies, and guidance in developing skills for reducing alcohol use [8]. INSPIRE aims to foster increased self-regulation through a variety of mechanisms, including setting and monitoring goals (both short-term and long-term) [8]. Our previous work on INSPIRE has shown that adolescents find it to be engaging, believable, and relevant to their lives [8].

This paper reports on an exploratory cluster-based analysis of how players’ choices of short-term goals (i.e., what are the protagonist’s goals for the evening) and long-term goals (i.e., what is important to the protagonist) influence their engagement with INSPIRE. Specifically, we investigate the following research questions:

RQ1: What groupings of players automatically emerge based upon the short-term and long-term goals players select as being important to the protagonist?

RQ2: How does reported engagement with the interactive narrative differ between the identified groups of players?

To answer these questions, we use data collected in a preliminary pilot study with 20 adolescents. We perform a cluster-based analysis using the short-term and long-term goals players selected. The clustering algorithm automatically determines the optimal number of clusters and partitioned players into a four-cluster group based on their selected short-term goals and a two-cluster group based on their selected long-term goals. We then explore how engagement differs between the clusters in these groups. Findings suggest that the choices adolescents make early in the game for the protagonist’s short-term and long-term goals can influence their overall engagement with the game.

2 Related Work

Digital games have for many years been a staple in the lives of adolescents. With 97% of children and adolescents playing games at least one hour per day, there is increasing interest in understanding the benefits of playing video games [19]. This underscores the potential of games to serve as a beneficial platform for reaching adolescents. Traditional entertainment focused games such as “Life is Strange” (2015) by Dontnod Entertainment have appropriated interactive narrative techniques to enhance players’ experiences. Interactive narrative technologies allow players to have deeper interactions with narratives through the choices they make which can directly impact the outcome

of the story. Mawhorter and colleagues introduced the choice poetics framework that examines how choices and their structure impact user experience with a narrative [20]. The presentation of choices can also influence players' narrative experience [21]. Choices can help increase players' agency, by enabling them to have greater responsibility over the unfolding story to generate meaningful outcomes [22].

In recent years there has been growing interest in the potential of digital games to promote health behavior change. Digital games for health have tackled a variety of issues including providing emotional support [9], preventing disease [23, 24], facilitating communication [25], and teaching healthcare professionals [10, 26]. Digital games for health have also been designed to promote health behavior change for adolescents. For example, "Escape from Diab" is an action-adventure game designed to reduce childhood obesity where the athletic DeeJay and his friends must escape from Diab, a world where it is difficult to acquire healthy food [23]. A key challenge to achieving successful health behavior change is ensuring players remain engaged with the intervention. Researchers have started investigating techniques to address this issue by providing tasks to keep players on track as well as purposely selecting narrative content to maintain engagement [27]. INSPIRE utilizes a familiar narrative-centric game design as well as impactful choices to promote health behavior change for adolescents.

3 The INSPIRE Interactive Narrative

INSPIRE is designed as a health behavior change intervention to support adolescents in developing strategies for handling challenging situations involving alcohol use (Figure 1) [8]. INSPIRE encourages adolescents to enhance their knowledge, personal efficacy, and self-regulatory skills as they navigate events in the game. The design of INSPIRE is grounded in social cognitive theory, and it emphasizes vicarious learning, mastery experiences, connecting to adolescents' lives, and scaffolding self-regulation [8]. Central to social cognitive theory are beliefs of personal efficacy: perceived self-efficacy, one's belief in their own ability to carry out actions to achieve desired outcomes, has been shown to be an important predictor of behavior. Those who believe they can carry out an activity tend to engage in those activities while avoiding activities in which they are less confident [28, 29]. In our previous work on INSPIRE, we provide an in-depth discussion of social cognitive theory and its linkage to the design and development of the interactive narrative [8]. Development of INSPIRE is still underway; however, the first episode is fully playable and is the subject of the work reported in this paper.



Fig. 1. The INSPIRE interactive narrative for adolescent health behavior change.

INSPIRE features a mystery involving a high school student named Max who discovers that his little sister is missing the morning after a small get together with his friends, which he was hosting at his house while his parents were away, turns into an out-of-control party. In the game, players “relive” the events of the night before. They experience issues dealing with peer pressure, social norms, and the consequences of alcohol use, while practicing strategies for reducing risky health behaviors. The narrative sees Max solve the mystery of where his sister has gone before Max’s parents arrive home.

3.1 Backstory and Tutorial

The INSPIRE story opens with a short trailer that sets the stage for the events taking place in the game (Figure 2). The trailer introduces Max, his little sister Mia, and his close friends Nikki and Jay who he invites over, while his parents are away for the weekend at his grandparents. Jay, in turn, asks his friend Hailey to join them. Hailey tells Jay that it sounds like fun and asks for the address. The introduction ends with a foreboding message about the night not going as planned.

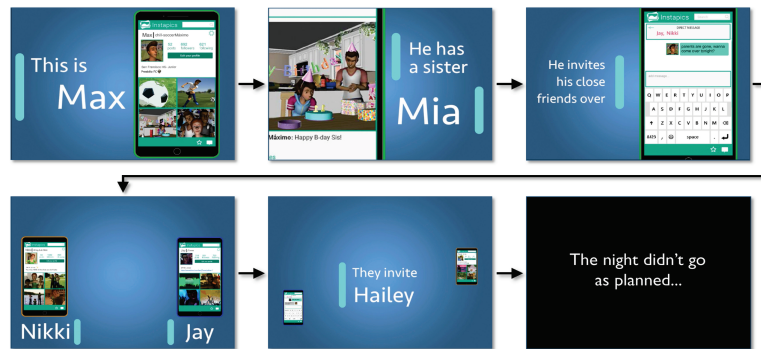


Fig. 2. Screenshots from the INSPIRE backstory trailer that introduces adolescents to the game.

The interactive narrative is set in Max’s house where players assume the role of Max, the story’s protagonist. As INSPIRE begins, players see Max awakening to the aftermath of the events from the previous night upon receiving a text message from his parents letting him know that they will be home earlier than expected (Figure 3).



Fig. 3. The INSPIRE protagonist awakening the morning after the party.

After getting out of bed, a short gameplay tutorial introduces players to navigating Max around the house and interacting with objects in the environment. The tutorial guides Max to look for his little sister to let her know that their parents will be home early, but she is not in her room. After hearing a noise, he heads downstairs where Max, expecting to find his sister, is startled by a stranger in his kitchen. Max remembers seeing Mia downstairs early on during the previous night, which was shortly before the party spiraled out of control. However, Max cannot remember where he last saw her. At this point, players are transported back to the beginning of the night where they are tasked with reliving the events of the party.

3.2 Goal Setting and Gameplay

As the events of the night begin, players are asked to identify what is important to Max. This is accomplished using an in-game goal-setting interface that supports adolescents' self-regulatory processes by allowing them to set short-term and long-term goals for the protagonist (Figure 4). First, players are asked to identify what is important to Max by selecting three long-term goals from a set of eight potential goals (e.g., being a good friend). Second, players select three short-term goals for Max that apply to the events of the evening (e.g., stay in control). These goals are intended to help guide adolescents' problem solving in the game.

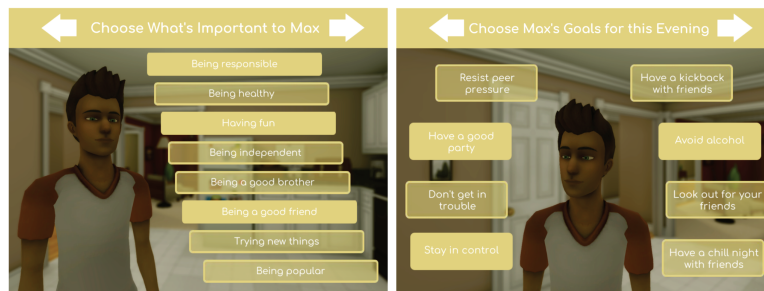


Fig. 4. Goal-setting interface in INSPIRE for long-term goals (left) and short-term goals (right).

As adolescents navigate the events of the night, they experience a series of problem scenarios in the interactive narrative that are realized through branching dialogue with non-player characters (Figure 5, left). Players' interactions with non-player characters feature 2 to 4 dialogue responses, as well as a timer, that require adolescents to assess the situation and make choices under time pressure that affect the outcome of the story. The INSPIRE storyline features two types of branching narrative structures. The first type of choice has short-term impact on the story through the immediate reaction of non-player characters (e.g., Nikki responding enthusiastically to Max after he approves of her decision to invite additional guests), while the second type has long-term consequences on the outcome of the story (e.g., Nikki's excessive drinking resulting in accidentally breaking a porcelain vase). In addition to the two narrative structures, players are asked to monitor the protagonist's short-term goals when responding to difficult situations in the narrative by prompting them to consult the goals they chose prior to

selecting a response to a non-player character (Figure 5, right). INSPIRE concludes with a cutscene showing Mia heading back upstairs after briefly watching Max and his friends play a drinking game, setting the stage for the beginning of the second episode where players will assume the role of Hailey. The cutscene comes after navigating a series of problem scenarios that provide opportunities for players to observe models of healthy behaviors related to alcohol use, practice problem-solving strategies related to alcohol use, and analyze tradeoffs between different courses of action.



Fig. 5. Interfaces for players to select dialogue responses to non-player characters to advance the narrative: without goal monitoring (left) and with goal monitoring (right).

4 Pilot Study

In this work, we use data from a pilot study that was conducted with INSPIRE to understand how adolescents engage with the game [8]. A total of 20 adolescents between the ages of 14 and 19 ($M = 16.63$, $SD = 1.36$) from public and private high schools and community-based after school programs in San Francisco, California participated in the pilot study. The sample included a diverse group of participants from a range of ethnic and socioeconomic backgrounds as shown in Table 1 based on data from 19 participants who provided demographic data. Informed parental consent and adolescent assent was obtained from all participants in the pilot study under a human subjects approved protocol.

Table 1. Adolescents' demographic data.

Gender		Race	
Female	53% (10)	Asian	16% (3)
Male	42% (8)	Hispanic or Latino	37% (7)
Transmale	5% (1)	Multiracial	26% (5)
		White	21% (4)

4.1 Procedure

Prior to interacting with INSPIRE participants completed an online pre-survey questionnaire to gather information about demographic variables such as age, gender identity,

and race.¹ Next each participant individually interacted with INSPIRE on a Samsung Galaxy tablet, which took 20 minutes on average for them to finish. After completing the interactive narrative, participants were asked to respond to an online post-survey questionnaire about their interaction with INSPIRE.

4.2 Data

The pre-survey questionnaire asked participants about their video game playing experience, such as how frequently do you play video games. It also asked about alcohol use, such as have you used alcohol in the past 12 months. The post-survey questionnaire included 10 items from a narrative transportation measure [30], which included items such as “I could picture myself in the scene of the events presented in the narrative” and “The narrative affected me emotionally.” These items were measured on a 7-point scale ranging from “Not at all” to “Very much.” The post-survey also included 15 items from a user engagement measure for video gameplay that focused on satisfaction and perceived usability, which included items such as “The gaming experience was fun” and “The gaming experience was demanding” [31]. These items were measured on a 7-point Likert scale ranging from “Strongly disagree” to “Strongly agree.”

Of the 19 participants who responded to the pre-survey, 5.3% reported playing games not at all, 36.8% rarely, 31.6% occasionally, 15.8% frequently, and 10.5% very frequently. Only 18 participants chose to report their alcohol use on the pre-survey with 61.1% indicating that they had used alcohol in the past 12 months and 33.3% reporting that they had at least one drink in the past 30 days. On the post-survey, adolescents reported a mean score of 4.16 (SD = 0.80) on the narrative transportation items measured on a 7-point scale, with the average item scores ranging from a high of 6.25 (SD = 1.16) on “I wanted to learn how the narrative ended” to a low of 2.95 (SD = 1.90) on “The events in the narrative are relevant to my everyday life.” The mean score on the engagement measure was 4.93 (SD = 0.78) on a 7-point scale, with the average item scores ranging from a high of 5.65 (SD = 1.18) on “I felt interested in the game” to a low of 4.00 (SD = 1.52) on “I found the game confusing to use.”

In addition to the data collected using the pre- and post-surveys, as participants interacted with INSPIRE the software recorded all of their interactions to log files on their tablet device. These interaction logs include records of all the events that occurred during the interactive narrative, such as navigating from one room to another, interacting with objects, selecting goals, and making dialogue choices. Across the 20 participants in the pilot study, over 70,000 events were recorded in the interaction logs.

5 Results

Using the data from the pilot study, we conducted a cluster-based analysis to examine groups of players based upon the short-term and long-term goals players select as being

¹ One participant did not complete the pre-survey questionnaire; however, they did complete the interactive narrative and post-survey questionnaire, so their data is included in the analysis.

important to the protagonist (RQ1) as well as how engagement differs between the identified groups (RQ2).

5.1 Clustering by Long-Term Goals

Leveraging the interaction log data collected during the pilot study, we used a clustering technique to assign each participant to a cluster based on the long-term goals they selected as being important to the protagonist at the beginning of the interactive narrative. Specifically, we adopted SPSS’s TwoStep Cluster Analysis algorithm to identify groupings of the adolescents using Bayesian Information Criterion (BIC) to automatically determine the optimal number of clusters [32]. The inputs to the clustering algorithm were the 8 binary variables (one for each potential long-term goal) indicating if the participant selected the corresponding long-term goal for the protagonist (Figure 4, left). Through the clustering algorithm, 2 clusters were automatically identified, each of size 10: *LTC1* and *LTC2*. In determining the clusters, “Having fun” was identified as the most important variable by the clustering algorithm, while “Being independent” was least important (Figure 6).

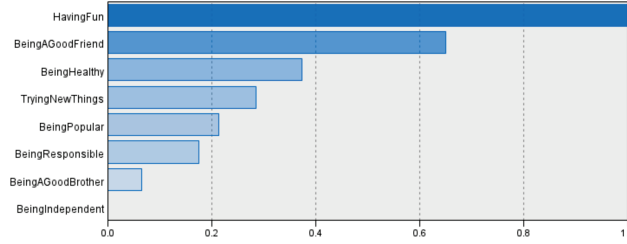


Fig. 6. Relative importance of long-term goals for identifying the two clusters.

In order to help interpret the derived clusters, a decision tree classifier was trained using the 8 binary variables as features and the assigned cluster as the class label. The decision tree was trained using Weka’s J48 algorithm [33], which resulted in a decision tree of size 5 that partitions all of the participants into their assigned clusters (Figure 7).

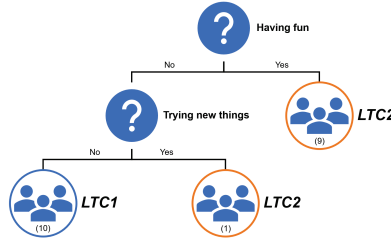


Fig. 7. Trained decision tree for predicting cluster assignment based on long-term goals.

The decision tree leverages two long-term goals in deciding how to properly label each participant, including “Having fun” and “Trying new things.” All but one of the participants is correctly classified by looking at whether “Having fun” was selected by the

participant as a long-term goal for the protagonist (*LTC2*) or not (*LTC1*). To correctly label the remaining participant the “Trying new things” long-term goal is examined. The difference between these two clusters is further illustrated by the stacked column graph in Figure 8, which shows “Having fun” and “Trying new things” as being selected by participants in *LTC2*, while “Being healthy” and “Being a good friend” are primarily associated with participants in *LTC1*. In short, *LTC1* consists of participants who did not select “Having fun” as a goal for the protagonist, while *LTC2* consists of participants who selected “Having fun” or “Trying new things” as a goal.

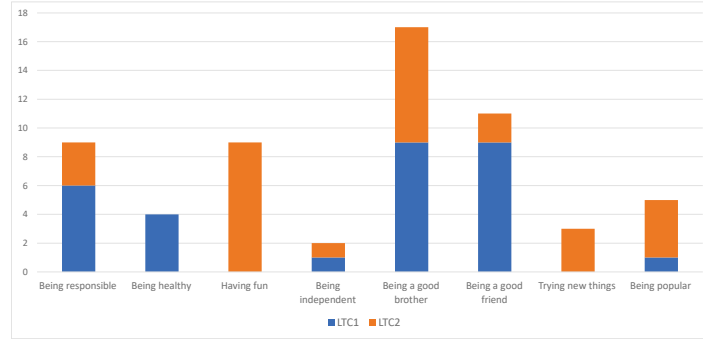


Fig. 8. Number of participants selecting each long-term goal across clusters *LTC1* and *LTC2*.

5.2 Clustering by Short-Term Goals

Using the same clustering approach as presented in Section 5.1 above, we also identified clusters based on the short-term goals participants selected as being important to the protagonist. The inputs to the clustering algorithm consisted of 8 binary variables (one for each potential short-term goal) indicating if the participant selected the corresponding short-term goal (Figure 4, right). Four clusters were automatically identified by the clustering algorithm: *STC1* with a size of 4, *STC2* with a size of 8, *STC3* with a size of 3, and *STC4* with a size of 5. In determining the clusters, the “Stay in control” goal was identified as the most important variable by the clustering algorithm, while the “Avoid alcohol” goal was least important (Figure 9). Another decision tree classifier was trained using the 8 binary variables for the short-term goals as features and the assigned cluster as the class label. This resulted in a decision tree of size 7 that correctly classified all of the participants into their assigned short-term goal clusters (Figure 10).

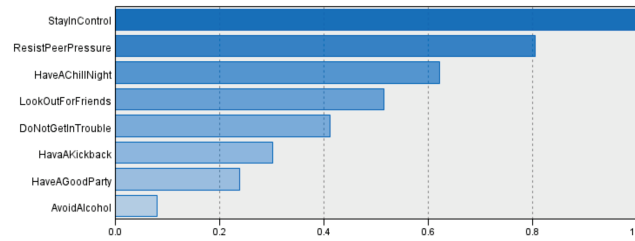


Fig. 9. Relative importance of the short-term goals for identifying the four clusters.

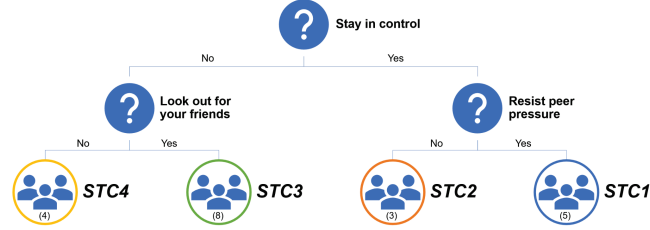


Fig. 10. Trained decision tree for predicting cluster assignment based on short-term goals.

The decision tree uses three short-term goals in labeling each participant, including “Stay in control,” “Resist peer pressure,” and “Look out for your friends.” At the top-level of the tree, “Stay in control” splits the participants into a group that is either in cluster *STC1* or *STC2* or a group that is in either clusters *STC3* or *STC4*. Within the first group the decision tree uses “Resist peer pressure” to correctly partition the participants into either *STC1* or *STC2*. In the second group, “Look out for your friends” is consulted to decide between *STC3* or *STC4*. The stacked column graph in Figure 11 shows the breakdown of short-term goals participants selected across the four clusters.

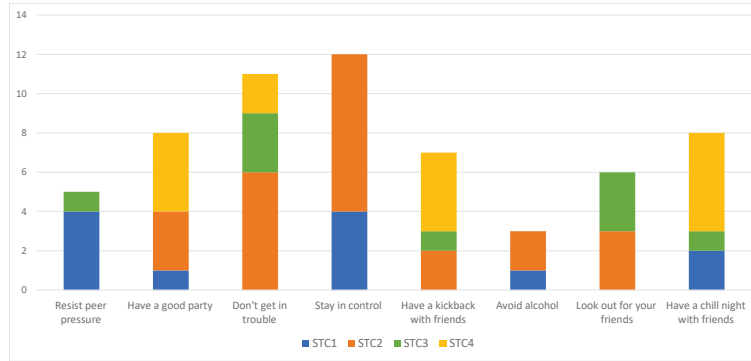


Fig. 11. Number of participants selecting each short-term goal across clusters.

Participants in cluster *STC1* wanted the protagonist to resist peer pressure and stay in control, while having a good time. Cluster *STC2* consisted of participants who wanted the protagonist to stay in control and not get in trouble, while looking out for friends and having a good time with limited alcohol use. Participants in cluster *STC3* wanted the protagonist to stay out of trouble and look out for friends, while resisting peer pressure and having a good time. Finally, cluster *STC4* was composed of participants who wanted the protagonist to have a good time, while not getting into trouble.

5.3 Engagement by Short-Term and Long-Term Clusters

To answer RQ2 we examined how engagement differed between the clusters identified based on the short-term goals and long-term goals using independent-samples t-tests.

Prior to using the parametric tests in the analysis, normality was confirmed with the Shapiro-Wilk's test.

Participants' self-reported engagement ranged from 3.00 to 6.27 with a mean of 4.93 ($SD = 0.78$) on a 7-point scale. Looking at engagement based on short-term goals, participants in cluster *STC1* has an engagement mean score of 4.77 ($SD = 0.67$), *STC2* had a mean score of 4.84 ($SD = 0.94$), *STC3* had a mean score of 5.76 ($SD = 0.45$), and *STC4* had a mean score of 4.71 ($SD = 0.53$). A series of independent-samples t-tests confirmed that engagement scores were significantly different only between participants in clusters *STC3* and *STC4*, $t(6) = 2.854$, $p = 0.029$, indicating that adolescents in *STC3*, who did not select "Stay in control" but did select "Look out for your friends", reported higher engagement than adolescents in *STC4*, who did not select "Stay in control" or "Look out for your friends" as a short-term goal for the protagonist.

Examining engagement based on long-term goals, participants in cluster *LTC1* reported engagement with a mean score of 5.33 ($SD = 0.64$), while participants in *LTC2* reported engagement with a mean score of 4.53 ($SD = 0.72$). An independent-samples t-test confirms that the engagement scores were significantly different between the two groups, $t(18) = 2.654$, $p = 0.016$, indicating that adolescents in *LTC1*, who did not select "Having fun" as a long-term goal for the protagonist, reported higher engagement than adolescents in *LTC2*, who selected "Having fun" or "Trying new things."

6 Discussion

Through the self-report questionnaires as well as our prior work on INSPIRE [8], preliminary evidence suggests that a diverse group of adolescents—with-respect-to race, gender, gaming experience, and alcohol use—found INSPIRE to be engaging. The storyline of the game appears to have successfully promoted adolescents' interest in the game as measured by items on both the narrative transportation and engagement scales, which will help drive continued use of the game. This will play an important role in supporting adolescents in developing mastery across a broad range of situations involving alcohol use and its effects.

Although adolescents overall reported being engaged with the game ($M = 4.93$, $SD = 0.78$ on a 7-point scale), the cluster analysis based on long-term goals identified a unique partitioning of players into two groups that reported a statistically significant difference in their engagement with the game. Deciding how to partition the players based on their selected long-term goals centered around the "Having fun" and "Trying new things" goals, while the "Being healthy" and "Being a good friend" goals were also identified as important. This suggests that one group of players (*LTC2*) approached the game wanting the protagonist to focus more on enjoyment and adventure, while the other group desired the protagonist to focus more on health and friends (*LTC1*). This later group reported significantly increased engagement with the game than the group focused on enjoyment and adventure.

Using the short-term goals that players selected as being important to the protagonist, the cluster analysis partitioned players into four unique groups. Two of these groups reported a statistically significant difference in their engagement with the game.

Both of these two groups did not select “Stay in control” as a short-term goal, while one (*STC3*) selected “Lookout for your friends” and the other (*STC4*) did not. The analysis of the clusters based on short-term goals suggests that players who wanted the protagonist to look out for their friends were more engaged with the interactive narrative than players who wanted the protagonist to have a good time.

There are two limitations to the findings presented in this work. First, only 20 adolescents participated in the pilot study. This limited the available statistical power, inhibited some of the analysis we could conduct, and resulted in the sizes of the clusters based on short-term goals being somewhat small. Second, the pilot study focused on measuring adolescents’ perceptions of (and engagement with) the interactive narrative since the primary objective of the pilot was to inform the continued development of the interactive narrative. The ultimate outcomes of changes in adolescents’ self-efficacy and risky behaviors related to alcohol use have not been examined.

7 Conclusions

Game-based interactive narratives offer a promising approach for engaging adolescents in health behavior change. In these environments, adolescents are empowered to make active choices that provide opportunities to enhance their knowledge, improve their perceived self-efficacy, and develop their self-regulatory skills. In this work, we have utilized INSPIRE, an interactive narrative for adolescent health behavior change that targets the reduction of risky behaviors around alcohol use in high school students (ages 14 to 18), to investigate how the goals adolescents select as being important to the protagonist character relate to their engagement with the interactive narrative. A cluster-based analysis with data from a pilot study with 20 adolescents revealed that the short-term and long-term goals selected for the protagonist early in the game can have significant impacts on player engagement, suggesting that how players approach the goals of the protagonist in the interactive narrative influences their overall engagement.

This work suggests several promising directions for future work. First, it will be important to undertake extensive user studies to gain a clearer picture of how participants’ individual differences impact their choices and engagement in the game. Second, investigations into the effects of incorporating interactive narratives for health behavior change into clinical settings need to be conducted. Finally, given the critical role engagement plays in achieving successful health behavior change, investigating AI-driven techniques for narrative generation that tailor narratives to individuals is particularly promising.

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