Journal of Diabetes Science and Technology
Volume 6, Issue 4, July 2012

SYMPOSIUM

Using an Alternate Reality Game to Increase Physical Activity and Decrease Obesity Risk of College Students

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Abstract

Background:

This quasi-experimental study investigated a game intervention—specifically, an alternate reality game (ARG)—as a means to influence college students' physical activity (PA). An ARG is an interactive narrative that takes place in the real world and uses multiple media to reveal a story.

Method:

Three sections of a college health course (n = 115 freshman students) were assigned either to a game group that played the ARG or to a comparison group that learned how to use exercise equipment in weekly laboratory sessions. Pre- and post-intervention measures included weight, waist circumference, body mass index (BMI), percentage body fat (PBF), and self-reported moderate physical activity (MPA) and vigorous physical activity (VPA), and PA (steps/week).

Results:

A significant group x time interaction (p = .001) was detected for PA, with a significant increase in PA for the game (p < .001) versus a significant decrease (p = .001) for the comparison group. Significant within-group increases for weight (p = .001), BMI (p = .001), and PBF (p = .001) were detected. A significant group x time interaction (p = .001) was detected when analyzing self-reported VPA, with both groups reporting decreases in VPA over time; however, the decrease was only significant for the comparison group (p < .001). No significant group differences were found for MPA.

Conclusions:

It is important that any intervention meet the needs and interests of its target population. Here, the ARG was designed in light of the learning preferences of today's college students—collaborative and social, experiential and media-rich. Our results provide preliminary evidence that a game intervention can positively influence PA within the college student population.

J Diabetes Sci Technol 2012;6(4):828-838

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Abbreviations: (ARG) alternate reality game, (BMI) body mass index, (MET) metabolic equivalent, (MPA) moderate physical activity, (PA) physical activity, (PBF) percentage body fat, (SCT) social cognitive theory, (SEE) standard error of estimate, (VPA) vigorous physical activity

Keywords: body weight, college student, games, physical activity, technology, weight

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Background

Despite national recommendations, the incidence of obesity and chronic diseases associated with physical inactivity continues to increase.[1] Research has demonstrated that college students and young adults are a population at risk and susceptible to chronic diseases, including obesity, metabolic syndrome, hypertension, and diabetes.[2–5] Attitudes toward health and physical activity (PA) are, in part, dependent upon behaviors formed early in life.[6] Therefore, interventions during young adulthood may be an effective means to establish healthy lifelong behaviors.

National reports indicate that only 44% of college-age students meet PA recommendations, compared with 68% of high school students.[7,8] Since the 1980s, obesity prevalence in adults aged 20 and older has increased to 33.9%. While obesity rates for college-age students remains relatively low (males 10.8%, females 9.6%),[7] the rate for those aged 20–39 years old (males 27.5%, females 34.0%) is considerably higher.[9] Obesity prevalence has been consistently increasing in the young adult population, with the steepest rise within the young (20–29 years) female population.[10,11] Weight gains of 1–3 kg have also been consistently found during the first year of college,[11–13] increasing the risk of obesity-related diseases later in life.[3–4]

Physical inactivity is largely preventable through educational, individual, and/or community-based interventions. Given the size of the college student population, colleges and universities have the potential to reach a large number of young adults. However, there is a paucity of research examining PA interventions specifically designed for college students. A review spearheaded by a Centers for Disease Control and Prevention task force concluded that "insufficient evidence is available to assess the effectiveness of college based health education and physical education interventions to increase PA behavior and fitness."[14,15]

Influencing Physical Activity through Games

Several intervention studies targeted at college students have centered on health-based lectures and fitness "labs," where students are provided the opportunity to be active.[16,17] However, traditional courses may not meet the learning preferences and strengths of college students in the generation born in or after 1982. In fact, designing effective interventions requires an understanding of students' PA patterns and the determinants of their behavior. Studies analyzing barriers to exercise found that college students report significantly more barriers (e.g., health issues, academic workload, lack of time and energy) than other age groups.[18,19] Research within this population has demonstrated that self-efficacy and social support are significant predictors of exercise behavior.[20] For example, an intervention that emphasizes peer support may counteract any reductions in family support that may occur as the transition is made from high school to college.[21] Finally, students have cited "having fun" as the number one reason to participate in PA.[22] We must also acknowledge the learning preferences of today's students, i.e., teamwork/collaborative style, experiential activities, goal orientation, multitasking, and technology use.[23–26]

Game playing addresses many of the same learning preferences, so it is no surprise that young people are attracted to this activity, which includes experiential learning, self-efficacy development, goal-setting, and social learning.[27] These factors should be considered when designing technology-based interventions aimed at college students,[22] and they suggest a strong role for game-based interventions for learning and health behavior change. In fact, there is growing interest in "learning through play."[28]

While there are very few games targeted specifically at college students, games for other age groups have been designed and studied as a means to influence healthy behaviors and encourage PA.[29–31] For example, the Super Nintendo console action–adventure health game *Packy & Marlon* improved the self-management behaviors of children and adolescents with diabetes related to proper nutrition, glucose monitoring, self-monitoring, and insulin dosing. The game used behavioral health strategies and experiential learning to improve players' self-concepts, self-efficacy for diabetes self-care tasks, communication with family and friends, and diabetes knowledge.[32,33] A 6-month randomized controlled trial found that emergency and urgent-care visits were reduced by 77% for participants who took home the diabetes game, whereas participants in the control group who took home an entertainment video game that had no diabetes content did not experience any reduction in these visits. Positive results were observed for a computer-based

game called *Squire's Quest!*, intended to improve the healthy eating habits of fourth-grade children.[34] Play led to a 25% increase in fruit and vegetable consumption by the end of the 5-week study. Games intended to encourage PA include physically interactive computer games such as *Dance Dance Revolution* and Web-based games such as *Fish'n'Steps*.[35] One study[36] found that playing *Dance Dance Revolution* had positive effects on the social life and physical health of players. A study of the *Fish'n'Steps* game found that players experienced improvements in their PA.[35] A review published by the American Heart Association[37] points to several studies and literature review articles demonstrating that well-designed PA games are engaging, are played frequently and by many in all age groups, and lead to significant improvements in PA and health outcomes.

The purpose of this quasi-experimental study is to examine the impact of an alternate reality game (ARG) intervention on PA within the college student population. We expect that students in PA classes who engage in PA-oriented game play will experience different benefits than students participating in a more traditional PA course intervention. Specifically, we predict

Hypothesis 1: The PA level of game players will be significantly higher than the PA level of non-players.

Hypothesis 2: Higher PA level will lead to an attenuation of the typical weight gain noted during the first semester of college.

To test these hypotheses, baseline and post-intervention PA levels of both groups were collected and analyzed.

Method

Subjects

Study subjects were incoming college freshman, at least 18 years of age, and enrolled in a traditional 16-week health course. The course involves a weekly 50 min lecture (~60–75 students) and a weekly 50 min fitness lab (~15 students). Given that the course requires fitness activities, no other inclusion or exclusion criteria were applied. Four course sections (i.e., different times/days) were scheduled. Due to game-related mechanics and activities, the Wednesday evening section was chosen as the game group. For students in this section, game play would substitute for the weekly fitness lab. No other section selection criteria were used. Students in this section were made aware of the game and were allowed to switch into an alternative section if desired. The game group was compared with students in other sections receiving the standard lecture and lab experience. Here, due to data collection resource and timing constraints, comparison students were drawn from only two of three available sections. This study was approved by the University institutional review board. Researchers obtained signed informed consent forms from 63 participants in the game group (90% of total available sample) and 108 students in the comparison group (88% of the total available sample).

Game Design

This study explored the efficacy of an increasingly popular game genre—ARGs—as a means to influence the PA of college students. An ARG, often involving multiple media to reveal a story,[38] is an interactive narrative that takes place in real time in the real world. Players engage in a complicated series of puzzles and challenges that not only involve them with an emerging story, but also with fictional characters, each other, and the real world.

The ARG designed for this study—called *The Skeleton Chase*—was based on current standards of game design research and practice[39,40] and established models of human behavior and motivation.[41] Game design elements purported to influence the attractiveness of playing any game include, among others, the need for concentration, challenge, skill, clear goals, feedback, and social interaction.[40] For example, if the skills of a player are much higher than the challenge(s) at hand, the player may quickly become bored; thus a game should be designed to balance skills and challenges. The ARG's design was also informed by social cognitive theory (SCT), which identifies personal, behavioral, and environmental factors that operate as reciprocal interacting determinants of behavior.[41] A key precept in SCT is self-efficacy or one's confidence in the ability to perform a specific behavior. Self-efficacy has been shown to be a core determinant of health behavior change, including changes in PA.[41,42] Key elements of SCT-based interventions include goal-setting, self-monitoring, direct reinforcement, and engaging in problem solving.[42] The ARG was designed to influence PA adoption by incorporating these elements as well as social support.

The ARG was designed by a faculty member who is also a commercial game designer and screenwriter. The plot involved the search for kidnapped professor Sarah Chase and her former teaching assistant, Sam Clemens. Sam was obsessed with a wild flower called a skeleton plant that

Sarah had used as the key ingredient for a new health drink. As the plot unfolded, it became clear that a nutrition company that had funded Sarah's research was conducting illegal experiments, testing the new drink on unsuspecting students. At the story's conclusion, both Sarah and Sam would be found and the company's illegal experiment shut down. The designer consulted with the authors and instructors to understand the content delivered in the health course. Media arts and information technology graduate students were charged with the technical development of game elements (e.g., Web sites). A small group of students pilot tested game activities (e.g., puzzles, challenges) to evaluate feasibility and degree of difficulty and to provide feedback so that necessary changes could be made.

Importantly, while designed to influence PA, this ARG is not a PA game *per se*. Rather, the goal was to influence behavioral change and tangential learning with PA as a backdrop to gameplay. Specifically, activities required players to move from one location to another to find plot clues and/or participate in live events, with the "game board" being the nearly 2000 acre university campus. When possible, game content and activities echoed lecture themes (e.g., alcohol abuse) without specifically referencing them. For example, paralleling lecture content on nutrition, players created recipes for an ultimate health bar. In addition to tangential learning opportunities, the ARG provided opportunities to learn about the campus and develop critical thinking and social skills. Leveraging the preferences of students, the game also utilized a wide range of media to tell the story and deliver clues: Web sites (both real and fictional, e.g., **Figure 1**), text messaging, phone calls and voice messages, emails, audio, video, real-world landmarks and locations (some staged specifically for the game), and live performances by actors. For example, Sarah Chase communicated with players via a variety of media, including her blog (**Figure 2**).

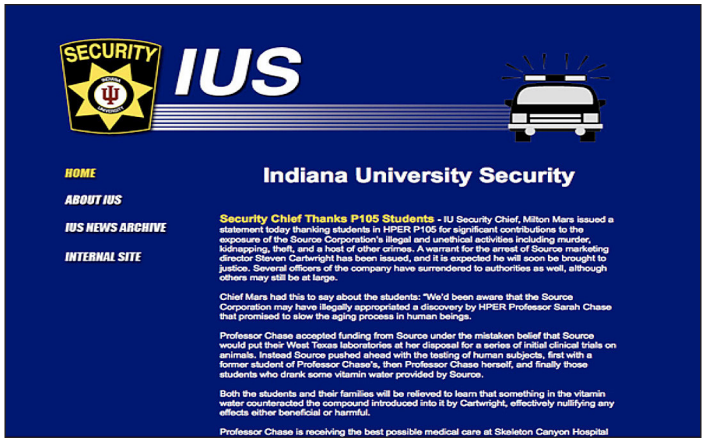

Figure 1. Fictional game Web site.

Figure 2. Sample blog.

Study Design

The study period was 9 weeks, with 7 weeks of game play intervention. A wireless accelerometer (FitSense Technology's LifeSource XL-20 Wireless Activity Monitor or "ActiPed"), worn on a shoe, was used to collect PA data (i.e., steps/week). The ActiPed is based on a previously validated accelerometer designed to estimate energy expenditure by examining the force of foot contact and the time between foot contacts while walking and running. The validation study reported a high correlation [R^2 = 0.97, standard error of estimate (SEE) = 65 W] between measured and estimated energy expenditure.[43]

The ActiPed has also been used to monitor free-living activity of adults with chronic obstructive pulmonary disease,[44] to promote walking in adults,[45] and to monitor PA during a game played by middle school children.[46] Moy and colleagues[44] counted the number of steps as subjects walked 2.5 mph and found the measured and recorded values were consistent more than 90% of the time.

The ActiPed monitor was used to collect baseline (week 1) and post-intervention (week 9) PA data for *both* the game group and the comparison group. Subjects were not able to view their data during collection periods. Since PA would contribute to game performance, balancing team membership at the start was essential. To do this, subjects in the game group were ranked from highest to lowest in terms of baseline steps and sequentially distributed across 17 teams of 3–4 players each.

Biometric data for game and comparison groups were collected during the baseline and post-intervention periods. These data were collected by two of the coauthors and exercise science graduate students in a private room adjoining a campus fitness center. During collection weeks, participants selected a convenient time among several 2 h blocks offered daily. Data included body mass (measured in kilograms), height (measured to the nearest 1 cm using a stadiometer), body mass index (BMI; [weight (kg)/height (m)]^2), and percentage body fat (PBF; measured using bioelectrical impedance analysis, Tanita Model TBF – 300A). In addition, pre- and post-intervention questionnaires captured demographics and PA behavior. The post-intervention questionnaire also included open-ended questions regarding game play and items about the game's design. Questions used to assess PA patterns were chosen from previous well-validated questionnaires (National College Health Risk Behavior Survey and American College Health Association–National College Health Assessment) and enabled comparison of the study sample to general college student population values.[47,7] The PA questions asked subjects to recall how many of the past 7 days they had participated in moderate-intensity PA for at least 30 min and/or vigorous-intensity PA for at least 20 min.[47] Dinger[48] examined the relationship between PA logs, Actigraph accelerometers, and the moderate physical activity [MPA; 3.0 to 5.9 metabolic equivalents (METS)] and vigorous physical activity (VPA; 6 or more METS) questions. Results demonstrated high intraclass correlation coefficients for VPA (r = 0.98) and MPA (r = 0.96), a significant correlation ($p < .01$) between accelerometer data and self-reported data for VPA (r = 0.60) and MPA (r = 0.60), and a significant ($p < .01$) correlation between PA logs and VPA (r = 0.82) and MPA (r = 0.49) questions.

Weekly, play was initiated at the end of Wednesday's lecture by the instructor who read a message from a game character *or* by a live visit from a game character. In terms of PA, while participants were encouraged to obtain 10,000 steps/day, the game goal was 50,000 steps/week. These targets are based on prior research that 7500 to 10,000 steps/day reflects an individual who is somewhat active to active.[49,50] Steps were accumulated during normal daily living and game play activities and transmitted from the ActiPed to a server via a wireless access point located in a dormitory lobby area. The device did not permit participants to manipulate the number of steps and allowed for 21 days of storage, so if a player forgot to upload their data, it was not lost. Overall, teams were vying to be the first to solve the ARG mystery and were ranked weekly based on successful completion of their PA and game-related challenges (**Table 1**). During the intervention, subjects could log into a personal Web page to view their steps (**Figure 3**).

Table 1.
Game Scoring

The final ranking of teams was based on cumulative scores over 7 weeks of play. Teams accrued points by correctly answering a series of three questions (50 points/question) posed by a game official who demonstrated they had successfully completed activities related to the narrative that week. They could also purchase hints for 10 points. If a team answered a question incorrectly, the game official automatically provided a penalty hint and directed the team to continue play (and call back later). The penalty hint automatically cost the team 50 points. When the team called the game hotline again, the official repeated the question. If the correct answer was provided, 50 points were awarded, bringing the total for that question to 0 points (i.e., no gain, but no loss), and the next question was asked. In each week, the first team to answer all three questions correctly received a 100-point bonus; the second received a 75-point bonus; and the third received a 50-point bonus. Lastly, if all team members achieved the target of 50,000 steps during the week, 100 points were received.

In lieu of gameplay, participants in the comparison group attended the standard weekly 50 min small group lab session held in a campus fitness facility. They received instruction on the use of alternative types of fitness equipment (e.g., treadmills, elliptical trainers) and received advice from lab instructors. They were also provided with a pedometer for personal use. Unlike the game group, the comparison group wore the ActiPed monitors only to collect baseline and post-intervention PA data.

Statistical Analyses

The analyses tested for group differences in baseline characteristics using a repeated-measures multivariate analysis of variance for continuous variables and χ^2 tests for categorical variables. Multivariate analysis of variance was utilized to detect group differences, within-subject differences (time), and interactions (group x time) in measured outcomes from baseline to post-intervention. Paired t-tests were utilized to identify where significant differences occurred pre- to post-intervention. Differences were considered significant at the $p < .05$ level. SPSS version 18 was used.

Results

Full data were available at the end of the study for 115 participants (**Table 2**). Five of the original game group subjects withdrew before actual play began. Sixteen subjects (25.4%) who completed baseline assessments and participated in the game did not complete

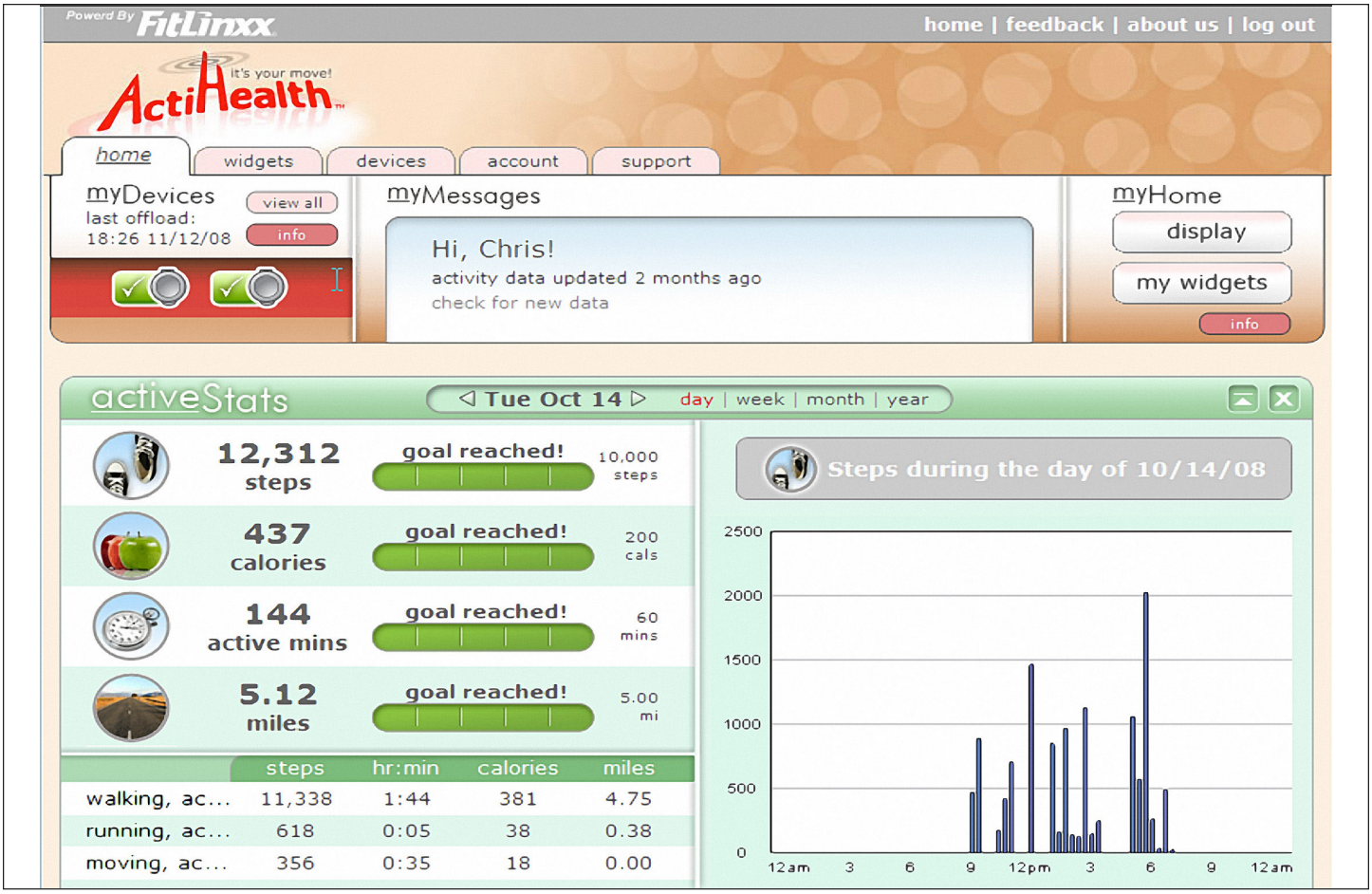

Figure 3. Individual step data.

Table 2.
Participant Characteristics and Baseline Measures

Variable	Total (n = 115)	Game (n = 42)	Comparison (n = 73)	p value
Age (years; ± SD)	18.4 ± 0.6	18.3 ± 0.5	18.4 ± 0.7	0.324
Gender %				
Male	44	38	47	0.325
Female	56	62	53	
Race/ethnicity (%)				
Non-Hispanic white	93.3	95.5	91.7	0.506
Non-Hispanic black	1.0	0	1.7	
Hispanic	1.9	0	3.3	
Asian	3.8	4.5	3.3	
Weight (kg; mean ± SD)	67.5 ± 10.9	66.3 ± 11.0	68.3 ± 10.9	0.496
BMI (mean ± SD)	23.21 ± 3.28	22.69 ± 3.24	23.55 ± 3.28	0.262
PBF(%; mean ± SD)	20.9 ± 8.8	20.6 ± 9.1	21.0 ± 8.7	0.895
Waist circumference (cm; mean ± SD)	76.8 ± 8.7	75.1 ± 9.4	77.8 ± 8.2	0.128
Activity (steps/week; mean ± SD)	41,677 ± 21,069	34,235 ± 16,791	46,177 ± 22,182	0.002[a]

SD, standard deviation.
[a] Significant at $p < .05$.

post-intervention testing. While none of the comparison group subjects withdrew, 35 (32.4%) also did not complete post-intervention testing. Subjects missing post-intervention data (PA, biometrics, and/or survey data) were not included in the analysis.

Baseline characteristics for the 115 participants are presented in **Table 2**. No significant baseline differences between groups were detected with the exception of PA; here, the comparison group demonstrated a significantly higher number of steps per week (p = .002) than the game group.

Over the 7 weeks of game play, the 17 teams successfully completed weekly game activities 91.6% of the time, 57% of students met the individual weekly step goal four or more times, and 25% of the teams met the team step goal four or more times. Results (data not shown in a table) indicate significant differences (p < .001) between baseline step data and each of the weekly totals, i.e., 35,000 baseline significantly less than week 1, week 2, and week 3.

Changes in Body Composition and Physical Activity

Table 3 summarizes baseline and post-intervention values for body composition, PA (steps/week), and self-reported moderate and vigorous activity. A significant group x time interaction was detected for PA (p < .001). A significant increase in steps occurred for the game group (p < .001) verses a significant decrease for the comparison group (p = .001). Significant within-group increases for weight, BMI, and PBF were detected for both groups. However, no significant group x time interactions were found for the body composition measures.

As shown, a significant group x time interaction was detected when analyzing pre- to post-intervention self-reported VPA (p < .001). While both groups reported a decrease in VPA, the decrease was only significant for the comparison group (game p = .298; control p < .001). No significant group differences were found for MPA. Further analysis (data not shown in the table) showed a significant sex difference for VPA within the two groups. Changes in VPA for females were not significant, regardless of group association. However, there was a significant decrease in days of VPA reported for the males in the comparison group (p < .001; 4.1 to 2.8 days) as compared with the game group (p = .848; 3.8 to 3.6 days).

Participant Feedback

The post-gameplay questionnaire included two open-ended questions that participants could use to offer comments regarding game play likes/positive benefits

Table 3.
Changes in Body Composition and Activity

Outcome variable	Gaming group		Comparison group		p value
	Pre	Post	Pre	Post	
Weight (kg; mean ± SD)	66.3 ± 11.0	68.2 ± 11.6	68.3 ± 10.9	69.9 ± 11.1	0.305[a] 0.001[b,c]
BMI (mean ± SD)	22.69 ± 3.24	23.37 ± 3.36	23.55 ± 3.28	24.02 ± 3.12	0.332 0.001[c]
PBF (%; mean ± SD)	20.6 ± 9.1	22.4 ± 8.8	21.0 ± 8.7	21.9 ± 8.6	0.208 0.001[c]
Waist circumference (cm; mean ± SD)	75.1 ± 9.4	76.5 ± 9.1	77.8 ± 8.2	77.8 ± 7.6	0.102 0.119
Activity (steps/week; mean ± SD)	34,235 ± 16,791	47,901 ± 20,224	46,177 ± 22,182	35,912 ± 17,865	0.001[c] 0.008[c]
MPA (days/week)	4.9 ± 1.6	4.1 ± 1.9	4.3 ± 2.0	4.1 ± 1.8	0.410 0.091
VPA (days/week)	4.1 ± 1.6	3.7 ± 2.0	3.9 ± 2.0	3.1 ± 1.8	0.001[d] 0.04[c]

SD, standard deviation.
[a] Group x time interaction.
[b] Time main effect.
[c] Significant at p < .05.
[d] Significant at p < .01.

(e.g., campus awareness, interaction with others) as well dislikes/negatives (e.g., assigned teams, time to play). Given the nonrequired and informal nature of the questions and comments, no formal analyses were conducted. However, comments (**Table 4**) may help inform the design of games targeted at this population.

Table 4.
Sample Comments

• "I liked getting to explore the campus and learning new things about it."
• "I really liked getting out of the classroom."
• "The game really did motivate me to walk—since I learned a lot about the campus, I know it is quicker and better for me to walk to class than take the bus."
• "I liked working with my team, and it was fun getting to know them."
• "The time to play the game each week took too long compared to other lab [non-game] sections."
• "I wish I could have picked my own team. We didn't know each other, and our schedules were different."

Discussion and Implications

The purpose of this study was to examine whether a game intervention could positively influence PA and weight gain within the college-aged population. Previous research has found a decline in PA and an increase in weight during the first two years of college.[7,13,51–55] By leveraging the preferences of today's students, and by drawing upon research related to game design and models of human behavior and motivation, we hypothesized that game play would lead to a more positive PA profile that would involve maintaining or increasing daily activity and also that this activity would attenuate college weight gain previously reported in the literature.[7,12,13,51–55] First, as expected, the game intervention positively influenced the PA (steps/week) of students in the game group; in contrast, the comparison group significantly decreased their PA. The second hypothesis was not supported. During the 9-week study period, both groups gained a significant amount of weight (respectively, 1.9 and 1.6 kg on average).

Regarding the PA results, a study by Randall and associates[51] noted a significant decrease (23%) in the number of daily steps taken during the freshman year for the general population of students, similar to the decrease that we saw in our comparison group during the fall semester of their freshman year (26%). Two studies have demonstrated positive impacts of technology use within the college student population. Magoc and coworkers[56] examined a 6-week behavioral-based course that was delivered online and informed by SCT. Weekly lessons and self-monitoring activities were designed to increase the PA of physically inactive students. Following the intervention, the number of days of self-reported MPA and VPA increased significantly. Jackson and Howton[57] provided pedometers to college students enrolled in a college health course. The students were instructed to wear the pedometer for at least 5 days/week and record their daily steps in an Excel spreadsheet. A significant increase in steps/day was noted from baseline to week 12 (~2400 steps). Overall, our results are consistent with these findings in that a significant improvement in PA and a comparable increase in steps were noted following a technology intervention.

During game play itself, students were accumulating activity (steps) by exploring the campus to solve puzzles and collect clues. In doing so, researchers noted, many of them became aware that walking (irrespective of play) was a viable mode of (campus) transportation and that PA could be part of their daily living. Post-intervention PA data provides initial evidence of this positive impact, i.e., a general increase in steps/week compared with baseline. This near-term result may have a longer-term positive impact on their approach to daily activity. In addition, students were made aware of campus landmarks, exposed to the campus's history, and introduced to many facilities, including activity-centered ones such as the pool. This type of exposure and learning is particularly important for first-semester freshmen and may influence future PA behaviors. Furthermore, play may have had a positive impact on exercise, as exhibited by the nonsignificant decreases in VPA and MPA. Finally, the game provided the opportunity for students to interact with and support each other and learn how to work together toward a common goal. As suggested by participant comments, the game provided a platform for tangential learning—"learning" that did not seem like formal classroom learning at all; rather, students were learning by collaborating, socializing, and engaging in face-to-face and media-rich exchanges.

Regarding weight gain results, typical weight gain during the first year of college has been reported to range between 1 and 4 kg.[12,13,51–55] One objective of the game was to minimize weight gain though PA. However, weight gain or loss is complicated in nature and is dependent upon maintaining an energy balance. Incoming freshmen are exposed to a significant change in environment, including decisions regarding the timing, quantity, setting, and composition of the food they eat; sleep patterns; and

amount of PA.[3,55] As noted earlier, *The Skeleton Chase* ARG was not designed to explicitly address nutrition and weight management. Therefore, it is likely that nutritional changes may have had a large impact on the weight of the subjects, offsetting any positive PA changes in the game group. This emphasizes the importance of testing multilevel and multidimensional interventions to improve healthy lifestyle behaviors during this critical transition time.

This study has several strengths worth noting. First, it focuses attention on a population that has been largely understudied. As evidenced here, interventions that speak to the needs and preferences of college students may facilitate the adoption of PA and healthy behaviors. Second, the use of the ActiPed monitor allowed for an objective measure of steps/day. Due to the design of the monitor, participants were also not able artificially inflate steps by shaking or tampering with the monitor, thus enhancing validity. And during the periods that baseline and post-intervention measurements occurred, students were not able to view their activity online, which could have influenced their activity. Lastly, the three-person student teams were created after baseline measures of activity were recorded and were balanced so that overall levels of initial PA had a similar range (i.e., one member at the low end of activity, one in the middle of the range, and one at the high end) within each team.

As in any study, limitations do exist. First, our subjects were freshman-level students enrolled in a health course. While this approach allowed us to test our hypotheses in a group transitioning from high school to college, it may cause possible contamination, as study groups were drawn from the same course. A next step is to examine whether results hold (or improve) with volunteer subjects from the general student body. Second, while an objective measure of PA (steps/week) was captured via the ActiPed, we also used a self-report questionnaire to describe MPA and VPA. While easy to administer and interpret, we acknowledge potential drawbacks, including the potential for memory or recall bias, as measurement occurs after the actual experience of PA. However, the questionnaire items were validated; self-report responses were highly accurate compared with measurements of actual PA.[7,47] Third, students raised concerns about what other, nonplaying, students thought of them as they wore the ActiPed during game play (e.g., other students suggested that shoes with ActiPeds were stolen or the wearer was under house arrest). We never anticipated these reactions but fully appreciate the concerns. Future studies should explore additional metrics and/or means to measure PA. Lastly, while our initial results regarding PA are positive, future work is needed to determine if these behavioral changes are sustained over time.

Conclusion

We reported the results of a game intervention designed to influence college students' PA. Designed in light of changing learning preferences and expectations, our initial results are promising relative to the impact of the game on PA. While much remains to be learned about the role of games as interventions, the lessons we have learned to date are serving as the impetus for further game design enhancements and testing. We hope our findings are useful to others interested in health intervention strategies.

Funding:

Support for this research was provided by the Robert Wood Johnson Foundation's Pioneer Portfolio through a grant from its national program, "Health Games Research: Advancing Effectiveness of Interactive Games for Health."

Disclosures:

Jeanne D. Johnston and Anne P. Massey are full-time employees of Indiana University. Rickie Lee Marker-Hoffman is a full-time student at Indiana University.

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