PNF 2.0? Initial evidence that gamification can increase the efficacy of brief, web-based personalized normative feedback alcohol interventions

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HIGHLIGHTS

- Students received either gamified or standard personalized normative feedback.
- Peer drinking norms were corrected in both gamified and standard PNF conditions.
- Reductions in norms and drinking were greater in the gamified PNF condition.
- Gamified elements may increase the efficacy of web-based PNF interventions

ARTICLE INFO

ABSTRACT

Gamified interventions exploit the motivational characteristics of a game in order to provide prevention information and promote behavior change. Despite the modest effect sizes observed in increasingly popular web-based personalized normative feedback (PNF) alcohol interventions for college students, previous research has yet to consider how gamification might be used to enhance efficacy. This study examines whether a novel, gamified PNF intervention format, which includes a point-based reward system, the element of chance, and personal icons to visually represent users, is more effective in reducing short-term alcohol use than the standard web-based style of PNF currently used on college campuses. Two-hundred and thirty-seven college students were randomly assigned to receive either a standard brief, web-based PNF alcohol intervention or the same alcohol intervention components delivered within a Facebook-connected social game called CampusGANDR (Gamified Alcohol Norm Discovery and Readjustment). In both study conditions participants answered identical questions about their perceptions of peer drinking norms and own drinking and then received the same PNF slides. Two weeks following PNF delivery, participants again reported their perceptions of peers' alcohol use and own drinking. Students in the CampusGANDR condition reported significantly reduced peer drinking norms and alcohol use at the two-week follow-up relative to students who received identical PNF delivered by standard online survey. Further, a mediation model demonstrated that this effect was driven by larger reductions in perceived drinking norms among participants assigned to receive CampusGANDR, relative to control. As web-based PNF is becoming an increasingly universal prevention strategy, findings from this study suggest gamification may represent one method by which intervention efficacy could be substantially improved. The potential methodological and economic benefits associated with gamified PNF interventions are emphasized and directions for future research are discussed.

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1. Introduction

College students tend to overestimate how much and how often their peers drink (Borsari & Carey, 2003; Larimer, Turner, Mallett, & Geisner, 2004; Lewis & Neighbors, 2004). This is a significant problem since perceptions of peer alcohol use norms are among the strongest

known predictors of future drinking behavior (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins, 2003). To combat this issue, researchers have developed interventions to correct misperceptions of peer drinking norms. Personalized Normative Feedback (PNF) is one norms-based intervention strategy that has become a dominant approach for reducing problematic alcohol use on college campuses. Brief and cost-effective, PNF consists of an individualized report in which national or campus-wide drinking statistics are presented graphically alongside participants' estimates of peer drinking behaviors and their own self-reported drinking (Berkowitz, 2005; Lewis & Neighbors,

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2007; Miller & Prentice, 2016). Both stand-alone and multicomponent interventions incorporating PNF have been found to reduce alcohol use in randomized clinical trials (Borsari & Carey, 2000; Doumas, Haustveit, & Coll, 2010; LaBrie et al., 2013; Lewis & Neighbors, 2007; Martens, Smith, & Murphy, 2013; Neighbors, Larimer, & Lewis, 2004; Neighbors et al., 2010). However, PNF has consistently demonstrated only small to moderate reductions in students' drinking (Dotson, Dunn, & Bowers, 2015; Walters & Neighbors, 2005) and researchers have identified several issues which may limit the effectiveness of this approach. If these limitations are remedied the public health benefits associated with this cost-effective intervention strategy could be substantial.

In order for PNF to successfully correct normative perceptions and induce reductions in alcohol use, participants' attention must be captured and they must accept the presented normative data as both believable and credible (Berkowitz, 2005; Perkins, 2003; Perkins & Berkowitz, 1986). Researchers have, therefore, speculated that doubts about the credibility of drinking statistics presented (Hummer & Davison, 2016; LaBrie, Hummer, Neighbors, & Larimer, 2010), defensive reactions among heavy drinkers (Granfield, 2005; Steers, Coffman, Wickham, Bryan, Caraway, et al., 2016), and general inattention to feedback (Lewis & Neighbors, 2015) may be responsible for the modest effects observed. Surprisingly, although approximately 100 published studies during the past two decades have evaluated PNF components (Cronce & Larimer, 2011; Dotson et al., 2015; Larimer & Cronce, 2002); innovation seeking to rectify these limitations has been slow to emerge. In fact, aside from advances in delivery modalities (e.g., in-person, mail-based, web-based) and reference group specificity (e.g., general student, same-sex student, same-sex and ethnicity student; LaBrie et al., 2013; Lewis & Neighbors, 2007), the format has remained essentially unchanged since the first PNF studies were published over 20 years ago (Agostinelli, Brown, & Miller, 1995). However, because web-based PNF is one of the most economical and scalable alcohol intervention formats, there is growing interest in how its efficacy can be improved. In the service of this interest, the current study presents preliminary data supporting a novel stand-alone, web-based PNF intervention, "CampusGANDR" (Gamified Alcohol Norm Discovery and Readjustment), which departs radically from standard PNF in that it is packaged not as a program to reduce risky drinking but as a Facebook-connected game about college life.

1.1.1. Intervention gamification

Gamified interventions, also known in the literature as *Serious Games*, exploit the motivational characteristics of a game in order to provide prevention information or engage behavior change (Cook, Brennan, Gray, & Kennard, 2015; Cugelman, 2013). *Serious Games* have shown initial promise as a method for motivating audiences to engage in healthy behaviors and decrease unhealthy behaviors, including alcohol use (Cook et al., 2015). In a recent analysis of gamification features, the presence of certain elements within a software app (e.g., point-based reward systems, chance, progressing difficulty levels) were associated with favorable reviews by users and increased app success (Bharathi, Singh, Tucker, & Nembhard, 2016). Informed by both gamification and alcohol intervention research, three of these elements were selected to improve the effectiveness of PNF delivered by CampusGANDR: personal icons, chance, and points.

1.1.2. Personal icons

The graphical representation of self and others via personal icons or avatars is an essential element of many online games. This feature induces self-awareness and virtual co-presence, the sense of being together with others online (Campos-Castillo, 2012; Lee, 2004). Personal icons leverage co-presence in CampusGANDR to combat a lingering problem associated with social norms interventions; the fact that heavy drinkers are likely to question, dismiss, and derogate normative statistics from national and campus-wide surveys (Campo & Cameron, 2006;

Granfield, 2005; Polonec, Major, & Atwood, 2006). One potential solution to this problem is suggested by LaBrie, Hummer, Neighbors, and Pedersen' (2008); LaBrie, Hummer, Huchting, and Neighbors' (2009); LaBrie et al.' (2010) live, interactive, group-based normative feedback intervention format. This approach involves groups of students using clickers to answer questions about normative perceptions and their own behaviors in real time, generating live norms for the group. The success of these interventions suggests that the ability to visualize the other college students whose behavioral reports create the normative statistics may increase the credibility of the feedback.

CampusGANDR was designed to simulate this generation of norms among visible peers by borrowing the concept of co-presence from the gamification literature and harnessing the popularity of social media. Facebook integration allows CampusGANDR users to view the thumbnail profile photos of peers contributing to the norms, creating a sense of shared experience and a feeling of inhabiting the same online environment. As Facebook is now used by over 95% of undergraduates (Boyle, LaBrie, Froidevaux, & Witkovic, 2016; Ridout & Campbell, 2014) many external applications and websites popular among college students now employ a Facebook login, which requires users to sign in with their Facebook credentials. This action both verifies the user's identity and allows the application to access to his or her Facebook information and profile picture. Facebook profile pictures are commonly used within external applications to personalize users' experiences and represent them socially. Thus, in CampusGANDR, Facebook login allows users to become members of a virtual group of students, all identified by their Facebook thumbnail photos, who participate collectively in the generation of normative statistics.

1.1.3. Chance

Most PNF alcohol interventions for college students have been transparent in their alcohol focus. That is, it has been abundantly clear to participants that researchers are interested in their alcohol use and are providing feedback in an effort to decrease their drinking. Problematically, research suggests awareness that the goal of an intervention is to modify behavior may trigger psychological reactance, undermining efficacy (Brehm & Brehm, 1981, 2013). Due in part to such reactance, dogmatic alcohol prevention messages have actually been found to *increase* alcohol use among heavy drinking college students (Bensley & Wu, 1991). In an effort to decrease potential reactance to alcohol PNF, CampusGANDR is presented as social game that tests perceptions and reveals truths about *multiple* aspects of college life including studying, hooking up, drug use, television watching, social media use, alcohol use, and exercising. To enhance belief in this cover story the app features a spinner, styled to look like a slot machine which selects three topics, ostensibly at random, at the start of each session. Participants then answer questions about their own behaviors and perceptions of peer behaviors in these three domains. Later, a second spinner selects one of the three topics, again ostensibly at random, on which the user will receive feedback. Thus, when this spinner is programmed to select alcohol as the feedback topic, CampusGANDR users receive the same alcohol PNF they would receive in a typical PNF intervention but the illusion of chance is employed to make it less obvious that this feedback is designed to alter drinking behavior.

1.1.4. Points

One of the earliest and most pervasive theories of learning is operant conditioning (Skinner, 1948), which holds that behavior can be shaped through the manipulation of consequences. In gamified learning paradigms this is generally manifested in the form of conditioned reinforcements such as points, badges, or tokens (Antin & Churchill, 2011, Evans, Jennings, & Andreen, 2012, Nagle, Wolf, Riener, & Novak, 2014). Use of these elements to reward desired behaviors and responses in educational games has been found to increase motivation and strengthen the learning of facts, procedures, and strategies (Johnson et al., 2016; Kapp, 2012). Further, a recent review of gamified interventions