Unpacking Peer Conversations in a Virtual Communitiy for Diabetes Self-Management Education and Support: Behavior Science and Linguistics Perspective

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Abstract. Diabetes is a chronic disease that can be effectively managed and controlled using strategies such as self-management education and ongoing support. Virtual environments offer innovative and realistic settings where patients can achieve self-management education and obtain ongoing self-management support from peers and healthcare professionals. Transcribed real-time conversations in an innovative virtual community were analyzed using qualitative and linguistic analysis. These virtual interactions were manually coded to identify embedded behavior change techniques and linguistic features. Results showed 13 behavior change techniques were manifested. Further, language differences were observed between behavior change techniques and social support types. Our research can provide valuable insights into the design of effective digital health interventions that maximize sustained use of virtual environments, subsequently impacting self-management of chronic conditions such as diabetes.

Keywords. Diabetes, social support, virtual communities, behavior change

1. Introduction

Diabetes affects an estimated 10.5% of the US population today, making it a serious public health threat to the country [1]. In addition, type 2 diabetes (T2D) accounts for about 95% of all diabetes burden, making it highly prevalent and very likely to increase

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in the coming years [1,2]. Despite this situation, evidence has shown that T2D can be managed and controlled effectively [3–5]. Effective diabetes management and control strategies include diabetes self-management education (DSME) and ongoing self-management support by both peers and professionals [3–5]. However, studies show that only 6.8% of people with diabetes participate in DSME [6]. Low engagement in DSME thus highlights the need for making these interventions more accessible to patients.

The Internet's increased and widespread adoption by patients creates new opportunities to make interventions targeting education, health behaviors, and social support more accessible. Virtual environments are offering patients innovative realistic settings that they can use to acquire and apply knowledge. Second Life (Linden Lab, San Francisco, CA) allow users to socialize and experience simulated environments resembling those of the real world through virtual human representations known as avatars [7]. These experiences have shown they can lead effectively to "significant learning gains" [8]. Features such as presence, immersion, and social interaction not only enable patients to learn and practice new behaviors, but also facilitate accessible communication with peers, educators, and providers [7,9].

Lastly, studies show virtual environments have been mostly used for information dissemination and support groups [10]. Additional uses of virtual environments that can benefit DSME include synchronous and asynchronous access to education, skill-building activities, and peer and professional support [10]. Our study uses data from an innovative virtual environment-based intervention for DSME and social support [1,2] with the twofold objective of: (1) characterizing behavioral change techniques manifested among virtual interactions and (2) describing linguistic features embedded within these interactions. Such characteristics can provide insights for the design of future interventions aiming for an effective control of chronic conditions, such as diabetes, that are based on virtual environments.

2. Methods

2.1. Second Life Impacts Diabetes Education & Self-Management (SLIDES)

SLIDES was one of the first virtual communities aiming to provide DSME and social support [2]. Created in Second Life, SLIDES' DSME and support sessions allowed avatar-mediated peer to peer interactions between participants and educators, which resulted in one of the first diabetes immersive communities to be studied [2]. The SLIDES community consisted of 20 participants and 4 diabetes educators/moderators. Participants were mostly female (95%) and 53 years old on average (range, 39-72 years); 65% were white and 35% were African American. Detailed participant demographics have been described elsewhere [2]. A key characteristic of SLIDES was the potential for participants to develop skills via simulation and rehearsal within the virtual environment [9]. These skills showed to be transferable and thus affected outcomes and behaviors in the real world [9].

Data from SLIDES virtual interactions was used for our study. These virtual interactions consisted of transcribed real-time conversations, emails, discussion board postings, and text-chat among participants and between participants and diabetes educators/moderators within the virtual environment [11]. However, most virtual interactions occurred via synchronous conversations held at different places within the SLIDES site (e.g., restaurant, community center). In addition, these synchronous

conversations were previously coded for types of social support by Lewiski et al [11]. Lewiski and her team identified 761 interactions where the following types of social support were exchanged between users: appraisal, emotional, informational, and instrumental. Lastly, our secondary analysis as well as related parent studies, were approved by the University's Institutional Review Board.

2.2. Theory-Driven Techniques for Behavior Change and Self-Health Management

The behavior change technique (BCT) taxonomy was used to manually code all SLIDES virtual interactions. The BCT taxonomy consists of 93 theoretically linked techniques which are clustered into 16 thematic categories [12]. Definitions for BCT categories and subcategories can be found in a study published by Michie et al [12]. Table 1 shows a few snippets of sample SLIDES virtual interactions.

Table 1. Sample extracts from SLIDES supportive virtual interactions mapped to BCTs categories.

BCT	Sample message snippets from SLIDES
Feedback and monitoring	We want your blood sugars to stay as normal as possible, but the goal is to get it below 7, uh, with diabetes.
Shaping knowledge	Hi everyone This is my tasty way of making healthy green beans with lots of flavor INGREDIENTS… DIRECTIONS…
Self-belief	Guess I better go this go on around the beer .That's not a good thing.

2.3. Linguistic Analysis

LIWC2015 (Linguistic Inquiry and Word Count) was used to perform linguistic analyses [13]. LIWC performs text analysis and also compares each word analyzed against its built-in dictionary. This dictionary identifies word associations with a diverse set of psychologically relevant categories. Most of the LIWC output variables are percentages of total words within a text, while summary variables have been derived from previous research and converted to percentiles based on standardized scores from large comparison samples. Evidence has shown LIWC to be accurate, in addition to its capacity to provide a broad range of social and psychological insights [13].

3. Results and Discussion

3.1. Behavior Change Techniques

Manual coding results showed 13 behavior change techniques were manifested with the following being the most common: comparison of outcomes (28%), social support (21%), shaping knowledge (19%), natural consequences (17%), and repetition and substitution (8%). Based on social support types, a larger proportion of BCTs were manifested within appraisal and emotional support. Particularly, the comparison of outcomes category manifested more frequently within these two support types. In contrast, the repetition and substitution category manifested more frequently within informational support.

3.2. Linguistic Analysis

SLIDES virtual interactions were characterized by a higher use of references to drives and needs; present time rather than past or future times; cognitive processes rather than analytical; positive emotions and affect language; and informal speech. Figure 1 shows the percentage of words associated with affective processes within support types. User interactions' language reflected the nature of educational cognitive processes within SLIDES. In addition, linguistic features of supportive interactions by user role showed that users were characterized by a higher emotional tone. Further, participants were characterized by higher authenticity while diabetes educators/moderators were characterized by higher clout.
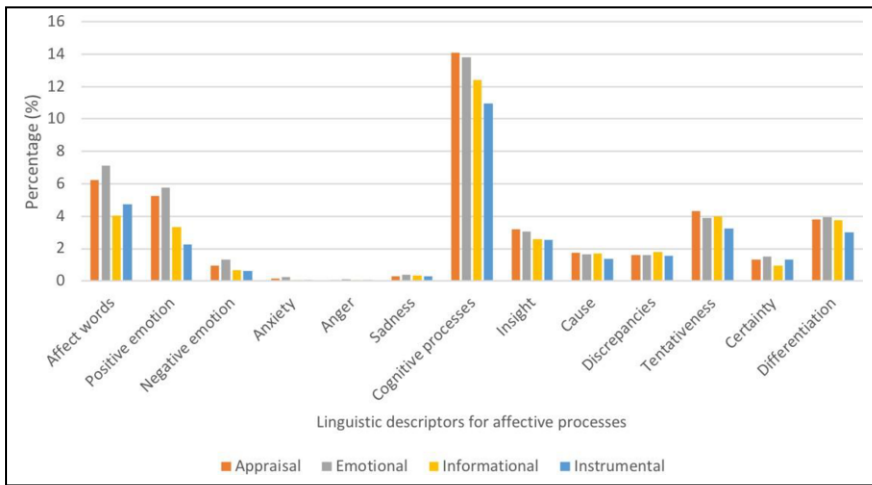

Figure 1. Percentages of words associated with affective processes for SLIDES interactions within support types.

Our linguistic analysis allowed us to reveal the unique language differences across BCTs more frequently manifested within SLIDES supportive interactions. Overall, BCT taxonomy categories manifested within SLIDES interactions were characterized by a high use of dictionary and function words; higher use of references to present time rather than past or future times; and higher use of references to drives and needs. Lastly, summary variables also indicated a higher use of emotional tone versus analytical language across the most frequently manifested BCTs.

3.3. Limitations

First, the small sample size of the SLIDES study limits our results, thus our findings should be interpreted with caution. Second, our analyses were not considered at an individual level. This resulted in group identification of social support, meaning that a type of social support was assigned to all participants interacting in a discussion where social support was provided. Future studies could analyze individual participant's interactions with other participants so that social support exchanges are described at an individual level, thus providing more accurate results. Despite these limitations, we

consider our findings valuable because of the insights provided into virtual social support exchanges and behavior change techniques.

4. Conclusion

Virtual environments offer chronic patients innovative and realistic settings they can use not only to acquire and apply health care knowledge but also to achieve self-management education and obtain ongoing support from peers and healthcare professionals. Virtual communities can be studied to better understand behavior change techniques manifested through virtual interactions as well as the linguistic features inherent in virtual environment-mediated communications. BCTs and linguistic features observed within SLIDES virtual interactions can provide valuable insights into the design of interventions that are based on virtual environments that can potentially maximize benefits for users while impacting support and self-management of chronic conditions.

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