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Assessing Video Game Satisfaction of Gamers with Disabilities

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According to a survey conducted by the CDC, it is estimated that 26% of Americans are living with a disability. Of those with disabilities in the United States, it is estimated that 33 million play video games. People with disabilities face many barriers in gaming, which is likely to impact game satisfaction. Measuring game satisfaction among this population can be problematic if the scale is not adapted to their needs, which can vary significantly based on the disability. To understand how best to assess game satisfaction among these populations, we discuss the issues people with cognitive, sensory, and/or motor disabilities may face when completing assessment scales and then use the validated Game User Experience Satisfaction Scale (GUESS) as a framework for understanding the game design issues that may impact satisfaction.

INTRODUCTION

According to a survey conducted by the CDC, it is estimated that 26% of Americans are living with a disability. 13.7% have a motor disability, 10.8% have a cognitive disability, 5.9% have a hearing disability, and 4.6% have a visual disability. The rest of the disabled population have disabilities relating to self-care and independent living (CDC, 2020). Additionally, it is likely that a person can have more than one disability at the same time. For example, someone may be both hearing and visually impaired.

This paper will focus on three categories of disabilities: cognitive, sensory, and motor (Aguado-Delgado et al., 2020).

Cognitive impairment is a mental and psychological disorder that can range from intellectual disability that developed in adolescence, to memory loss or cognitive decline as a result of aging. Autism, Down syndrome, dyslexia, and attention deficit disorder are common cognitive impairments.

Sensory impairment includes hearing impairment or visual impairment. Hearing impairment refers to the partial or complete loss of the ability to hear from one or both ears, and can range from mild to profound. Deafness refers to the complete loss of hearing in one or both ears. Visual impairment refers to the result of having a certain degree of vision loss. This could include color blindness, low vision or partial sightedness, legal blindness, and complete blindness.

Motor impairments refer to the loss or limitation of muscle control, or the limitation of mobility. This can be caused by injury, paralysis, or disorders such as Parkinson's or Rett syndrome (WHO, 1993).

ADAPTATION OF SCALES FOR SPECIAL POPULATIONS

There has been a number of studies proposing alternative scale design for people with disabilities. Considerations for those with cognitive, sensory, and motor deficits have been noted as follows:

Cognitive

Those with cognitive disabilities are more likely to struggle with comprehension of questions. Strategies for improving comprehension of the scale questions include presenting each question one at a time, using large print, reading the questions out loud (Dagan et al., 2008; Lindsay & Skene, 2007), presenting supplemental questions (Lindsay & Mitchey, 1988), incorporating photos or symbols that relate to the question or meaning of the text along with the text of the question (Illingworth et al., 2003; King et al., 1994), shortening the length of the questionnaire (Nezu et al., 1995), and simplifying the language of the question (Dagan et al., 2008; Ramirez & Lukenbill, 2008).

Additionally, the response formats of questions may need to be changed. The most proposed changes were to modify Likert scale responses to only have three options, rather than five or more (Cuthill et al., 2003; Finlay & Lyons, 2001; Lindsay et al., 2008; Nezu et al., 1995), or to change the response scale to only have yes/no responses (Cuthill et al., 2003; Dangan & Sandhu, 1999; Dagan et al., 2008). Other strategies included having pictures or symbols accompany the text of the response (Illingworth et al., 2003), changing response scales from numbers to faces (Cummins et al., 1997; King et al., 1994), including a histogram with the appropriate bar sizes to enhance comprehension of the response options (Linsday & Skene, 2003) or change the response scale from having distinctive points to being a continuous line on which the participant can mark (Dangan & Sandhu, 1999), or including an option for caregivers to report responses on behalf of the individual (Cummins et al., 1997; Cuthill et al., 2003; Esbensen et al., 2003).

Another issue presented when using scales with participants with cognitive disabilities is response acquiescence. Strategies for adapting scales include asking participants to respond by pointing at pictures that represent the correct response, varying where the correct response was placed on the page (Illingworth et al., 2003) including questions that had opposite responses (Stancliffe & Parmenter, 1999), including neutral items in their response options (King

et al., 1994), and presenting response options in a random order (Lindsay & Mitchey,1988). These strategies allow the researcher to make sure that a participant is not just giving the same response to each question or pointing to the same place on a page.

Additional strategies for presenting scales to individuals with cognitive disabilities included breaking up the test into different sessions to prevent boredom (King et al., 1994) and including a cessation rule to limit distress at failure, if a participant fails to complete a task multiple times (Masson et al., 2010).

Sensory

Those with sensory disabilities may need to have the presentation of the scale changed. For example, with respondents with visual disabilities, King et al. (1994) asked special education teachers to administer the survey, while also providing the option to use magnifying lenses, and providing the survey in both large print and braille. Surveys can also be provided in an online format instead of on paper (Kaczmirek & Wolff, 2007). Strategies for enhancing understanding of the overview or purpose of the survey and how the questions are formatted include having as few questions and answer types as possible, providing information about the topic of the survey, how to fill out and return the survey, and the length of the survey. Survey designers should also provide information about the type of answer that is needed after each question, and, if developing a braille version, show the number of answer options after each question. To enhance navigation and orientation, survey designers should make every question and every answer distinct by starting questions with a number followed by a period and starting answers with a letter followed by a parenthesis, and the first answer in that category should start with letter “a" with the following answers being in alphabetical order. Additionally, they should group questions and answers together by adding a blank line before each question, but not before answer options, and answer options should be worded in such a way that there are a maximum of different letters at the beginning and end of each answer option so it is easy to recognize each answer item. In order to streamline the survey answering process, checkboxes should be included immediately after the text of each answer option, and including answer options in the question, rather than having them on separate lines after the survey question (Kaczmirek & Wolff, 2007).

For those with hearing impairments, it may not be necessary to modify the presentation of written scales. However, if any portion of the scale is presented auditorily, having a written version of the scale or providing an ASL translator may be necessary.

Motor

Adaptations of scales for people with motor disabilities focuses mostly on the content of the questions in the scale, rather than the format of how the questions are presented. Questions should be modified, added, or removed in order to better fit the population (Washburn et al., 2002). Additionally, experts can be consulted in order to develop appropriate questions or evaluate existing questions. If the scale is evaluating motor movement, experts can also provide guidance on the level of support that should be given in order to promote understanding or help the participant complete a task (Salavati et al., 2015).

Measuring Game Satisfaction Among Disabled Populations

According to the AbleGamers Foundation there are approximately 33 million disabled gamers in the United States (Barlet & Spohn, 2012).

The disabled community faces barriers in gaming including the inability to hear necessary audio features, distinguish important visuals, or move the controller easily. Barriers also occur when the game does not work well with the assistive technologies that disabled gamers use, such as text-to-speech systems, voice commands, modified controllers, on-screen keyboards, or assistive programs such as AutoHotkey (Porter, 2013).

Several scales have been developed to assess video game satisfaction, such as the Player Experience of Needs Satisfaction (PENS; Ryan et al., 2006), the Game Experience Questionnaire (GEQ; IJsselsteijn et al., 2008), and the Game User Experience Satisfaction Scale (GUESS; Phan et al., 2016). The GUESS is one of the most comprehensive, validated measures of video game satisfaction; it has 55-items and nine subscales including Usability/Playability, Narratives, Play Engrossment, Enjoyment, Creative Freedom, Audio Aesthetics, Personal Gratification, Social Connectivity, and Visual Aesthetics. The GUESS-18, a shorter,18-item version recently was created for quicker testing and research (Keebler et al., 2020)

Since gamers with disabilities face barriers that affect how they can play video games, it is likely that satisfaction is impacted when a game is not designed to meet their needs. However, no previous studies have been conducted on how much satisfaction is affected nor how best to measure satisfaction among these populations.

Scale Adaptation in Gaming

A review of the literature shows a lack of video game satisfaction scales adapted for use with disabled gamers. The System Usability Scale (SUS; Brooke, 1996), a general 10-item perceived usability scale which could be used to assess user perceptions of game usability, has been modified for use with older adults and those with cognitive impairments. In this adaptation, the text of each item was simplified, an item using the term “inconsistency” was replaced with the term “confusion”, and the system being evaluated was specifically mentioned in each item. While this instrument can be used to assess perceived usability, it was not developed for video games specifically, like the PENS, GEQ, or GUESS. More

research needs to be done to determine how well the existing video game satisfaction scales measure satisfaction among gamers with disabilities, and whether adaptation is necessary.

VIDEO GAME DESIGN IMPLICATIONS FOR DISABLED POPULATIONS

To understand how video game satisfaction can be impacted by how a game is designed, we explored a set of game accessibility guidelines (www.gameaccessibilityguidelines.com) and mapped them to the nine dimensions of the GUESS (see Table 1 in Appendix). For example, if the background noise in a video game is not adjustable, the noise may blend in with or overpower important speech or audio cues, causing a gamer with a disability to have a poor auditory experience (as reflected in the GUESS Audio Aesthetics dimension). Some of the game accessibility guidelines did not map to the statements within the GUESS dimensions but are expected to influence satisfaction. For example, the guidelines recommend that a game provide an option 1) to adjust game speed 2) to turn off/hide background animation, and 3) to ensure screen reader support. While the lack of adherence to these guidelines would most likely impact Usability/Playability, Play Engrossment, and/or Enjoyment, it was not evident that it would be reflected by the current GUESS statements. This suggests that the GUESS may need to be re-evaluated and adapted for disabled populations.

DISCUSSION

Future research on adapting game satisfaction scales to gamers with disabilities is needed. Aguado-Delgado et al. (2020) conducted a systematic review of the literature concerning accessibility in video games. Findings from this review reveal the need for more defined software development methodologies to ensure accessible game design. This may include the strict adherence to guidelines throughout iterative design and development as well as validated measures to assess gamer satisfaction. A qualitative study using the Game User Experience Satisfaction Scale (GUESS) with disabled populations is currently underway in our laboratory. We are examining how understandable, comprehensive, and accessible the scale is for these populations so that changes can be made for future validation. Preliminary results have shown that wording may need to be simplified when presenting the scale to those with cognitive disabilities, and the ability to adapt video game settings based on personal needs is not addressed in the GUESS-18, which may affect satisfaction.

TAKE-AWAYS

- Scales often need to be adapted for people with disabilities in order to enhance understanding and correctly measure constructs.
- Since people with disabilities often face barriers in gaming, it is likely that satisfaction in gaming is impacted.
- No game satisfaction scales have been modified for people with disabilities and thus the game satisfaction of gamers with disabilities may not be measured accurately.
- More research needs to be done to evaluate game satisfaction scales with gamers with disabilities to ensure their needs are being met.

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APPENDIX

GUESS Dimension	Game Design Guidelines for Accessibility
Audio Aesthetics - The different auditory aspects of the game (e.g., sound effects) and how much they enrich the gaming experience	Subtitles/captions; adjustable background noise/music; visual cues as to who is speaking and cues or captions for significant background noise; short and understandable subtitles/captions; surround sound is used
Creative Freedom - The extent to which the game is able to foster the player's creativity and curiosity and allows the player to freely express his or her individuality while playing the game	Adaptable and easy to use interactive elements; separate volume controls or mutes for effects, speech and background/music
Enjoyment - The amount of pleasure and delight that was perceived by the player as a result of playing the game	Alterable difficulty level; option to disable blood and gore
Narratives - The story aspects of the game (e.g., events and characters) and their abilities to capture the player's interest and shape the player's emotions	Subtitles/captions are or can be turned on before any sound is played; no essential information is conveyed by sounds alone; all sound is able to be replayed; narrative progress summaries
Personal Gratification - The motivational aspects of the game (e.g., challenge) that promote the player's sense of accomplishment and the desire to succeed and continue playing the game	Alterable difficulty level; reminders of current objectives during gameplay
Play Engrossment - The degree to which the game can hold the player's attention and interest	All settings are saved/remembered; surround sound is used
Social Connectivity - The degree to which the game facilitates social connection between players through its tools and features	Text, voice, and symbol-based chat supported; preference settings for playing games with players who will only play with or are willing to play without voice chat; real time transcription and signing
Usability/Playability - The ease in which the game can be played with clear goals/objectives in mind and with minimal cognitive interferences or obstructions from the user interfaces and controls	Flexible mapping/reconfiguration/sensitivity of controls; customization of interface and element sizes; alternative input devices and screen reader support; voiceovers for all text; clear indication of what elements are interactive
Visual Aesthetics - The graphics of the game and how attractive they appeared to the player	Customizable font sizes; sufficient contrast between text and user interface background; screen reader compatibility; no essential information is conveyed by color, sounds, or text alone

Table 1 - Game Design Guidelines by GUESS Dimension Measuring Satisfaction