SHORT PAPER: NEUROPSYCHOLOGICAL GAME-BASED INTERVENTION WITH GIFTED STUDENTS

Short Paper - Concurso de Teses e Dissertações SBGAMES 2025

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Abstract. *This short paper presents a précis of the dissertation "Protocolo de Intervenção Neuropsicológica baseada em jogos para Estudantes Superdotados". This dissertation, being written in Scandinavian model for thesis and dissertations, presents a metasynthesis on recent findings on the use of games for mental health, as well as a design study for a role-playing game concerning personality, executive functions and intelligence for a neuropsychological GBI, and a double-blind clinical trial with teenage students which found out solid evidence for the usage of analogic games for attention, verbal intelligence, and somatization of mental-health concerns with both general teenager population and gifted students population.*

Keywords— *Game-based Intervention, neuropsychology, giftedness, RPG*

1. Introduction

From 1970 onward, with the publication of Serious Games, by Clark C. Abt (1970), there are studies on the use of games as tools for teaching and for health promotion, but it was not until a decade ago that the field of Game-Based Interventions gained traction and is having a meaningful growth (Tanello, 2025). Nonetheless, there are issues both in theoretical embasement for GBI (game-based intervention) in psychology, as well as the lack of quantitative, longitudinal, clinical trials of quality that can support its findings

This dissertation is organized in a Scandinavian style for thesis and dissertations, therefore, it presents three studies that are interwoven by a conductor thread - the use of analog/tabletop games as a tool for GBI with teenagers, mainly (but not only), gifted students. The first study is a metasynthesis (or, in other words, a qualitative systematic review of literature with the greater degree of scientific evidence among qualitative studies) named *Scholarly Inputs Toward the Use of Games as Instruments of Mental Health Interventions*, the second is a game design study for a RPG development as a

neuropsychological GBI (GBI-N) tool named *Design of a RPG supplement to Neuropsychological Game-Based Intervention (GBI-N)* and the last a longitudinal, longitudinal experimental clinic comparison study, named *Viability Evidences of a RPG for GBI-N with students from Curitiba*.

Even if it presents some minor setbacks, being them mostly due to the small pool of samples for the statistical analysis of the clinical study (a factor that was addressed and corrected in the statistical analysis model utilized for the study, for maximum predictive results), this dissertation presents a series of meaningful advances for game studies, mainly for the use of games in mental health. For instance, it answers a constantly formulated issue on GBI studies (Yuliawati et al, 2024) that is the lack of methodological consistency, the lack of a coherent theoretical approach, with pre-defined terms and academic concepts, which detracts from the replicability and academic evidence degree of studies without this theoretical embasement. Moreover, the report of a game design process on a game designed for a health intervention delineates basic game design concepts that are usually forgotten or left aside when a research team of therapists, educators or health professionals engage in such an endeavor. Although being the first TTRPG reportedly designed with a health intervention purpose in mind, this doesn't take away the fact that there are elements of game design that are of utmost importance when designing a game, with health and educational purposes or not. Lastly, but not least, the clinical study is one of few to present clinical uses of RPG in a quantitative way, with a profound degree of evidence. Also, it is the first (quantitative or qualitative) paper that addressed RPG's potential for verbal intelligence interventions with gifted students, and found interesting evidence on positive attentional effects of RPGs with teenagers.

2. Methods

The metasynthesis adhered to Finlayson e Dixon (2008) parameters for qualitative synthesis and aimed for an a priori, detached, exhaustive, formal criteria of evaluation, and systematic approach, it also followed PRISMA's regulations for a coherent report of a systematic review of literature (see Figure 1 below). The study analyzed papers from Scielo (latin-america database) and the main databases on psychology research internationally (PsycInfo, Pubmed, and Scopus) trying to answer his proposing question of research: Which theoretical approaches and concepts are better applied to an analogic game based neuropsychological intervention?

Inclusion criteria consisted of: qualitative and mixed approaches studies on psychological interventions with analog tabletop games. As such, digital gaming, sporting games, and interventions where games were environmental enrichment instruments were exclusion criteria, together with the usual methodological exclusion criteria of repeated studies, studies that weren't peer-reviewed. Also, being a metasynthesis, quantitative findings were away from its scopus (since this study model aims to synthesize a study field through the extensive analysis of theoretical (and therefore qualitative) approaches for the theme in question, therefore, only qualitative and mixed approaches finding were analyzed.

For the second study, the methods utilized for game designing the RPG for a neuropsychological GBI were mainly based on MDA's framework for game design

(Hunicke et al., 2004) and on Csikzentmihalyi's Flow Theory (Csikszentmihalyi et al., 2018), but it was a coherent design process with the final user (the aimed public) always in line of sight. Together with game design parameters, Abrisqueta-Gomes' (2006) and Wilson's (2020) parameters for neuropsychological interventions design were followed.

The first step was the delineation of the design process comprising of a Pre-Design moment of similar artifacts analysis with the application of MDA framework for game design (Hunicke et al., 2004) happening simultaneously to a literature review of methods on neuropsychological intervention upon Executive Functions, and Personality. Both of these analyses were tied up to the neuropsychological profile of the aimed public for the game. Then the game design was divided into narrative design, game-mechanics design and graphic design, with these three processes happening according to theoretical parameters.

For the Narrative design it was used mainly the hero's journey principles, as it aligns with the concepts that epic related stories are fundamental for the build of human identity (Campbell, 2005, Tolkien, 2008) and therefore, deeply enticing for this age. Specifically for the campaign narrative, Law's (2010) model of narrative beats was addressed as a way to develop its quality and therefore interest. Also, parameters of popularity with the age threshold for the final user were deeply addressed in the narrative, as a way of enticing engagement on the neuropsychological intervention.

For the Mechanics design process, the main focus was to engage the aimed cognitive functions through the in-game challenges without breaking its ludonarrative consonance (Bigogno et al. 2017), as well as maintaining the users' Disbelief Suspension intact (Coleridge, 1817) (or, in other words, maintaining the teenagers inside the game's magic circle, Huizinga, 1980).

For Graphic Design, the main parameters for engaging the teenagers into the intervention were addressed, mainly in the junction of the pop culture references that were dear to this public and the character and ambience design. For the character design, the *Kindchenschema* theory was fundamental for the positive engagement with the narrative and the visual aspects of the game, as well as the Big V theory for personalities, regarding traces, descriptions, and colors. Therefore the main outlines that guided this part of game design were the inclusion of a generic mythological setting with deep multicultural references whilst affiliated to a *chibi-style* design that addressed the prevalence of the importance this culture assumes among teenagers age 12-18. The full methodological process flow is depicted in Figure 1, below.

The last study comprised of a longitudinal (12 weeks) double-blind clinical trial of 43 teenagers (12 - 18 years old), that went through a pre and post psychological evaluation protocol for Executive Functions, Personality, Intelligence, and Behaviour linked to attention, and psychopathologies. After the pre-evaluation, the group was divided into 4 study groups: a passive control group, two active control groups (Boot et al., 2013), and a purpose group of gifted students that undertook the neuropsychological GBI protocol developed in the second study. The first control group was a group that went through another GBI protocol developed by Giraldi (2024) in Executive Functions, and the second control group was a non-clinic (non-gifted) group that went through the same intervention protocol of the purpose group, the RPG).

After the intervention protocols all the groups went through the psychological evaluation battery, and the results were statistically analyzed by a third party non-involved neither with the intervention nor the evaluation. The evaluation team didn't know which teenager went through each intervention, which grants the double-blindness of the study. These methods were summarized on figure 1, below.

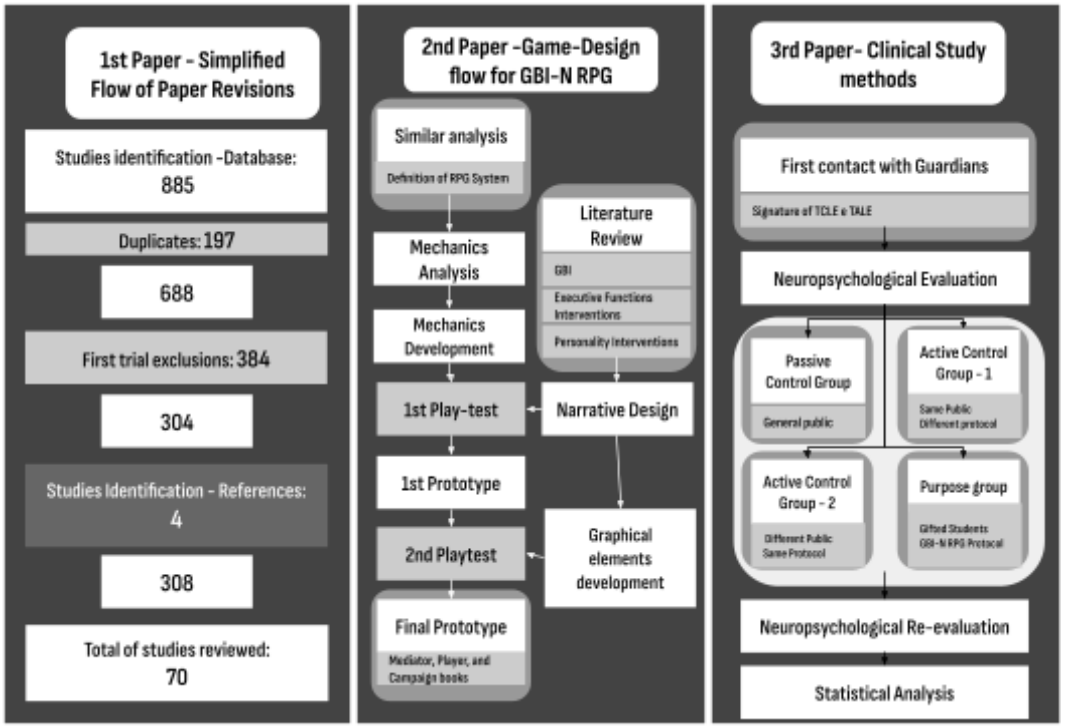

Figure 1. Methodological Flow of Studies 1, 2 and 3

The results underwent a descriptive statistical analysis of Kolmogorov-Smirnov's and Shapiro-Wilk's test for data normality, Two-ways ANOVA, ANOVA of Repetitive Measures (for continuous variables) and Generalized Estimating Equations (for the discrete variables), effect estimative was measured with Bonferroni's post hoc.

3. Results

With the metasynthesis it was possible to define that the term Serious games isn't viable anymore for analog gaming interventions (being deeply related to digital softwares, in contemporary studies), moreover, it was possible to delineate the mainline GBI methods in psychology and to present that this approach had good responses in social skills, anxiety and depression, and executive functions. But mixed and negative results when used by parents, to work with postpartum cognitive dysfunction, and geriatric recovery to old-age related dementia. In the mixed studies, qualitative evidence and results performed better than quantitative.

The design study had as results a RPG Supplement for Neuropsychological intervention with teenagers named Cinco Torres (5 Towers) comprised of three books, as well as an array of support materials (the Therapeutic Mediator's Book, The Campaign Book, The Player's Book), as well as a preliminary result on the safety of

RPG based GBI's with teenagers, addressing concerns of 'gaming causes violence' common sense claims.

The clinical trial study had great (and innovative) results on Verbal Intelligence development with the gifted students group, as well as pointed both GBI's interventions as good interventions toward Attention, and with mixed positive results toward general intelligence. With the Control Group (non-gifted), that also presented claims of somatization for psychological symptoms, and went through the RPG intervention, those claims disappeared after the intervention. Even though gender distribution being disproportional inside each group, it was proportional between groups, therefore there was no statistical relevance of this variable on the results.

4. Discussion

This dissertation presented a multi-factorial point of view analysis of the use of Games in mental Health, presenting both a thorough literature review on the matter that presented positive evidences and issues in this field of study, a scientific rooted game design for intervention purposes with good results of engagement and security of the game made neuropsychological intervention protocol, as well as clinical trial approach to deepen the evidences that games can be used as tools for mental health promotion. Also, is the first work reported that developed a RPG for Neuropsychological Intervention.

Apart from that, two other results are important to be looked upon: the first is that, in consonance with the literature both from game studies and studies with gifted people, gender inequality was a constant, there were more male students engaged with games in every group, and there were more male teenagers with reports of giftedness. This points to a social issue of low identification of female gifted students (as presented also by Neumann, 2018) as well as low engagement into the gaming scenery (as presented as well by Scoats and Malloney, 2024). Such issues derived from a lack of inclusion of this group both as aimed at giftedness evaluation and as aimed at the public for gaming.

The other important result is that both GBIs performed well to develop attention behaviour with the teenagers, in consonance with the constant finding that games can improve attention. Well, in the current "epidemic" of inattention faced by the world (both due to COVID and to social related issues), analogic games, when purposefully used, can be a reliable and democratic tool that educators and therapists can use to help with this issue.

5. Ethical concerns and conflict of interests:

This dissertation was funded by CAPES institution of research foment. It was approved by the Health Ethics Committee under the number: CAE 67175222.9.0000.0102.

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