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Empathic Games and Older Adults: A Systematic Literature Review on Empathic Gaming and Aging Populations

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Abstract Empathic games simulate real-life challenges to foster players' understanding of complex situations, such as daily medical practice, financial stress, or coping with grief. While these games have been used to support physical and cognitive health across age groups, little is known about older adults' engagement with them. To understand the breath and lenght of this knowledge gap, a systematic literature review (SLR) following a structured PRISMA protocol was performed. The papers inside the Scopus, Web of Science, PubMed, IEEE, DBLP and ACM databases were examined, without consideration for a set time period, using keywords related to "empathic games" and "older adults." Studies were included if they investigated digital games with empathetic elements targeting adults aged 60+. Two HCI specialists independently screened titles, abstracts, and full texts in a two-round process, applying predefined inclusion/exclusion criteria. Of 205 identified records, 15 met the final criteria. Findings suggest empathic games can positively influence issues such as loneliness, depression, and family dynamics among the senior citizens. However, significant gaps remain regarding usability needs, player preferences, and profiles. These results highlight the need for further research to guide the effective design of empathetic games for older adults and to explore sensitive emotional topics.

Keywords: Systematic Literature Review, Older Adults, Video Games, Empathetic Games, Active Aging

1 Introduction

Video games are a type of media that prominent in modern popular culture. In addition to entertainment purposes, the virtual spaces games can serve a wide variety of purposes, such as: the simulations that range from physical phenomena (i.e: biomes, wind patterns, fluid dynamics etc.), to the the daily operation of companies, historical settings, professionals and others [Klopfer and Yoon, 2004]; telling complex emotional stories with interactive elements [Blot, 2017; Belman and Flanagan, 2010], providing spaces where people can connect and socially interact remotely [Lewis *et al*., 2021]; offering a competitive sporting environment [Marelić and Vukušić, 2019], and many other potential uses.

Such possibilities are also attractive to academia, due to the ludic and engaging qualities that video games have, they are used in a variety of scenarios, such as: in supporting students and teachers in their learning process or class activities [De Gloria *et al*., 2014]; professionals such as doctors, industry workers, police officers, and others can experience and practice common scenarios of their jobs in a safe space [Geier *et al*., 2022]; patients can use games to learn more about their treatment, and they can be used to support their healing process [Lee *et al*., 2020].

Alongside the many different games' subcategories and genres there are the empathic games - games that try to capture with their graphical, audio, gameplay, and narrative elements the challenges and circumstances that are faced daily by individuals around the world. Such as people with physical or mental limitations (i.e: depression, blindness, being stuck to a wheelchair, etc.), or dealing with circumstances beyond their control (i.e: addiction, financial difficulty, grief, etc.) and others [dos Santos Nogueira *et al*., 2025].

Not to be confused with Affective Games, which focuses in using sensors to recognize and tailor the game's experience to respond to the players emotions, ensuring the appropriate challenge and engagement [Gilleade and Dix, 2004; Sykes and Brown, 2003]. The players emotions in an affective game are constantly monitored in order to adjust the game's aspects to either reflect or induce an emotion in the player (i.e.: To increase or reduce the game's difficulty; Non-Playable Characters reacting accordingly to what the player is feeling; The colors and art style can reflect the player's mood and others) [Nacke *et al*., 2011].

Games of this subcategory, in short, seek to capture real-life scenarios by using all the game's design resources to present a version of reality to the player, and foster in them an understanding of complex real world issues by "living" them through the game [Wulansari *et al*., 2020]. These games do not prioritize the player's victory or defeat. Instead, they try to simulate the issues and circumstances that are the daily reality to some individuals around the world, and so allowing players to better understand their context and living circumstances, be them objective or subjective experiences [Wulansari *et al*., 2020].

According to the works of Boltz *et al*. [2015] and Goulart [2017], outside the games' context, they can allow players to empathize with people who are facing these situations on a daily basis and even become possible agents of positive change in their environment with their friends, family mem-

bers, and even complete strangers.

While often a type of media associated with younger audiences, senior audiences are also becoming more interested in video games. According to the works of Carrasco *et al*. [2018], older adults engage in both casual (i.e: crosswords, poker, checkers, etc.) and hardcore ones (i.e: *World of Warcraft*[1], *Battlefield 3*[2] etc.). Statistics also indicate that their general interest in games is growing [Salmon *et al*., 2017]. In academia, games for the senior citizens are often used in a generally utilitarian sense, such as to increase their engagement in a therapeutic setting or to keep them physically and cognitively active [Taylor *et al*., 2018; Phillips *et al*., 2018]; it is reasonable to infer that, in the future, games (or even empathic games) can also be a vehicle to discuss complex issues with emotional depth for this audience in a novel and engaging manner.

Many older adults lack access to virtual spaces and digital solutions that adequately address their specific usability needs, limiting their ability to discuss sensitive issues and engage in social-emotional interactions where empathy plays a central role [Olsson *et al*., 2019; Aggarwal *et al*., 2020]. To address this gap, this study conducts a Systematic Literature Review (SLR) to examine how empathic elements have been incorporated into digital games for older adults. It aims to characterize design approaches, user profiles, and reported outcomes in order to identify research gaps and consolidate current knowledge, ultimately informing the design and evaluation of future empathic game experiences for this population. The review is guided by a primary research question supported by nine sub-questions.

This paper is organized as follows: After the introduction, in Section 2, we briefly present the related works of other SLRs that focuses on employing games for older adults and better frame how the present study positions its contributions among the others of a similar nature, we describe the importance of empathy in technology and in Human-Computer Interaction (HCI), what empathic games are, their objectives and limitations, the current understanding of the relationship of senior citizens with technology and related works concerning empathy and games. Next, in Section 3 it is presented the methodology and details regarding the procedures and steps taken. Afterward, in Section 4, the results concerning the SLR's main question and the 9 guiding questions are presented, and we discuss our findings and the significance of this study. Finally, in Section 5 we present our final considerations, the limitations faced, and possible future works.

2 Related Works

SLRs focusing on older adults and games are a recurring theme in academic research. Many of these studies examine the health benefits that seniors may derive from engaging with games [Hall *et al*., 2012], their experiences during gameplay [Rienzo and Cubillos, 2020], and how games can support the acquisition of knowledge and skills among older populations [Wang *et al*., 2020].

[1]Blizzard Entertainment, © 2004

[2]DICE, © 2011

Some investigations address more specific applications, such as the positive impact of games on physical fitness [Kappen *et al*., 2019], their role in supporting dementia treatments [Eckert *et al*., 2024], and their potential to foster active aging through targeted interventions [Vazquez *et al*., 2018], among other benefits.

In broader contexts, studies exploring the relationship between empathy and video games are also well established. However, these typically focus on adults and younger populations, examining how games can support learning processes [Chen *et al*., 2018], whether they can foster empathy in players [Bhatnagar, 2021], and how individuals perceive simulated experiences [Pallavicini *et al*., 2018]. Research involving younger demographics frequently investigates complex cognitive and neural processes, including decision-making [Huang and Cheng, 2022] and addiction [Lissak, 2018]; examines how games affect neurodivergent individuals [Börjesson *et al*., 2015]; and addresses cultural and ethical issues, such as gender representation [Fernandez *et al*., 2019] and moral perception within simulated game environments [Van Mechelen *et al*., 2020].

The breadth of this literature highlights the versatility of games as tools for investigation and intervention across diverse knowledge domains. Numerous studies emphasize their potential to address physical and mental health issues, inform cultural analysis, and support the understanding of complex behaviors across different demographics and contexts.

For the purpose of adequately positioning the impact of this research, it should first be noted that the majority of current SLRs investigating the use of digital games by seniors have focused primarily on how such resources can aid in promoting physical/mental well-being, improvement of decision making, and the encouragement of developing empathy amongst younger audiences towards seniors. Although these areas have begun to be investigated, there still exists a large gap in the research related to the development of empathy through gaming with seniors, particularly from an HCI standpoint.

In order to fill this void, the current study will explore the intersection of empathetic game design and seniors, with the goal of synthesizing existing literature and calling out new, under-researched areas. Ultimately, through the identification of the evidence introduced through this SLR, this study hopes to provide insight and opportunities for further research in the development of empathy in the use of gaming with senior populations.

2.1 Empathy in technology

Empathy is commonly understood as the "*capacity to understand the feelings of another person, verbal or not*" [Michaelis©, 2024]. This emotion is celebrated by scholars such as Adam Smith [1822] and David Hume [1896] as the key factor that allows people to act in a moral and ethical manner. Current scholars, such as Ellie Wiesel [2017], highlight that this capacity is what allows people to look at each other and their individuality in its entirety, with their qualities, flaws, nuances, etc. According to [Eres and Molenberghs, 2013] studies, empathy is composed of 3 key elements:

1. **The Affective** - Which allows a better understanding of

the emotional state of others;
2. **The Cognitive** - Which refers to the capacity to deliberate over the mental states of other people;
3. **The Regulator** - Which refers to how intense the emotional responses are, and it allows for an empathic experience of appropriate magnitude.

For Technology, specifically, while empathy may seem a concept unrelated at first glance due to the mathematical and objective nature of its related fields, Seïler and Craig [2016] studies point out that, the more that people are using technological devices in their daily lives, the more these tools need to be able to support and capture their emotions for better communication between users.

Otherwise, it may allow users to have their words misinterpreted, their disposition perceived as insincere, or even to appear disinterested during interactions, and such impressions may even affect their relationships, both online and in person [Seïler and Craig, 2016].

For computational systems, it is usually necessary to abstract emotions via concepts or structures, such as Maslow [1974]'s Hierarchy of Needs or Plutchik [2001]'s Wheel of Emotions, despite being models that are not originally meant to be used in Technology related areas, they can be adapted to computational systems in order to measure the users' emotional responses, which can vary depending on what is the input method the system requires (via text, audio, video, etc.).

Alongside the adaptation and use of such concepts, technological solutions can also foster empathy via interfaces; the use of animated characters, colors and geometric shapes for example, can both guide and humanize the interactions between users and machines [Glaskin, 2012; Prendinger and Ishizuka, 2005]. The language, sounds, icons, texts, and other elements that the systems use to communicate with the users can also help in fostering empathy in users as well [Carolus *et al*., 2021; Hassan, 2020].

Another form that IT solutions can foster empathy in users is to not demean or minimize the users' feelings, such as via repetitive answers when troubleshooting, nor offering answers on how to solve the issue or contact specialists' contact info [Gorry and Westbrook, 2011]. The lack of these aspects, according to Gorry and Westbrook [2011], gives the impression that the computational systems are not respecting the users' time and aptitude, harming the overall user experience.

2.2 Empathic games - A brief overview

Empathic games can be regarded as a subtype of serious games; however, the primary distinction between the two lies in their intended purpose. Serious games are specifically designed to impart practical knowledge and skills that can be applied in real-world contexts. In this regard, they function as pedagogical tools aimed at supporting the development of specific competencies, such as administering the appropriate dosage of insulin to a diabetic patient. [Almeida and Simoes, 2019; Crookall, 2010].

Empathic games are inherently more ambiguous, as they often do not incorporate explicit win-or-lose conditions. Their central aim is to leverage a combination of game elements — such as graphics, audio, narrative, and gameplay mechanics — to foster players' understanding of the perspectives of individuals whose lived experiences may be either familiar or unfamiliar to them [Blot, 2017; Galvão *et al*., 2024].

Some of the situations in these games can depict, include [Wulansari *et al*., 2020; Shliakhovchuk and Muñoz García, 2020]: The reality behind professionals (i.e.: teachers, doctors, police officers, etc.), capturing cultural, technical, and political, as well as the emotional and interpersonal aspects; people who live with physical impairments (i.e.: blindness, wheelchair bound, fine motor coordination impairments, etc.); people who are dealing with psychological, emotional, or mental conditions (i.e: depression, deep grief, autism, etc.); people who are dealing with circumstances that are largely out of their control (financial difficulties, living with a parent or loved one who suffers from an addiction or disease, natural disasters, etc.); among other life circumstances.

Such games are designed to give players perspective and awareness of life conditions that may be unknown to them, and by experiencing the in-game scenarios, they can act in a more pro-social manner with people who are dealing with similar situations [dos Santos Nogueira *et al*., 2025; Boltz *et al*., 2015] According to de Melo Pinheiro *et al*. [2021] works, empathic games have the following objectives:

- **The intention of being an artistic work** — different technical aspects need to be well integrated, which means that, in addition to narrative, art direction is a category to which much attention must be paid;
- **Provide the player with the expression of feelings** — through the narrative, related to the universe(s) that touch the player, the game must awaken in him/her the desire to meet the characters' needs at an affective and perceptual level;
- **Generate reflective action** — must seek narratives that can generate reflections, with the player identifying with the theme and awakening a desire for action in players in their lives outside the context of the game.

While there is evidence that games can be a viable medium to explore sensitive life subjects and have effects on the players' daily lives, academics are still divided over how much of this empathic effect is real, or how effective it really is [Sarmet and Pilati, 2016]. Sometimes, according to Blanco [2019] works, the gaming industry cultural trends tend to take advantage of empathy to present a product that is palatable to a larger audience, thus sanitizing and misrepresenting, for example, queer identities or minorities, from getting both proper representation and discussion of issues that they face in society.

Such resistance in the media is also present in the entertainment industry as a whole, where works that have the opportunity to tackle hard-hitting questions, become a more tame version due to stakeholders' demands or for the sake of having a more marketable product [Todd, 2015]. Empathy, as aforementioned, is by its very nature subjective, and part of the human experience is abstract, ambiguous, and not always guided by reason, so there are doubts whether games can really affect people or even how much can this medium explore without having sensitive issues being misused, gratuitous, or exploitative [Chesler, 2022].

For such games to be effective, besides solid design and understanding of development tools limitations, according to Blot [2017], empathic games to be effective they need attention to the elements of *immersion* and *role-play* to emotionally invest the player in the game's universe and their role in it. Blot [2017]'s works additionally calls attention to the ethical question involved in these games, which requires deep research and understanding of the themes that these games are approaching. If any of these aspects are not carefully considered; presented; and balanced; the empathic game may be ineffective in achieving its goals.

2.3 Seniors and Technology - The current understanding of their relationship

According to the works of Jacobson *et al*. [2017], during the pre-pandemic period, older adults tended to prefer staying at home—either alone or with family members—and generally avoided using new technologies unless strictly necessary. Similarly, Berenguer *et al*. [2017] highlight that, due to age-related physical and cognitive limitations, combined with the often inadequate design of information technologies for their specific needs, older adults have been less inclined to learn and fully utilize all the features of their devices.

This hesitation that senior people have regarding technology has been explored in the works of Raymundo [2013] and Castro *et al*. [2024], where senior volunteers reported that the main obstacles for them to have good acceptability of newer technologies is fear. Specifically, *fear of the unknown* - they are not comfortable and have a hard time understanding how newer technologies function; and *fear of losing their autonomy* - Where they may need the help from younger family members to learn how to use newer technologies, but the fact that they can't learn by themselves, may open them to be labeled as a "fossils" or "obsolete".

Such scenarios make them feel as though they are experiencing yet another loss of autonomy, as well as a certain sense of isolation. To avoid this situation within the family, older adults feel that, due to social pressure, they must learn on their own — a point the authors highlight as being more of a social process than a technical one [Castro *et al*., 2024; Raymundo, 2013]

In this context, both public and private organizations have taken the initiative to promote digital literacy for older adults, as part of efforts to support their active aging [3] and foster their autonomy in using technology in their daily lives [**?**]. Despite the barriers and difficulties in using technology, senior individuals, especially after the Covid-19 pandemic, recognize the value of technology in their daily lives. And the ways of supporting this audience, whose profile is not homogeneous, the use of technology is a growing priority in a wide variety of different knowledge fields (i.e: Biology, Health, Psychology etc.) [Vercruyssen *et al*., 2023].

Some of the usability barriers that seniors face are known and documented, such as [Awan *et al*., 2021]: small font size, buttons with poor color contrast to the background, lack of clear feedback from the IT solution to the user, confusing menu navigation, lack of responsiveness and other issues that harm their user experience. Concerning the technical aspects of the interaction experience of older adults with IT solutions, the academic literature possesses guidelines, methods, procedures, and other resources to overcome most of these problems [Li *et al*., 2022; Lindberg and De Troyer, 2021].

However, for more specific contexts, for example, the emotional engagement of older adults with IT solutions when they are dealing with specific cognitive issues (i.e: depression, overall cognitive decline, delayed attention spans, etc.) or with the seniors' overall feeling of insecurity when using the internet (i.e: fearing getting scammed), the literature still lacks resources to better attend these needs [Alvaro *et al*., 2022; Lee *et al*., 2020; Iancu and Iancu, 2020].

2.4 Older adults and video games

Scholars have already found that video games can contribute to the self-esteem and cognitive stimulation of older adults since the early 80s and 90s [Weisman, 1983; Whitcomb, 1990]. Seniors who participated in these studies back then reported improved reaction times, better cognitive and perceptive adaptability, and overall improved self-esteem, dexterity, fine motor coordination, and speed in finishing daily tasks [Weisman, 1983; Whitcomb, 1990].

Not only were such benefits confirmed in later studies, scholars, in addition, found that video games can also contribute to the psychological well-being of senior individuals [Gamberini *et al*., 2008a], mitigate conditions of cognitive diseases such as Alzheimer [Zelinski and Reyes, 2009; Torres, 2011], increases in their memorization capabilities [Gamberini *et al*., 2008b] among other cognitive benefits. Often, the relationship between video games and older adults in the current literature is often framed as a clinical one. Where games are employed to test, stimulate and support both their physical and cognitive capabilities [Taylor *et al*., 2018], to help their learning process in an engaging manner [Wang *et al*., 2011], support their treatment as in helping them get better control of some physiological phenomena (i.e: vertigo) [Chen *et al*., 2012], etc.

To the older individuals who engage with gaming, the benefits can go beyond their physical and mental health, it allows them a way to stay active without the need to leave their homes, to socialize and make new friends, to find communities and bond over an activity or a goal; either by playing casually with friends and family, attending gaming events, becoming live streamers, or competing in tournaments Matei [2025].

While they may not be the main target audience for the industry, both in academic and market contexts, according to Carrasco *et al*. [2018] and Matei [2025] works, the profile of older adults regarding video games and their usability preferences are relatively unknown, such as: What genres of games they prefer? What devices and input methods are more comfortable to them? And more in particular to the present work, what are the main aspects of games that emotionally engage with them? Thus, we hope that by exploration performed in our SLR, we may be able to elucidate some of these knowledge gaps and better understand how empathic games

[3] Active aging is the process of optimizing opportunities for health, participation in society, and security, aimed to improve the overall quality of life of people, especially seniors citizens. [Organization *et al*., 2005]

can be used with them.

3 Methodology

In the present exploratory study, a Systematic Literature Review (SLR) with a qualitative approach was conducted to examine academic publications that focus on games, older adults, and empathy as their core themes. An SLR follows a set of structured and well-defined procedures to systematically explore the body of literature within a given knowledge domain [Conforto *et al*., 2011]. This method enables a critical evaluation of the selected works through meta-analysis, allowing researchers to identify the main areas of academic focus as well as topics that remain underexplored within a specific scientific field [Conforto *et al*., 2011].

The SLR of the work followed the script proposed by Conforto *et al*. [2011], and it is divided into 3 main phases:

1. **Input** - The Planning and protocol of the SLR ;
2. **Processing** - Search, analysis, and documentation of results;
3. **Output** - Reports, discussion, and the synthesis of findings.

In the input stage a protocol is elaborated, which contains the guidelines and procedures that are followed throughout the entire SLR. Primarily, we focused on setting what would the SLR 's main objective be, which, after initial discussions, this was settled as: *How have empathic elements been designed, implemented, and evaluated in digital games for older adults, and what gaps exist in the current body of research*. With the objective defined, the next step was to decide what questions the SLR sought to explore. For this in particular, for the **main question (MQ)** it was settled as:

> *What are the characteristics of existing research on digital games with empathic elements for older adults in terms of user profiles, design approaches, and evaluation outcomes?*

To guide in the exploration of this main question, **secondary questions (SQ)** were elaborated as well to guide the study, these SQs being:

- **SQ1.** What are the motivations of the authors addressed in these studies?
- **SQ2.** What methodologies were used and what aspects were evaluated by the authors to reach the conclusions of their works?
- **SQ3.** What is the gaming profile of the senior audience (habits, platform preferences, preferred game genres, etc.)?
- **SQ4.** What are the main reasons for the senior audience to play?
- **SQ5.** What types of games are used (digital, board, hybrid, etc.)?
- **SQ6.** What characteristics and themes in these games generally include elements considered empathetic to this audience?
- **SQ7.** What are the main challenges this audience faces when interacting with games?
- **SQ8.** What design and evaluation methods are used in the development of the games or solutions?
- **SQ9.** Is there participation from domain experts in the stages of solution development?

To better prospect the sample size our study could explore, initially, tests were made with terms like "games", "empathy", and "seniors", and their variations, alongside defining what range of years the SLR would consider interesting to the present work. The final string combination used in the present work can be seen in the **Table 1** below:

Table 1. Strings that were used in the SLR .

(games OR game OR gaming OR play OR playing) AND
(elder OR elderly OR elders OR "older adults" OR senior) AND
(empathic OR empathy OR compassion OR sympathy or pity)

Source: Table generated by the authors.

Initial string tests did not yield many results, both before and after using advanced filters in academic databases. Thus we did not consider a set period of time in order to further limit our exploration.

We acknowledge that 'empathy' is conceptually distinct from related notions such as 'compassion,' 'sympathy,' and 'pity.' However, these terms were included in the search strategy for two main reasons: (1) to broaden the scope of the initial search, as the use of 'empathy' alone yielded a limited number of studies; and (2) to explore broader forms of emotional engagement between older adults and games, since how human emotions are perceived a as spectrum and the feelings of empathy and sympathy can overlap Reisenzein [2007]. This was done with the expectation that relevant content could be later identified and subsequently filtered according to the objectives of the SLR.

Following the strings, we also decided what academic databases were selected to be explored in the present study. We chose bases that contain scientific publications related to Computer Science and its many fields, we also considered bases that were related to Health scientific works, since, as mentioned in the Introduction section, a common use for games with the older adults is to support their physical and cognitive well-being, which are often works that have the collaboration of both Health and IT specialists to investigate or create games adequate to the study's context. In the end, the following academic bases were selected:

- *ACM Digital Library (ACM)*[4];
- *IEEE Xplore (IEEE)*[5];
- *DataBase Systems and Logic Programming (DBLP)*[6];
- *SBCOpenLib*[7];
- *PubMed*[8];
- *Web of Science*[9]

[4]ACM - *Association for Computing Machinery* — https://dl.acm.org

[5]IEEE - *Institute of Electrical and Electronics Engineers* Xplore — https://ieeexplore.ieee.org/Xplore/home.jsp

[6]DBLP -*Digital Bibliography & Library Project* - https://dblp.org

[7]Biblioteca Digital da Sociedade Brasileira de Computação (SBCOpenLib) — https://sol.sbc.org.br/index.php/indice

[8]PubMed — https://pubmed.ncbi.nlm.nih.gov

[9]Portal de Periódicos da Capes (*Web of Science*) — https://www-periodicos-capes-gov-br.ez67.periodicos.capes.gov.br/index.php

The languages of the works considered for analysis during the systematic review were English and Portuguese. The former is a common language in publications and various conferences around the world, while the latter is the author's native language. The first author and the specialists invited to this present work are proficient in both languages. The total amount of works found in each of the knowledge bases can be seen in **Table 2** below:

Table 2. Number of studies found in the databases.

Databases	Results
ACM	144
PubMed	44
IEEE	15
DBLP	1
SBCOpenLib	1
Total	205

Source: Table generated by the authors.

To manually process the found works, this SLR included 2 filtering stages. **The 1st Selection Filter** only focused on the reading of the title, abstract, and keywords of each and every article found in order to determine if, their initial content would be of interest to the present study. This filter was carried out by the first author with two other specialist researchers from the research group. They were invited to participate in this methodology due to them being computer science specialists and their familiarity researching how to engage older adults with game-like technological solutions.

Initially, both the first author and the specialists received their own individual tables, via Google Drive, the contents of each table were the same. They each had the titles of the found papers, their abstracts, keywords, and meta-data (Authors, database, DOI, URL etc.). Each reviewer would individually read the paper's keywords, abstract, and title; and then they would mark if the study in question was "Qualified" or "Not Qualified" to the next filtering stage. A study would only pass to the next selection filter if it had at least two "Qualified" votes among the reviewers. This step had minimal communication between the parties in order to reduce bias in the filtering process.

In case of conflicts or doubts about a paper in particular, the reviewers would discuss it via either *e-mail* or *Whatsapp* and decide whether to allow it to the next selection filter or not. In case a consensus was not reached via discussion, the paper was "Qualified" to the next selection filter in order to be further inspected.

In the **2nd Selection Filter** the papers that had passed the previous filter were read in their entirety, and they were marked as either "qualified" or "not qualified" for the data extraction process where their findings and what aspects contribute to answering both the MQ and SQs were summarized and cataloged.

The data extraction form included 28 information points, such as questions about the methodologies employed, the interaction difficulties encountered by the volunteers in the study, the types of games used, the presence of experts in the field related to elder care (e.g., gerontologists) and other relevant points for this study. Both the 2nd selection filter and the data extraction process were performed only by the first author.

Concerning the matter of bias, while in the first filter it was possible to have HCI specialists in order to find if the works broadly align with the SLR objectives for the 1st filtering stage. However, only the first author has experience studying and working with empathic games, thus the 2nd filtering stage is subject to bias.

Both filters also applied the same inclusion and exclusion criteria. For a paper to be considered "Qualified", it had to fulfill one of the following criteria:

Inclusion Criteria — (IC):

- **IC - 01** — The study explores how digital games foster empathy in older players;
- **IC - 02** — The study presents the profile of the older player and their preferences;
- **IC - 03** — The study discusses game design or dynamics that are inclusive of the needs of senior individuals;
- **IC - 04** — The study addresses other aspects related to empathetic games and the senior individuals.

For the exclusion criteria, if a found work fell into one or more ECs they were considered "Not Qualified" and not considered for the purposes of the SLR.

Exclusion Criteria — (EC):

- **EC - 01** — The study does not use games with the target audience in any capacity;
- **EC - 02** — The study was a summary or presentation at conferences/editorials/workshops;
- **EC - 03** — Extended abstract (length less than 4 pages);
- **EC - 04** —The study was not presented in Portuguese or English;
- **EC - 05** — Duplicated Paper;
- **EC - 06** — The study was not available (paid databases, or not accessible through the institution network, broken links, etc.).

Due to the nature of the research and the explored databases of different knowledge areas, it was preferred that, if whenever one of the found works matched with at least one of the ICs, it was of interest to be read and examining if its contents were aligned with providing answers to the SLR's MQ and SQs.

Important to note that, when the SLR was carried out in about four months, between November 2023 and February 2024. In November 2023 the protocol was elaborated and polished. In December 2023 the found paper's metadata were organized into a digital spreadsheet and specialists were invited, each with their own copy of the spreadsheet in order to avoid biasing each other's review during the execution of the 1st filter. In January 2024, the 1st filter was finished, and the data of all reviewers were compiled and organized to detail what papers were classified for the 2nd filter. Finally, in February 2024 the 2nd filter was completed by the first author, and the data extraction process was also completed as well. Due to the low number of works found at the end, it was not necessary to have further filtering stages or additional ICs or ECs.

Table 3. Summary of SLR's main findings.

Title	Author(s)	Year	Summary of the Paper's Main Findings	Inclusion Criteria	Database
Design of The Active aging Game System Based on Humanization Theory	Xinyu Yin; Zhuoyi Zhou	2019	The study presents an active aging game for the mental health of older adults, showing improved emotions and stability, with expert feedback confirming its effectiveness.	IC-04	IEEE
Combining skeletal tracking and virtual reality for game-based fall prevention training for senior citizens	William L. Raffe; Jaime A. Garcia	2018	The study explores using Kinect and HTC Vive VR for senior fall-prevention games, finding it promising for step training but limited for unsupervised use.	IC-03	IEEE
Intergenerational shared action games for promoting empathy between Japanese youth and elders	Katie Seaborn; Nina Lee; Marla Narazani; Atsushi Hiyama	2019	The study develops two intergenerational games in Japan, finding the foot-based version most effective and revealing age and gender effects on empathy for future affective computing.	IC-01	IEEE
Designing the Lost Self: Older Adults' Self-representations in Online Games	Romina Carrasco, Jenny Waycott; Steven Baker; Frank Vetere	2018	The study shows that older adults use avatars to express past and present identities, highlighting the need for game designers to accommodate their diverse preferences.	IC-02	ACM
Life Review Using a Life Metaphoric Game to Promote Intergenerational Communication	Seywon Lee; Hyunyoung Oh; Chung-Kon Shi; Young Yiim Dom	2020	The study reviews serious games and interactive technologies for supporting older adults' cognitive functions, assessing devices, effectiveness, and current trends in digital interventions.	IC-01	ACM
Accessibility of Kahoot! And Quizizz: Utilizing educational games with Senior Students	Mirkka Forssell; Lobna Hassan; Markku Turunen; Isabella Aura	2023	The study finds that older adults face accessibility and design challenges with educational games like Kahoot! and Quizizz but remain eager to engage when games are well-designed.	IC-04	ACM
Out of sight, out of mind: co-player effects on seniors' player experience	Brian J. Gajadhar; A Henk Herman Nap; Yvonne A. W. de Kort; Wijnand A. IJsselsteijn	2010	The study found that seniors did not enjoy online co-play more with increased social presence, and replacing a computer with a distant human co-player had no effect.	IC - 04	ACM
No player is ideal: why video game designers cannot ethically ignore players' real-world identities	Erica L. Neely	2017	The paper argues that game designers must ensure fairness and accessibility for all players, balancing creative vision with respect for diverse identities, abilities, and safe online interactions.	IC - 04	ACM
Aging, empathy, and prosociality	Beadle JN; Sheehan AH; Dahlben B; Gutchess AH	2013	This study found that older adults showed greater prosocial behavior than younger adults when empathy was induced. Suggesting that aging may increase motivation to help others in socioemotional contexts.".	IC-04	PubMed
Behavioral empathy failures and suicidal behavior	Zhang K; Szanto K; Clark L; Dombrovski AY.	2019	The study found that older adults with suicide attempts were less influenced by empathy, suggesting reduced emotional sensitivity may weaken social deterrents to suicide.	IC - 04	PubMed
Impact of an Aging Simulation Game on Pharmacy Students' Empathy for Older Adults	Chen AM; Kiersma ME; Yehle KS; Plake KS.	2015	This study found that participation in an aging simulation game significantly improved pharmacy students' empathy and perceptions of older adults, suggesting such games can enhance empathy and positive attitudes toward senior patients.	IC - 04	PubMed
Impact of the Geriatric Medication Game® on nursing students' empathy and attitudes toward older adults	Chen AM; Kiersma ME; Yehle KS; Plake KS.	2015	Participation in the Geriatric Medication Game® improved nursing students' empathy, attitudes, and understanding of older adults' healthcare experiences.	IC - 04	PubMed
Impact of game mode in multi-user serious games for upper limb rehabilitation: a within-person randomized trial on engagement and social involvement	Pereira F; Bermúdez I Badia S; Ornelas R; S Cameirão M.	2019	In a two-player rehab game, the Collaborative mode boosted social involvement and empathy, while Competitive mode suited players with closer relationships.	IC-04	PubMed
The Aging Game: improving medical students' attitudes toward caring for older adults	Varkey P; Chutka DS; Lesnick TG.	2006	A 3-hour aging simulation game improved medical students' empathy, attitudes, and skills in senior care, showing its effectiveness early in medical education.	IC - 03	PubMed
Walking a mile in Grandma's shoes - medical students' evaluation of a very simple online aging game to enhance their understanding of older patients	Geier AK; Lippmann S; Rau A; Schrimpf A; Bleckwenn M; Deutsch T.	2022	This study found that a simple online aging simulation effectively gave medical students insights into older patients' experiences, enhanced their understanding and empathy, and was well received, though not seen as a full substitute for in-person simulations.	IC - 04	PubMed

Source: Table generated by the authors.

4 SLR Results

Of the 205 papers found during the initial investigation, 76 were kept after the *1st filter*. In the end, after the *2nd filter*, 15 papers were considered of interest to the present study. A summary of the numbers papers can be seen in the PRISMA flow diagram, in the Figure 1 below.

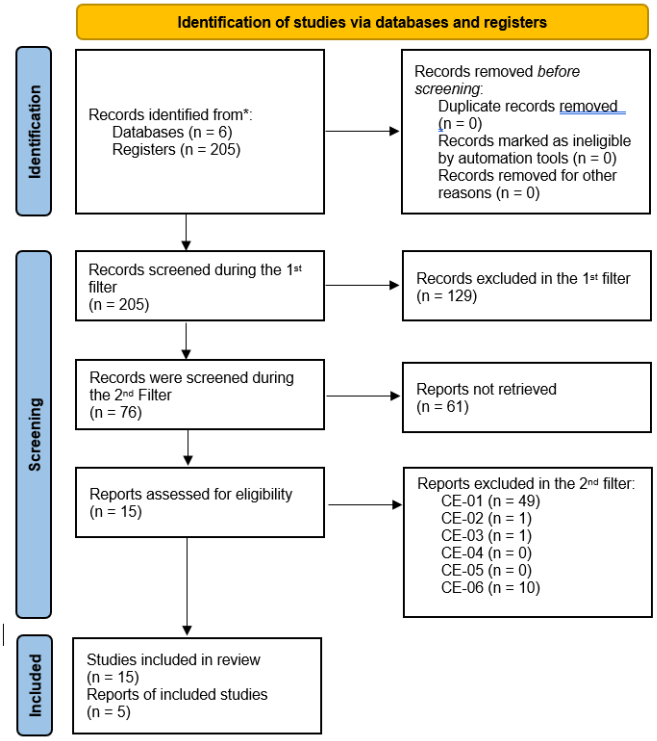
As previously mentioned, we did not find many results in the initial sample, and after filters, the year range of the accepted papers, as illustrated in Figure 2, comprehends papers that were published as early as 2023, and as late as 2006. After filters, only papers from the bases IEEE, ACM, and PubMed had works of interest to the SLR, as shown in Figure 3.

From the 1st filter to the second, we had about 76 papers that were of interest. After detailed reading of each of these papers during the 2nd filter, the works that were excluded due to them not using games with the target audience in any capacity with 49 excluded entries (EC-01). Following this exclusion criteria 10 were not available, 1 was excluded to it being an extended abstract (EC-03) and 1 was excluded due to it being a summary of a workshop (EC-02). All found works were either in English or Portuguese (EC-04), and none of them were duplicated (EC-05)

A table summary of the main findings is presented on Table 3. A link with access to the full table of findings can be found at the "availability of data and material" section at the end of the paper.

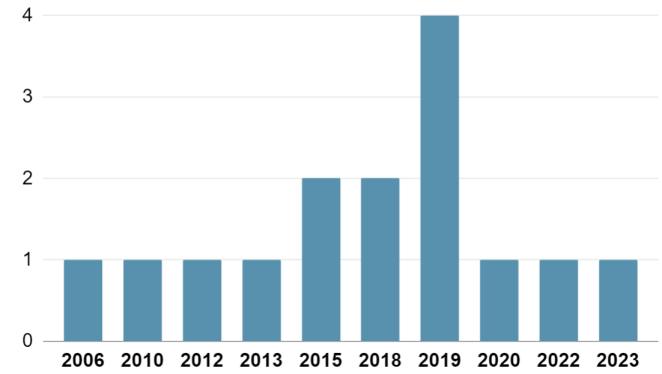
Regarding the inclusion criteria, 10 of them met *IC-04*; 2 met *IC-03*; 2 met *IC-01*; and only 1 met *IC-03*, as seen in Figure 4. A notable overall aspect of the found works is that 7 of them were published in conferences, while 8 of them were published in journals.

Figure 1. PRISMA Diagram of the present's work SLR



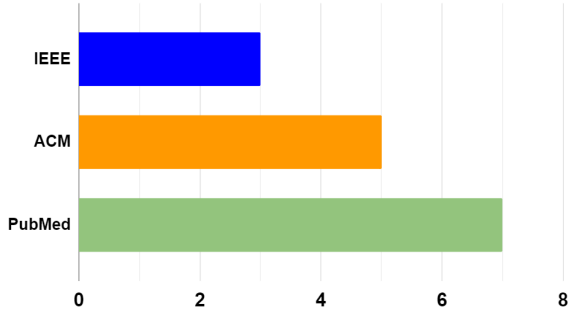
Source: Image generated by the authors.

Figure 2. Quantity of the studies found according to their published Years in the SLR.



Source: Image generated by the authors.

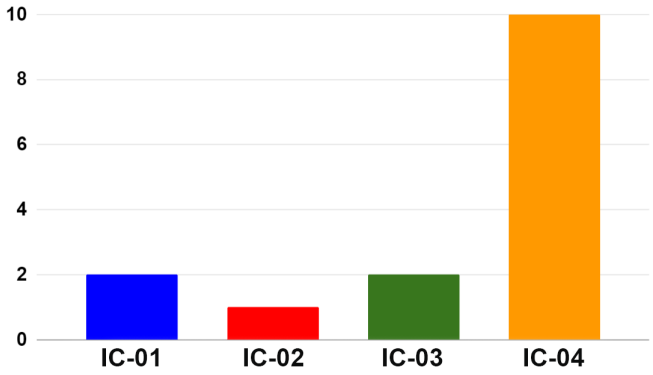
Figure 3. Number of works classified by their knowledge bases



Source: Image generated by the authors.

Concerning their geographical context, 6 studies originated from the USA, 2 each from Autralia, Germany and China, and 1 each from Japan, Taiwan, Germany, South Korea, Finland and Portugal.

Figure 4. Number of works included due to their ICs in the SLR.



Source: Image generated by the authors.

About how older adults participated in the found works, in 7 of them they acted as *testers*; in 3 they were *informants*; and the remaining 5 they were not directly involved. Concerning whether they felt some or any empathic connection with the games played in the found works, only in 9 studies did older adult volunteers report feeling empathy.

About the forms of empathy were related by the studies (some could report more than one type): 8 works reported that they felt any stronger emotional connection with the games via their *mechanical aspects* (as in the form that they control and interact with the games); 6 works detailed the volunteers felt that the *visual aspects* (art direction, animations, graphics etc.) were more impacting to their empathic experience; 3 reported stronger connection with the game's *narrative aspects*; 3 also reported that the volunteers had a stronger emotional connection via interpersonal aspects (the game being used as an interactive medium between players); only 1 study reported *audio aspects* as the key to their emotional experience; and also 1 study found that *emotional aspects* (the players' self-reflections generated after their experience with the game) were responsible for their emotional experience.

Important to disclaim that the forms os empathy that the present study applies, are from [Galvão *et al.*, 2024]'s work about empathic games, where the authors classified that the forms that empathy can occur in the player are via the game's narrative, graphics, audio, mechanics (gameplay). Alongside these definitions the matters of interface and emotion were considered from design aspects from HCI as explained in [Carolus *et al.*, 2021] and [Hassan, 2020] works were they can be involve emotional aspects and interpersonal aspects (a technological solution mediating and supporting emotional communication between users), language, and interface design. To better organize and discuss SLR's findings, the following subsections are presented as explorations of the SQs and at the end, the MQ will be answered.

4.1 SQ1 - What are the motivations of the authors addressed in these studies?

The found works had a wide variety of motivations, and sometimes, they had intersections regarding their methodology, game type, objectives, and other related information. The detected motivations in found studies were as follows:

- Games dedicated to supporting the physical activity of the older adults by the use of exercise games [Yin and

Zhou, 2019; Pereira *et al*., 2019; Chen and Wang, 2012; Raffe and Garcia, 2018];
- Games for socializing and integrating generations between younger people and other unfamiliar senior individuals [Lee *et al*., 2020; Seaborn *et al*., 2019; Gajadhar *et al*., 2010; Carrasco *et al*., 2018];
- Games to understand the empathetic capacity of older individuals with depression, suicidal tendencies, and other psychological disorders [Zhang *et al*., 2019; Beadle *et al*., 2013];
- Games to support the educational process of older individuals in their digital literacy [Forssell *et al*., 2023];
- Games that allow older individuals to reflect on and discuss key moments of their lives [Lee *et al*., 2020; Carrasco *et al*., 2018];
- Games whose creation had older individuals report their experiences with the health care services, and their experience was molded to allow students to understand what it's like to be "in the shoes" of older individuals in order to access the necessary healthcare and medications for their well-being [Geier *et al*., 2022; Varkey *et al*., 2006; Chen *et al*., 2015].

It was observed that the motivations in the found works were mainly to understand and support in aspects related to their physical or mental health, education, and social integration (with people from both the same generation and younger ones) [Yin and Zhou, 2019; Pereira *et al*., 2019; Chen and Wang, 2012]. Some of these works dealt with specific sensitive themes (i.e: grief and depression) and suicidal tendencies [Zhang *et al*., 2019; Beadle *et al*., 2013].

Outside these aspects, it was also notable games that were based on the senior experience in dealing with the healthcare system, but were meant to be played by Medical and Pharmaceutical students [Geier *et al*., 2022; Varkey *et al*., 2006; Chen *et al*., 2015], highlighting how sometimes these systems can be deficient in attending the needs of older adults in a timely manner or even have the proper support and guidance to them. Some students who were volunteers in these works reported that, after experiencing the game, it made them desire act in a more understanding manner with their future senior patients when they graduate and become active professionals [Geier *et al*., 2022; Varkey *et al*., 2006; Chen *et al*., 2015].

These diverse motivations suggest that empathic games have the potential to engage audiences across different generations. They also reinforce the notion that the present study contributes to the broader field of game research by addressing existing gaps related to empathic games and the senior population. It is also noteworthy that, although the studies by Raffe and Garcia [2018], Seaborn *et al*. [2019], and Yin and Zhou [2019] were not originally designed as exercise games (i.e., exergames), they could be classified as such, with only Yin and Zhou [2019] explicitly intending their game to serve this purpose.

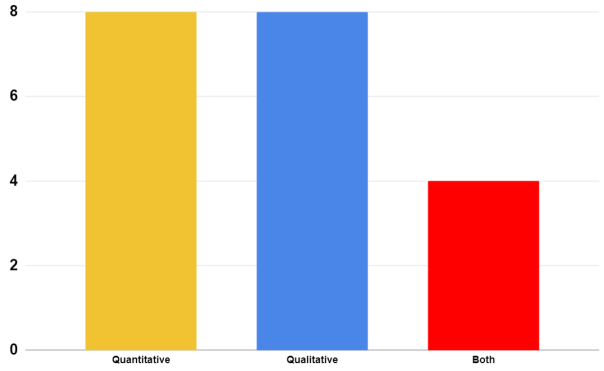
4.2 SQ2 - What methodologies were used and what aspects were evaluated by the authors to reach the conclusions of their works?

The studies evaluated here apply a range of different methodologies, mainly of a qualitative, user-centered, and exploratory nature, demonstrating that research related to empathic games for older adults is in its early stage. Commonly used methods are semi-structured interviews [Seaborn *et al*., 2019; Lee *et al*., 2020; Carrasco *et al*., 2018], observations of gameplay [Lee *et al*., 2020], participation in workshops [Geier *et al*., 2022; Chen *et al*., 2015], and using a method of research through design Yin and Zhou [2019]; these methods were used to capture user experience, emotional responses, and usability problems from the participants.

Participatory and co-design methodologies have also been used in several studies and older adults were involved in the design and evaluation of the game experience directly, indicating that HCI research has emphasized the need for designing with an inclusive and context-sensitive approach [Yin and Zhou, 2019; Pereira *et al*., 2019; Chen and Wang, 2012; Raffe and Garcia, 2018]. Some of the studies used experimental or quasi-experimental designs in the assessment of empathy, cooperation, and decision making [Lee *et al*., 2020; Seaborn *et al*., 2019; Gajadhar *et al*., 2010; Carrasco *et al*., 2018]. Controlled gameplay scenarios (such as cooperative gameplay tasks or economic game paradigms, e.g., the ultimatum game [Zhang *et al*., 2019; Beadle *et al*., 2013]) have been utilized in those studies.

An examination of the methodologies reveals that several studies adopted a mixed-methods approach, combining quantitative instruments—such as the GEQ, ASES, and PANAS — with qualitative techniques, including interviews and observational studies involving senior participants. This methodological integration shows was crucial for validating the authors' inferences and for collecting numerical data to substantiate and strengthen their findings. The distribution of studies and their respective methodological approaches is presented in Figure 5.

Figure 5. The number of works and methods they used.



Source: Image generated by the authors.

Another notable point regarding the use of methodologies in the studies found in the literature is that, except for observation and questionnaires, methodologies specifically originating from HCI for interface evaluation were not widely utilized. Particularly, methods for inspecting the games used

or their interfaces.

Aspects related to the understanding and semiotics of interfaces in studies involving digital games were not extensively addressed. Within the technological domain, however, many investigations adopted methodologies more closely aligned with software engineering objectives. For instance, Yin and Zhou [2019], developed a game from the ground up, involving senior participants as both testers and advisors throughout the development process. Across these methodologies among the found papers, the primary aspects evaluated include:

> Emotional and empathic engagement during gameplay; User experience and usability of game systems; Social interaction and collaboration between players; Motivations and preferences of older adult players; Behavioral responses, such as decision-making and cooperation.

In conclusion, this field relies largely on qualitative and participatory methods that are context-sensitive; however, in terms of evaluation practices, there is little standardization, indicating a need for future studies to develop more standardized and stronger methodological frameworks.

4.3 SQ3- What is the gaming profile of the senior audience (habits, platform preferences, preferred game genres, etc.)? And What are the main reasons for the senior audience to play?

In general, for both questions, *it was not possible to ascertain what is the gaming profile for an older audience, nor what is their general preferences*.

In most studies found in the SLR , discussions of gaming habits and their motivations for playing were not a priority of the authors. The work of Carrasco *et al*. [2018] is the only exception among our findings. In the Table 4, it is possible to visualize the main findings in Carrasco *et al*. [2018] study regarding the profile of senior volunteer players. This work also uncovered that the seniors also have diverse motivations for playing video games. The summarization of their findings are the following:

Table 4. Breakdown of player profiles in Carrasco *et al*. [2018]'s work.

Type of Player	Gaming Habits	Preferred Platform	Preferred Game Genres
Casual Players	1-3 hours daily	Mobile and Personal Computers (PC)	Casino, Strategy and Casual
Online Players	2-6 hours daily	PC	First Person Shooters and MMO RPGs

Source: Table generated by the authors.

- Recall places from the past in the life of the older individual player during the game;
- Interact and connect with people (known or unknown) through the avatar that represents the senior player in the game;
- Maintain and celebrate the current "self" outside the games, having a version of themselves self-representing in the game;
- Incorporate new careers or relive past jobs;
- Engage in leisure activities from the past (that sometimes they can't do anymore);
- Reclaim or relive their past youth;
- Associate with other groups of senior individuals (and younger people) who are playing the game.

The findings of this study are noteworthy, as they suggest that the profile of older adults regarding the types of digital games they engage with may be more diverse than initially anticipated. While one might assume that age-related physical and cognitive limitations would lead this population to prefer games that are less complex, less action-oriented, and less demanding of reaction time, the evidence indicates that this assumption may not necessarily hold true.

It is also interesting to note that the motivations for this audience to engage with games are related to their needs for socialization, to exercise their to motor and cognitive coordination skills, and reliving aspects of their past (such as their professions, hobbies, milestones of their life, and other events).

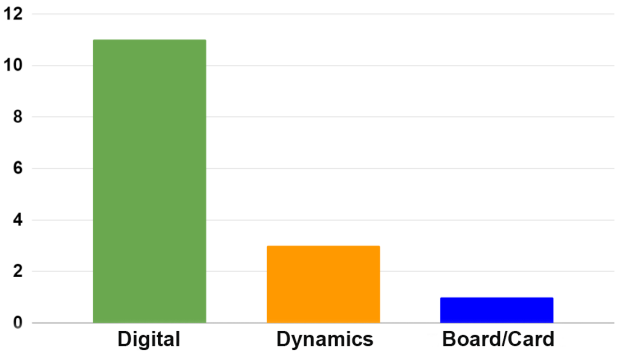
Regarding gaming habits and preferences, it was striking to identify that the senior audience has habits and interests in game genres that are, in theory, more similar to demographics with younger ages. This applies to both casual gamers and those who prefer more complex games (which Carrasco *et al*. [2018] refers to as "online gamers").

However, it was not possible to generalize or draw in-depth reflections due to the sample size used by Carrasco *et al*. [2018]. Highlighting that there are still many unknown aspects of the relationship between this demographic and digital games that can be explored in the future.

4.4 SQ5 - What types of games are used (digital, board, hybrid, etc.)?

All the studies utilized games in some capacity. The count of the games used was as follows: 1 used card/board games, 3 employed dynamics to engage with the volunteer participants, and 11 resorted to digital games (as seen in Figure 6).

Figure 6. Types of games used in the found works.



Source: Image generated by the authors.

In most studies, digital games managed to work with the older adult volunteer's health issues and support their empathic engagement. Such engagement was notable in Seaborn *et al*. [2019]'s work, where the volunteers, when playing the game together with people from younger generations, by becoming aware of each other's limitations via interaction,

were able to experience a cooperative and interpersonal empathic experience. In Lee *et al*. [2020]'s work, the game was able to stimulate the senior volunteers to look at the game's scenarios and relate them to their own life's trajectory, and thus encourage them to talk with younger volunteers about their perspectives. Which denotes the potential that empathic games have to work with this audience.

Another use for the games detected in the SLR was to engage empathetically in the educational aspect. In Forssell *et al*. [2023]'s study. An important caveat in this study is that the volunteers felt more of a sense of "surprise tests" administered by educators in the past; and simultaneously, the experience encouraged them to compete and collaborate more. The game, according to the authors, was a way to introduce variety into the lecture-based classes and to assess prior knowledge in the classroom, and according to the authors, the volunteers enjoyed a more active and interactive, even if at times challenging, way to review their studies [Forssell *et al*., 2023].

Studies that did not use digital games were also identified. Forssell *et al*. [2023] used playing cards to capture the values and concerns expressed by older individuals during 3 workshops focused on designing technological solutions for this demographic. The authors adopted a playful format, in which cards were texted with problems and tools that helped them understand problems that could be addressed with future technological solutions and emotions in a participative manner.

Taking a different approach, Beadle *et al*. [2013] and Zhang *et al*. [2019] worked with older adult volunteers who have suicidal tendencies, severe depression, and other related psychological traumas or conditions. Both authors used the dynamics of the 'dictator game' (also known as the 'ultimatum game'), where participants receive an offer from an unknown person for a hypothetical amount of money to be divided between them and the player; the unknown person presents a justification for their offer, which is often unfair and favors the unknown person.

The player can only accept (receiving the money) or reject the offer (in which case, neither party receives any of the offered amounts). The authors of this study simulated offers from unknown individuals in emotionally challenging situations (financial instability, family abandonment, difficulty caring for their families, and other circumstances where the offered amounts could alleviate these individuals' situations) [Beadle *et al*., 2013; Zhang *et al*., 2019].

The authors found that older adult individuals suffering from the aforementioned conditions do not feel inclined to empathize with the pain of others. This highlights that fostering engagement and empathetic feelings also depends on whether older adult participants are willing to confront, experience, and see perspectives beyond their own [Beadle *et al*., 2013; Zhang *et al*., 2019].

Such perspective presented from the games demonstrates that alongside the subjectiveness of empathy, the cognitive state that the older adults are in plays an important role in how their empathic engagement with games can be fostered. Both when interacting with the game individually or with someone else.

4.5 SQ6 - What characteristics and themes in these games generally include elements considered empathetic to this audience?

The games used in the found studies covered diverse themes and objectives, them being:

- A maze disguised as a suburban neighborhood where players are trying to deliver mail around the houses [Yin and Zhou, 2019];
- Participants needing to communicate and work together in order to achieve a goal [Seaborn *et al*., 2019; Gajadhar *et al*., 2010];
- The simulation of the conditions that the older adults face when trying to access health services [Geier *et al*., 2022; Varkey *et al*., 2006; Chen and Wang, 2012];
- The use of a sailing boat as a visual metaphor to represent an individual's life trajectory [Lee *et al*., 2020];
- Medieval fantasy games [Carrasco *et al*., 2018];
- Dynamics that determine an ultimatum where the player must decide to accept or not a proposition, be it fair or not [Beadle *et al*., 2013; Zhang *et al*., 2019];
- First person games with military ambiance [Carrasco *et al*., 2018].

Sometimes, the themes were used as a backdrop to contextualize the actions the players were taking, such as in Yin and Zhou [2019]'s work, the players had the role of a post officer, and the movements they made throughout the game contextualized physical exercises and stretches as well as they had objectives do deliver mails and packages in a maze fashioned as a suburban neighborhood. This, however, did not engage the senior volunteers emotionally, only mechanically, as the game was developed alongside them as a means to support their physical therapy [Yin and Zhou, 2019].

In Seaborn *et al*. [2019]'s study, the game was meant to be played in doubles of an senior individual and a younger adult. In the game, the participants had to synchronize their leg movements to step-in buttons that were displayed via a projector with the correct rhythm.

During gameplay, in order for the players to achieve their objectives, younger players often slowed down their movements to match their partners, becoming more aware of their limitations, while senior players felt more comfortable communicating and moving around with their partners. Both younger and senior volunteers reported that, after playing, they had an easier time socially engaging with people from different generations[Seaborn *et al*., 2019].

In Gajadhar *et al*. [2010]'s study sought senior players who were already familiar with video games and paired them up into pairs. The study aimed to understand what type of game-mediated interaction was preferred by this audience. The volunteers played a variation of the game *Pong!*[10], where they needed to communicate in order to move, hit the ball to score points, and win.

They played the game remotely in the following conditions: 1) them being in different rooms with no means to communicate between each other; next, the participants were in the same room but, with a barrier between them, they could

[10]Atari, © 1972

only speak loudly in order to communicate; and finally, they played the games was in person and together, they both shared the same monitor, for this condition each participant had a controller Gajadhar *et al*. [2010]. Despite the game's theme being almost absent (given that the original game's fame is based on tennis) the volunteers reported feeling more comfortable when they were in the same physical space for game-mediated interaction, thus improving their communication and synchronization of movements. This study is noteworthy for the interpersonal concern among them for teamwork and their partner's awareness.

The works of Geier *et al*. [2022], Varkey *et al*. [2006], and Chen and Wang [2012] used a game based in the experiences of older individuals with the healthcare system and the challenges they face during this process. The experiences reported by the authors proved effective with medical and pharmacology students. The students in their works reported having a better understanding the difficulties faced by this audience and noted how healthcare systems, in their local context, need improvements in treatment and communication with older adults.

The study by Lee *et al*. [2020] used a commercially available game for life review activities, originating from the field of Psychology. Typically, this technique is applied with a specialist who encourages the patient to discuss their life journey and understand their actions, perspectives, and possible psychopathologies, thus helping the patient to find decisions they wish for their future and eventual death [Lee *et al*., 2020]. The game employs visual metaphors to represent a person's life and milestones in their journey via a small boat embarking on a journey after falling from a waterfall (representing birth); the boat grows along the journey, passing through forests, containers, and clouds (representing stages of a person's growth, such as adolescence and adulthood), culminating in the boat encountering another, resulting in a smaller boat (representing relationships and marriage). All of this metaphor culminates in a family of boats, the maturation of the "child" created, and the eventual death of the player's boat [Lee *et al*., 2020].

The senior participants, while playing the game, received assistance from young adult volunteers to help, when necessary, with technical difficulties and to aid the participants in interpreting the metaphors [Lee *et al*., 2020]. While the game was able to evoke emotions and reflections as the life review technique proposes for most participants, the authors also reported that [Lee *et al*., 2020]: **1)** some metaphors, such as those related to adolescence, were confusing, which hindered their emotional and empathetic engagement with the game; **2)** some participants reported feeling significant emotional discomfort when using games to discuss their lives, stating that the gaming experiences brought past scars to the surface, leading them to prefer to stop playing midway through the activity.

Although self-reflection on one's own life is not, by definition, an empathic process, it has been argued that the experience reported by older adults in [Lee *et al*., 2020] may support the development of empathic engagement. Reflecting on personal experiences can help individuals imagine how others might feel in similar situations, thereby fostering cognitive empathy — an understanding of another person's perspective. For example, recalling one's own fear of public speaking can facilitate empathy toward someone experiencing anxiety before a presentation. While self-reflection alone does not constitute empathy, it can serve as a valuable tool for enhancing empathic capacity. For this reason, and following the discussions with specialists involved in the present study, this aspect was considered relevant to the SLR.

This work highlights that games have the potential to serve as a virtual space for older individuals to reflect on their lives and express their thoughts to others, as well as the importance of respecting their limitations and willingness to discuss such issues [Lee *et al*., 2020].

In terms of sensitive topics, Beadle *et al*. [2013]; Zhang *et al*. [2019] studies explored these topics through games with the senior audience. However, they sought participants who were experiencing severe depression or had previously attempted suicide.

The dictator game was applied to understand whether, in their psycho-emotional state, they could empathetically engage with the pain of strangers. This was something the volunteers in this study showed reluctance towards and were less concerned about the difficulties of others [Beadle *et al*., 2013; Zhang *et al*., 2019]. Their findings suggests that the empathetic experience requires the emotional state and volition of senior participants to align in order to emerge, and that similar aspects relating to games for the seniors afflicted by psycho-emotional conditions still need further studies and in-depth discussions.

The work by Carrasco *et al.*, as presented in Subsection 4.3, demonstrated that the profile and motivations of older adults for playing video games can be quite diverse [Carrasco *et al*., 2018]. The themes of the games were related to their interests, such as a military first-person shooter game connected to the past career of one volunteer, and medieval-themed games related to the interests of two other participants in medieval fiction and history [Carrasco *et al*., 2018]. According to Carrasco *et al*. [2018], the same interest in familiarity with past hobbies was observed among casual players who engage in word searches or poker on their mobile devices, as they already participate in these activities outside technological devices, and sometimes with friends and family members.

In summary, *there was no single dominant theme that elicited empathetic reactions from the senior audience*. In the studies reviewed, those that generated the most empathetic responses from senior participants were those that required interaction and cooperation with other players, both of the same age and younger, as these allowed for engagement of the gaming activity with the feelings of senior players and younger volunteers, with the game serving as a mediator for the activities in the studies [Seaborn *et al*., 2019; Lee *et al*., 2020].

4.6 SQ7 — What are the main challenges this audience faces when interacting with games?

The found works, in general, *did not focus on what are the usability and interaction barriers with the target audience regarding the games used in their studies*. The authors found in the SLR pointed caveats in the interaction aspects of the

games that harmed some of the senior volunteers' experiences with them. The reported difficulties were:

- Fine motor coordination of the hands, mainly [Raffe and Garcia, 2018; Seaborn *et al*., 2019];
- Games that demand reflexes are challenging to them to respond and act in time [Forssell *et al*., 2023; Gajadhar *et al*., 2010];
- In online games, sometimes, they did not feel comfortable to interact with other players [Carrasco *et al*., 2018];
- Certain visual metaphors from the games were not easily understood by them [Lee *et al*., 2020];
- Older individuals, in case they are dealing with a condition similar to depression, have shown themselves to be less empathic with other players as well as the game's proposed emotional experience [Beadle *et al*., 2013; Zhang *et al*., 2019];
- Difficulty in using the game's built-in communication methods, be it via text or voice [Gajadhar *et al*., 2010];
- Games with a short time limit were challenging to them to identify the context of what to do and act within this limitation [Forssell *et al*., 2023; Gajadhar *et al*., 2010].

The difficulties, when reported, proved to be of various natures, but not general to the senior population and their interaction with digital games. Some of these discomforts align with previous studies by Whitcomb, indicating the need to know more about the barriers (intrinsic and extrinsic) in the interactive experiences of senior individuals with digital games [Whitcomb, 1990].

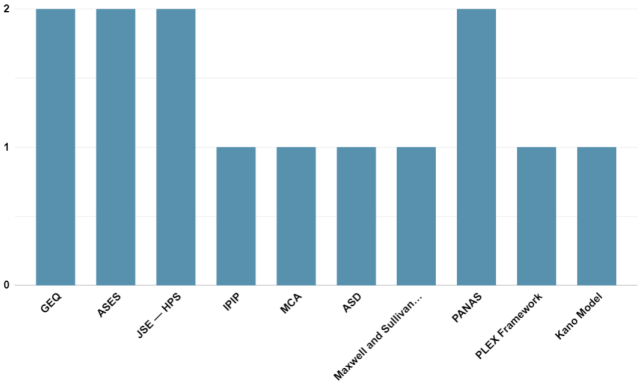
4.7 SQ8 — What design and evaluation methods are used in developing the games or solutions?

Of the found works, the following methods they used were detected:

- **Design Methods:**
  - PLEX Framework [Forssell *et al*., 2023];
  - Kano Model [Yin and Zhou, 2019].
- **Evaluation Methods**:
  - GEQ [Seaborn *et al*., 2019; Gajadhar *et al*., 2010];
  - ASES [Chen *et al*., 2012; Chen and Wang, 2012];
  - JSE — HPS [Chen *et al*., 2015, 2012];
  - IPIP [Pereira *et al*., 2019];
  - MCA [Pereira *et al*., 2019];
  - ASD [Varkey *et al*., 2006];
  - Maxwell and Sullivan Questionnaire [Varkey *et al*., 2006];
  - PANAS [Beadle *et al*., 2013; Yin and Zhou, 2019].

The evident disparity between the number of design methods and evaluation methods is due to how digital games have been utilized in the studies found in the SLR (the number of studies that used specific methods can be seen in Figure 7). Most works used a game that was already available commercially or otherwise. While only Forsell *et al.* and Yin and Zhou's works focused on creating a game from scratch with

Figure 7. Number of studies that used specific design and evaluation methods.



Source: Image generated by the authors.

the participation of the older adult volunteers Yin and Zhou [2019]; Forssell *et al*. [2023].

The cited evaluation methods were used in a targeted manner, such as ASD, GEQ, and ASES, to assess the experience of volunteers after activities involving digital games [Varkey *et al*., 2006; Seaborn *et al*., 2019; Gajadhar *et al*., 2010; Chen *et al*., 2012; Chen and Wang, 2012]. Some of these methods, such as IPIP and MCA, were used by specialists to screen volunteers, checking their cognitive readiness to respond to the digital gaming experience employed in the study. These methods required domain experts to apply these methodologies [Pereira *et al*., 2019].

In line with specific methods for the health field, the JSE — HPS used in the studies by Chen *et al*. [2012, 2015], and it was applied to measure the experience of health specialist volunteers after the gaming experience.

In contrast, the work of Yin and Zhou [2019] detailed how they created a game to support physical activity among the senior, from requirement gathering based on reports from senior volunteers to prioritizing requirements using the Kano Model and evaluating the interactive experience with PANAS.

Forssell *et al*. [2023] dedicated their study to making the learning process a playful experience using the PLEX Framework. The framework guided how the authors designed the digital literacy classes for senior participants and how they integrated digital games to encourage competition and interaction among them, thus incorporating games as a playful part of the digital literacy of the study's volunteers [Forssell *et al*., 2023].

In light of the methodologies found in the SLR, it was noted that there is a lack of specific methods for the design and evaluation of empathetic games.

4.8 SQ9 — Is there participation from domain experts in the stages of solution development?

Only 2 of the found studies had the participation of domain experts.

Beadle *et al*. [2013]'s work had psychologists and neurologists in the screening process of participants, to verify if they were apt and aware to make decisions with consideration with the presented scenarios of the *dictator game*, and after the

game experience, if they could report their justifications of why they decided that they did.

Pereira *et al*. [2019]'s study also declared they had the participation of a therapist to screen senior participants recruited in a community center, but it was explained what was the therapist's specialty.

4.9 MQ — What are the characteristics of existing research on digital games with empathic elements for older adults in terms of user profiles, design approaches, and evaluation outcomes?

Given the main research question of the SLR, it was possible to find and explore a number of studies detailing the involvement of the older adults with empathetic digital games. In principle, with relation to empathic games, few works were found in the literature considering our established protocol. Another consideration is that, within the 15 explored works; *few of them were focused on the empathic or emotional relationship between older adults and their interaction with video games*. The found works do explicitly say that their emotions can emerge and be influenced during the game's experience, but little focus was on *how* this emotion engagement happens or in what harms it or supports it.

With our findings, it is possible to conclude that studies regarding empathy and games with the older adults *is a subject not currently well explored or understood*. The profile of the seniors in relation to games is still largely unknown. It is not possible to clearly tell what kinds of games are attractive to them, or what themes are better at fostering empathic engagement in participants.

Some aspects of the studies revealed that cooperative games, where they have to be mindful of each other's limitations or need to work together to coordinate and win against a computer controlled opponent, seem to be mildly effective in supporting their empathic engagement in games [Beadle *et al*., 2013; Gajadhar *et al*., 2010].

Also, it is unknown what are the generalized motivations for this audience to play, which aspects of games (narrative, visual, auditory, and mechanical elements) are most conducive to fostering an empathetic experience, and which digital game platform they prefer.

Carrasco *et al*. [2018]'s work shed some light that their preferences could be as diverse as younger people, where they enjoy both casual and hardcore games, whether be it into a PC or mobile platform. Carrasco *et al*. [2018]'s work only managed to recruit 10 volunteers from Australia and Ecuador, and thus cannot offer generalizations of the average profile of senior gamers and their preferences without further dedicated studies with wider samples, and in different social-geographical contexts as well.

The studies also demonstrate that the older adults can appreciate interactive experiences mediated by games. There is evidence that this audience may be more diverse than expected, as there are players who prefer more casual titles and those who prefer more complex games.

They also report that through games, they can have an engaging and emotional experience both with the software, the story, and also with other players via a mediated in-game task where they can cooperate and come to mutual understanding and compromises.

Taking our findings from an HCI perspective, it is interesting that established methods to prospect, design and develop technological solutions are a viable approach in creating empathic games. Also that involving doming specialists from different knowledge areas can better support the exploration and fostering of empathy via digital games. This, however, poses a question: "*Why aren't games used more to explore empathy with older adults?*"

It could be argued that lack or more studies that explore such issue it is inherent to the nature of sensitive topics, cultural contexts where the studies took place, and also how the preference of senior individuals towards digital games (which most of the founds work used) are not universal. The exploration of such issues also is not one that does not need to employ technological solutions. A conversation with a trained professional (i.e: a therapist) or a trusted confidant can also be just as effective in exploring empathy.

The works found in the SLR suggest that technology can facilitate such discussions with older adults and that an engaging manner to present and discuss such issues was interesting to them, even so, its not possible to implicate that this can be a preferred form to explore empathy with them. Nor it can be certain that it is an experience they will clearly understand or have tangible benefits for them or society.

Our findings indicate that designing games to explore empathy requires highly specific and context-sensitive approaches. Such endeavors demand considerable resources, effort, and attention to detail to ensure that the games are appropriately developed for studies involving older adults. The need for these specialized design efforts may help explain why games are not yet a common medium for investigating empathy in this demographic. Insufficient attention to these requirements could lead to physical or psychological discomfort among participants, ultimately hindering the empathic experience that the games aim to foster.

Delving deeper in the design of the games used in the found works, their variety is noteworthy since they were used as:

- Metaphors for human experiences - Be a mundane one delivering letters [Yin and Zhou, 2019], or a more abstract one where a boat was used to explore a person's life journey [Lee *et al*., 2020]) - These games are not only played but also felt — using environment and mechanics to make abstract human experiences tangible.;
- Emphasis on empathy and collaboration [Seaborn *et al*., 2019; Gajadhar *et al*., 2010] - both point to empathy-building and social understanding. These designs push players to see through others' perspectives, creating emotional engagement rather than just strategic challenge. Collaboration becomes a means to understand others, not just to win;
- Moral and ethical decision-making The "ultimatum dynamic" - Where deciding whether to accept a fair or unfair proposition introduces moral tension and self-reflection [Beadle *et al*., 2013; Zhang *et al*., 2019]. This brings psychology and ethics into play: putting players in position where confront their own fairness instincts,

biases, and motivations. Such games turn choice itself into a mirror of character;
- Power and vulnerability contrasts - Considering the hardcore games played in Carrasco *et al*. [2018] and the healthcare access simulation game in Geier *et al*. [2022]; Varkey *et al*. [2006]; Chen and Wang [2012] they exhibited the contrast of how games can explore both power fantasies and empathy experiences, often opposite but equally revealing of human psychology;
- Spatial design as emotional narrative - The use of space in [Lee *et al*., 2020] also reveals that can somewhat mirror psychological navigation — confusion, journey, conflict, or discovery. The player's movement through the game world becomes symbolic of their inner movement toward understanding or resolution.

Taken together, these examples demonstrate how games can function as experiential narratives for older adults, integrating elements such as metaphor, moral decision-making, physical engagement, and empathy to explore how they perceive and interact with the world. Each of these experiences shared the common goal of encouraging players to feel, reflect, and connect. This suggests that, when effectively designed, empathic games can reveal dimensions of the human experience that are often difficult to access through traditional methods, serving as powerful tools for fostering deeper understanding of ourselves and others. Specifically, for the HCI field, the present work and its findings make the following explicit contributions:

Establishes empathic game design for older adults as a distinct and underdeveloped research domain, demonstrating that empathy mediated through digital games remains largely unaddressed in existing literature. Provides the first structured synthesis of this space, exposing critical gaps in current knowledge, including the absence of robust user characterizations, unclear player motivations, and limited evidence on which game design elements effectively foster empathic engagement. Articulates a set of emergent design patterns and applications for empathic games, showing how metaphorical narratives, collaborative mechanics, moral decision-making, and spatial interaction can be leveraged to support emotional and social engagement of older adults Reframes empathic game design as a complex, context-dependent HCI challenge, arguing that effective solutions require intentional, interdisciplinary, and resource-intensive design approaches tailored to older adults. Defines a concrete possíble research agenda for HCI, positioning empathic games as a promising yet unvalidated medium and outlining the need for rigorous evaluation methods, design frameworks, and broader empirical validation.

Considering the SLR's objectives, our findings did indicate that the development and use of empathic games with older adults remains a largely underexplored research niche. This particular knowledge gap has space for innovation, as well as significant investment of time and resources, to address the gaps identified. Specifically, there is a lack of generalizable evidence regarding older adults' gameplay preferences, their motivations, which game elements most effectively foster empathic experiences, as specific methods to better design such solutions. Overall, this review highlights a promising research niche within HCI that remains open to inquiry, exploration, and experimentation alongside other knowledge areas.

5 Final Remarks

The current study carried out a Systematic Literature Review (SLR) to delve into the existing research on how older adults interact with digital games and their connection to empathy. The findings showed that while games hold great potential as a tool for promoting active aging, there are still significant gaps in our understanding of how older adults emotionally engage with these games. The studies reviewed, which involved senior participants playing digital games, highlighted various evaluation and design methods—like the GEQ, PANAS, and PLEX Framework—that could be useful for future research in this area.

Despite these findings, we still know very little about the unique characteristics of older gamers and how they interact with digital games. This opens up a chance for this study to make a meaningful contribution by pointing out overlooked areas and encouraging more scientific exploration. For instance, the research by Lee *et al*. [2020] demonstrated that games can be a powerful way to discuss sensitive topics with older adults, showing their potential in facilitating important conversations.

However, there's still a lot we don't understand about the emotional and empathic experiences of older adults when it comes to gaming, including what they prefer and what they need for a great interactive experience. While general software guidelines can help older users to some extent, digital games are unique in their variety of purposes, mechanics, aesthetics, and other design elements. As a result, the current resources and methods may not fully equip designers and developers to create games tailored for this demographic, especially when it comes to empathic games, which currently lack standardized development and evaluation processes.

Looking at global trends, even though today's older adults might not play games as much as younger generations, this is likely to shift in the future. As younger generations who have grown up with gaming age into older adulthood, we can expect their engagement with games to increase significantly.

As for the present work, we need to acknowledge significant key-limitations. Unfortunately, due to time and resource constraints, we couldn't dive into additional academic databases or include gray literature[11] Additionally, the second filtering stage of the systematic literature review was carried out solely by the first author because of scheduling conflicts, which has, event if unintentionally, introduced some bias into our findings.

Looking ahead, we plan to tackle the knowledge gaps we've identified by conducting empirical studies with older adult participants. This will involve interviews and participatory activities to capture their gaming profiles, specific usability

[11] Information produced outside traditional publishing and distribution channels, and can include reports, policy literature, working papers, newsletters, government documents, speeches, white papers, urban plans, and so on [Bonato, 2018].

challenges, and design elements that truly enhance empathic engagement. Our hope is that this research not only brings attention to this often-overlooked topic but also inspires researchers in technology and related fields to help bridge these gaps, sparking new discussions and innovative approaches within the scientific community.

Alongside these efforts, we plan to expand the review across a broader range of databases, apply more rigorous filtering criteria, and adopt a more contemporary SLR protocol to strengthen the validity, coverage, and reproducibility of our findings, particularly, a more time-considerate approach, in order to find more recent works thus compiling and sumarizing more up-to-date knowledge. Ultimately, we envision this line of work contributing to the development of more inclusive, meaningful, and empathetically grounded interactive experiences for older adults.

Lastly, we can't overlook the ethical considerations that come with this research. Aging and the challenges that come with it are deeply personal experiences that differ from person to person. As we work to fill these gaps, we must prioritize ethical responsibility, aiming to create empathic games that serve as tools for people of all ages to better understand one another, nurture empathy, and encourage social engagement.

Declarations

Authors' Contributions

The present work was originally written in Portuguese by **VFG** as part of his Master's qualification procedure, and the present work was also translated by him. Most of the translation was done manually, with *ChatGPT-4* and *Google Translator* used on occasions to suggest translations and sentences that were more natural to the English language. To help correct the grammar and spellchecking during manual translation, the *LanguageTool* browser extension was used.

AECV helped with the SLR's first filtering stage and with overall text improvements of the present work.

KRHR supervised the methodological stages, the discussion of the results of the present study, and reviewed the current work alongside the first author.

All authors read and approved the final manuscript

Competing interests

The authors declare that they have no competing interests.

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Availability of data and materials

The analyzed papers are available online, and the SLR's data extraction table can be seen at: `https://docs.google.com/spreadsheets/d/1PuxNWJZ_4wogPU6YygVQv893NxuQPbf6SylS72VOnW4/edit?usp=sharing`

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