

ACCESSIBLE GAMES: A BIBLIOMETRIC ANALYSIS FOR FUTURE DIRECTIONS

JOGOS ACESSÍVEIS: UMA ANÁLISE BIBLIOMÉTRICA PARA RUMOS FUTUROS

FAHRIYE ALTINAY

Professor, Ph.D.in Educational Technology
Societal Research and Development Center,
Faculty of Education, Near East University
Nicosia, Northern Cyprus, Mersin 10 Turkey
fahriye.altinay@neu.edu.tr

AYTUN KAZMACI

Master's in Computer Science
Günsel Academy
Nicosia, Northern Cyprus, Mersin 10 Turkey
aytun.kazmaci@gunsel.com.tr

GOKMEN DAGLI

Professor, Ph.D. in Educational Management
Faculty of Education, University of Kyrenia
Kyrenia, Northern part of Cyprus, Mersin 10
Turkey
gokmen.dagli@kyrenia.edu.tr

KEMAL ALPTÜRK

Master's in Genetics
Faculty of Education, Kyrenia University
Kyrenia, Northern part of Cyprus, Mersin 10
Turkey
kemal.alpturk@gmail.com

ZEHRA ALTINAY

Professor, Ph.D. in Educational Technology
Societal Research and Development Center,
Faculty of Education, Near East University
Nicosia, Northern Cyprus, Mersin 10 Turkey
zehra.altinaygazi@neu.edu.tr

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Corresponding author:

fahriye.altinay@neu.edu.tr



Abstract: Sustainable society and education rely on the policy and strategies about accessibility. Making inclusion fosters quality of education and services for all in relation to the well-being in the digital context. Accessing facilities and information play a great role to acquire services for all. People with disabilities have rights to access information and all facilities. Games are key facilitator for socialization and learning for wellbeing. This research study aims to determine how accessible games can fulfil inclusiveness and well-being based on a systematic review of the literature for future directions after pandemic times. In this respect, bibliometric analysis was conducted to reach out the answers of; 1. What is the distribution of the publication and citations by years in Web of Science? 2. What is the distribution of the studies by language and countries in research of Web of Science? 3. What are the most-cited (citation and co-citation) journals publishing research, document types in Web of Science? 4. What are the most-cited keywords, fields in Web of Science? 5. What is the time trend in title and abstract about accessible games for well-being in Web of Science?

Keywords: Accessibility. Accessible games. Bibliometric analysis. People with disabilities. Technology.

Resumo: A sociedade e a educação sustentáveis dependem de políticas e estratégias sobre acessibilidade. Fazer a inclusão promove a qualidade da educação e dos serviços para todos em relação ao bem-estar no contexto digital. O acesso a instalações e informações desempenha um grande papel na aquisição de serviços para todos. As pessoas com deficiência têm direito de acesso à informação e a todas as instalações. Os jogos são facilitadores essenciais para a socialização e a aprendizagem para o bem-estar. Este estudo de investigação visa determinar como os jogos acessíveis podem proporcionar a inclusão e o bem-estar com base numa revisão sistemática da literatura para orientações futuras após tempos de pandemia. Nesse

sentido, foi realizada análise bibliométrica para chegar às respostas de; 1. Qual a distribuição das publicações e citações por anos na Web of Science? 2. Qual a distribuição dos estudos por idioma e países nas pesquisas da Web of Science? 3. Quais são os periódicos mais citados (citação e cocitação) que publicam pesquisas e tipos de documentos na Web of Science? 4. Quais são as palavras-chave e campos mais citados na Web of Science? 5. Qual é a tendência temporal no título e no resumo sobre jogos acessíveis para o bem-estar na Web of Science?

Palavras-chave: Acessibilidade. Jogos acessíveis. Análise bibliométrica. Pessoas com deficiência. Tecnologia.

1. Introduction

Technology covers all kinds of tools and equipment that humanity has developed as a result of its struggle against nature in order to continue its life from past to present (Feenberg, 2012). Human beings contribute to the continuous development of technology by taking advantage of the knowledge they have in the face of new problems they encounter (Veblen, 2007). The development in the field of technology has caused the society to be named with concepts such as Information Age, Internet Age, Information Age, Electronic Age, Cyber Age, Digital Age, Post-Industrial Age (Çetin and Özgiden, 2013). The twenty-first century, in which information technologies are developing rapidly, is described as the "digital age" (Parlak, 2017; Kara, 2023). Social structures are changing rapidly under the influence of globalization and technological developments, and this rapid change paves the way for the emergence of new phenomena and concepts (Karabulut, 2015). One of the most popular technological tools used by the digital generation of the digital age to have fun and spend time is the computer, and one of the most popular computer applications is games, and these games are a very popular entertainment tool today (Bostan and Tingöy, 2015). Digital games are games that are programmed with various technologies and allow users to log in in a visual environment (Dinç, 2012). The results of the study show that children spend more and more time in front of the screen and play digital games (Kabali, Irigoyen, Nunez Davis, Budacki, Mohanty, Leister, & Bonner, 2015). The most widely used tools and technologies in pre-school education are computers and television, apart from these; Tools and technologies such as projectors, radio, electronic toys, cameras and cameras can also be used (Öner, 2017; Mirici, 2019).

A game is a complex system in which the player performs tasks based on a set of rules (Domínguez, et al., 2013). These tasks should be designed as a cycle of experience (Gee, 2004). However, the tasks to be experienced should be divided into small parts so that the player knows

what to do next time. The use of educational games in education has now become a common concept. Instead of using video games to educate, some researchers have focused on transferring the good aspects of video games to educational environments where there are no games (Domínguez et al., 2013). Here we encounter a concept that has nothing to do with the field of education but that we can carry into this field. (Gamification). Gamification in education; It is the use of video game components in non-game systems to increase the user experience or enable the user to connect to the environment (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). In the context of education, the process of gamification is not just adding games to knowledge or skill teaching, but also taking advantage of its potential to facilitate students' learning in the existing learning field by integrating it with game characteristics. (Deterding et al., 2011).

Looking at the literature, gamification in education; It relates concepts such as educational games, educational gamification, fun interaction and game-based technologies. Gamification is motivating users to adapt to new behaviors by increasing their physical condition, working harder, or learning something new (Simões, Redondo, & Vilas, 2013).

Distance education and e-learning, which have been developing rapidly in recent years, are rapidly developing contemporary education models used to solve all these problems. Gamification emerges as an alternative method to solve this situation. In this way, adults' expectations regarding the behavior towards them will be eliminated. In addition, various factors such as fear of failure will disappear due to the presence in the virtual environment (Mutlu, 2006). E-learning is a developing third industry field that changes the way students learn and the way educators teach (Xu, 2011), and with the developments in the field, there has been a huge explosion in the online game industry, especially the users of online-based, role-playing games are widespread all over the world. started to continue its existence. According to statistics from Google, the most common search engine in the world, the countries where gamification is most active are Australia, America, India, Canada and the Netherlands. The rapid development in these countries is followed by Brazil and France (Google, 2013).

The most common use of gamification applications in these countries is vocational training for adults. Gamification will enable the individual to actively gain experience by using the scoring system, which is one of the most interesting and typical parts of the game (Robertson, 2010). Gamification uses game design elements to increase effectiveness in achieving goals in solving organizational problems. According to Gartner, the purposes of gamification are “the realization of higher-level obligations, changing behaviors and encouraging renewal” (Singh, 2012). Components that should be used together to increase the efficiency of gamification applications

(Ivetic & Petrovic, 2012); feedback, sociability, competition, development opportunities and content.

It is possible to overcome the problems of high dropout rate, decreasing motivation and social deficiency, which are the main limitations of e-learning, with the gamification method (Maksumoto, 2012). However, this does not mean that the gamification method does not have its own limitations. Gamification basically serves the concept of motivation. Intrinsic motivation is one of the basic principles in adult education (O'Donovan, 2012). According to Landers and Callan (2012); Applications in the virtual world for the business world, those who want to improve themselves and the education of students have not become widespread enough. It has been determined that the learning outcomes of the application users are higher than the others.

Thanks to the use of information and communication technologies in learning environments, active learning opportunities have increased and learners have been enabled to collaborate among themselves (Williams and Chann, 2009). With technological developments, games have begun to be used in education as well as in many other fields. Games have taken their place in the field as motivating materials that can keep the interest and motivation of learners high and have been effective in the emergence of the gamification approach (Yıldırım and Demir, 2014). Educational computer games, which are a new type of games that emerged as games began to be used for educational purposes, can also be used in open and distance learning environments.

2. Methodology

In this study, the bibliometric analysis method is applied to examine publications related with accessible games and to define a set of distribution patterns. Bibliometric analysis is a popular technique for accurate analysis of large amount of data (REF) (Song & Wang, 2020).

First of all, a systematic literature research is performed to obtain the related data for the analysis. The data are collected via using the Core Collection on Web of Science (WoS) database. WoS database provides an easy access to a large amount of high-quality literature and popularly used in bibliometric studies. “Accessible Game” OR “Accessible Games” were searched in the Topic section of the WoS search engine, including all of the indices, years and document type of the publications. In total, 89 publications were extracted on the day of the research (16th of October 2023). For the analysis and visualisation of the obtained data, VOSviewer (van Eck & Waltman, 2010) and the “Analyse Results” option, which is provided within the WoS, were used. In addition, R Programming Language with Bibliometrix library (Aria & Cuccurullo, 2017), was used for

further bibliometric visualisation. The aim of the analysis was to visualise and answer the below questions.

- (1) What is the distribution of the publication and citations by years in WoS?
- (2) What is the distribution of the studies by language and countries in WoS?
- (3) What are the most cited (citation and co-citation) journals publishing research and document types in WoS?
- (4) What are the most cited keywords in publications?
- (5) What is the time trend in title and abstract about accessible games for well-being in WoS?

3. Results and Discussion

1. Publication and Citation Analysis by Years

1.1 Publication Year Analysis

The time trend of publications was analysed with the Bibliometrix tool of R! Programming Language and represented in *Figure 1*. The analysis results show that the first publication that was focusing on accessible games is from 2003. In this work, author has introduced a project, called The TiM Project, that aims to develop computer games that can be adaptable for visually impaired children (Archambault, 2003). In terms of interest and the number of publications per year, the twenty-year-old history of publications about accessible games is seemed to have fluctuations. In this timeline, year 2007 can be considered as the first important year that highest number of publications was observed and the following two years seemed promising with 5 publications per year. However, in 2010 no studies were published and until 2015, the number of publications per year was unsatisfactory. In 2015, again a record of 9 publications observed followed by a decrease by nearly half in the next year. Until year 2022, which is the year with highest number of publications in this timeline so far (10 publications), the number of publications again had fluctuations. In 2023, 4 studies were published until the day of this research (16th of October 2023) and the time trend shows that one can expect a smaller number of publications in the end of 2023 than year 2022.

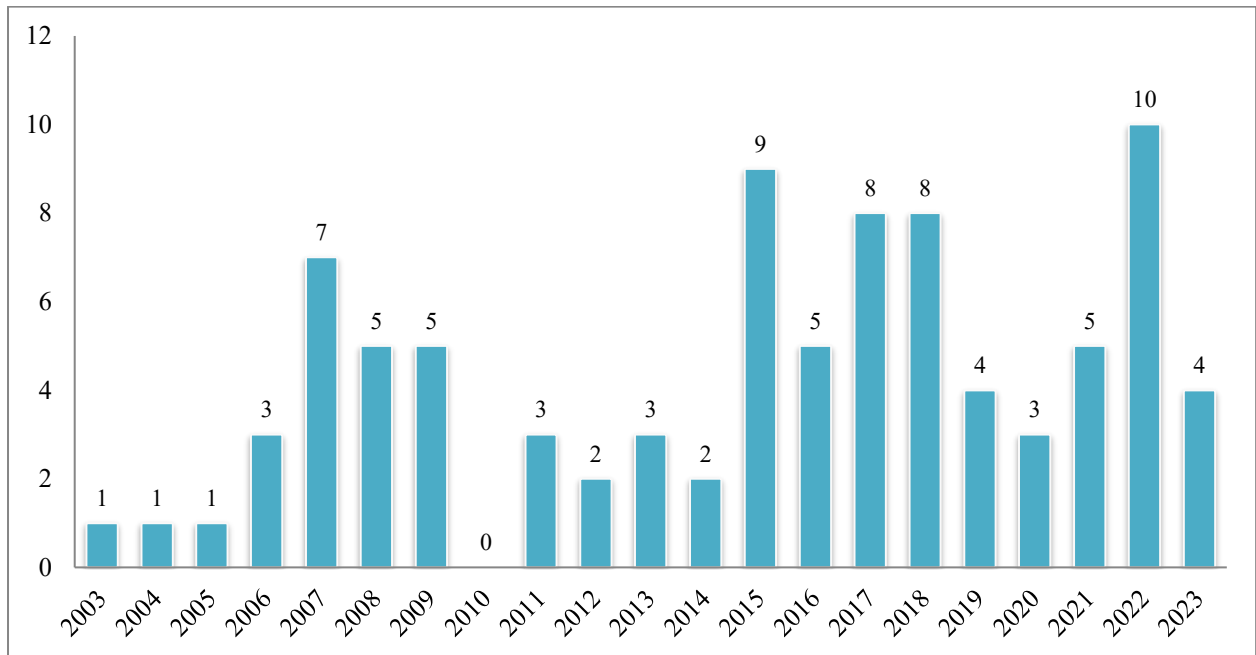


Figure 1 - Publication Year Analysis of Documents Related to Accessible Games per Year, Source: Authors

1.2 Citation Year Analysis

The citation numbers of publications per year analysis was performed via Bibliometrix tool of R! Programming Language and presented in *Figure 2*. The mean total citation of documents is observed to be very low and only in 5 years the mean is more than 1. Year 2011 has the highest mean in this timeline with a mean total citation of 4.10 whereas in 2005 and 2010, there were no citations observed. In addition to previous publication analysis, this kind of distribution in citation analysis also represents a low interest in accessible game studies.

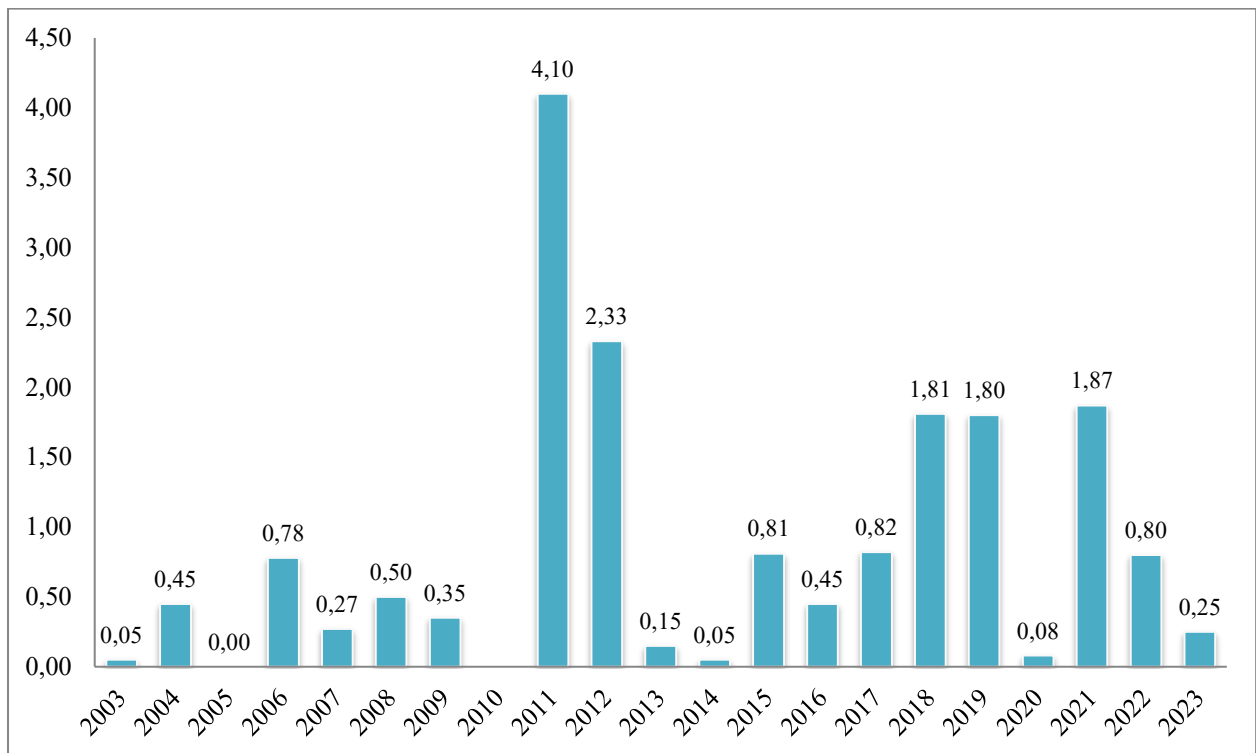


Figure 2 - The Mean Total Citation Analysis per Year, Source: Authors

2. Language and Country Analysis of Publications

To start with the language analysis, all of the analysed publications within this work are published in English language. The results were directly obtained from the analysis tab already provided within WoS.

Regarding the analysis of countries, both VOSviewer and Bibliometrix tool of R! Programming Language was used to visually map the distributions. *Table 1* shows the top 10 productive countries on accessible games. The USA is by far the leader in terms of published documents with 26 documents (~30%). The USA is followed by the UK (8 documents, ~9%), France (7 documents, ~8%), Greece (6 documents, ~7%) and Japan (5 documents, ~5%) in the top 5 countries. *Figure 3* shows the total world map of the productivity of countries.

When the bibliometric coupling of countries is analysed via VOSviewer, the USA has the strongest links with Scotland, Canada and England respectively.

Region Country	/ Frequency
USA	26
UK	8
FRANCE	7
GREECE	6
JAPAN	5
BRAZIL	4
CANADA	4
AUSTRIA	4
ITALY	4
AUSTRALIA	3

Table 1 - Top 10 Country List, Source: Authors

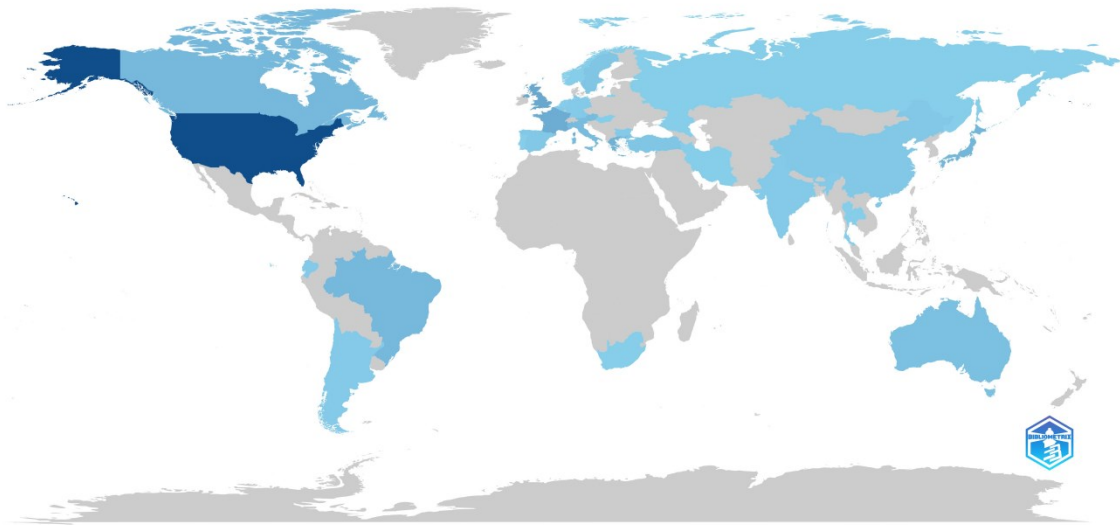


Figure 3 - Geographical Distribution of Researches Conducted on Accessible Games, Source: Authors

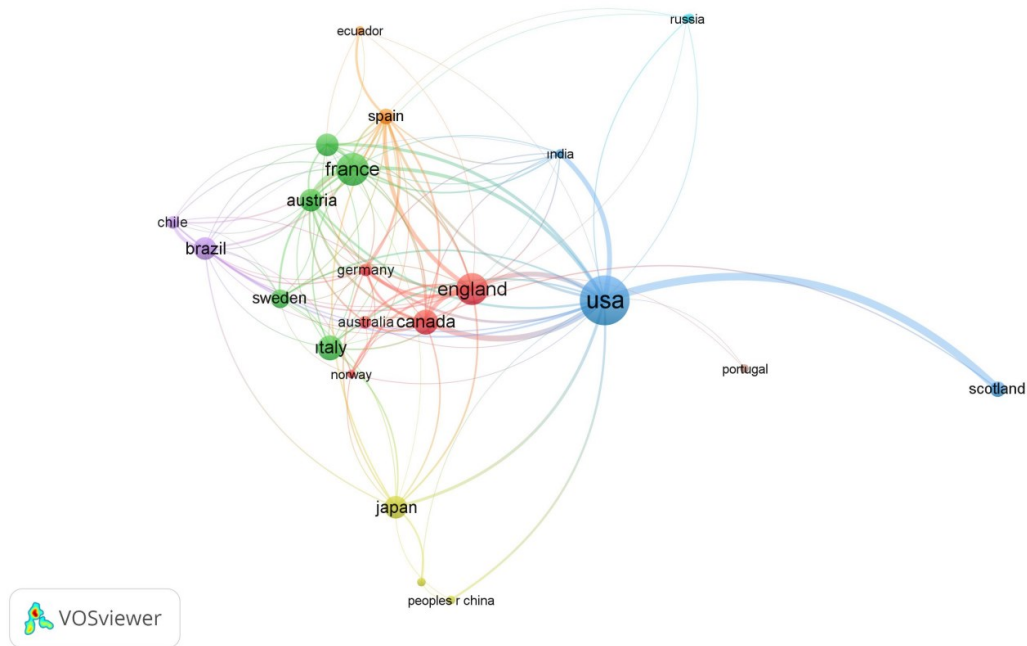


Figure 4 - Bibliometric Coupling of Countries, Source: Authors

3. Most Cited (citation and co-citation) Journals & Document Types

3.1 Most Cited Journals

The citation analysis was conducted with the Bibliometrix tool of R! Programming Language. In the field of accessible games, the most cited source is observed to be the “Lecture Notes in Computer Science” (LNCS) with a frequency of 68 citations. “Computers & Education”, “American Journal of Public Health”, “Universal Access in the Information Society” (UAIS) sources are following the leader with a frequency of 23, 17 and 17 respectively. Below, *Table 2* gives the top 10 list for the cited journals.

No.	Publication Venue	Frequency
1	LECTURE NOTES IN COMPUTER SCIENCE	68
2	COMPUTERS & EDUCATION	23
3	AMERICAN JOURNAL OF PUBLIC HEALTH	17
4	UNIVERSAL ACESS IN THE INFORMATION SOCIETY	17
5	P 3 INT C UN ACC HUM	16
6	BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	14
7	INTERNATIONAL ACM SIGACCESS	13
8	PLOS ONE	12
9	INTERNATIONAL JOURNAL OF HUMAN-COMPUTER STUDIES	10
10	JOURNAL OF ADOLESCENT HEALTH	10

Table 2 - Analysis of the most Cited Journals, Source: Authors

3.2 Document Type Analysis

The document type analysis was performed from the analyser provided within WoS. Proceeding Paper is the most published document type with a frequency of 55 and a dominant percentage of around 62%. Article is the second most popular published document type with a frequency of 25 (~28%). The rest of the published document types covers only around 10% of the published documents. All results are illustrated in *Figure 5*.

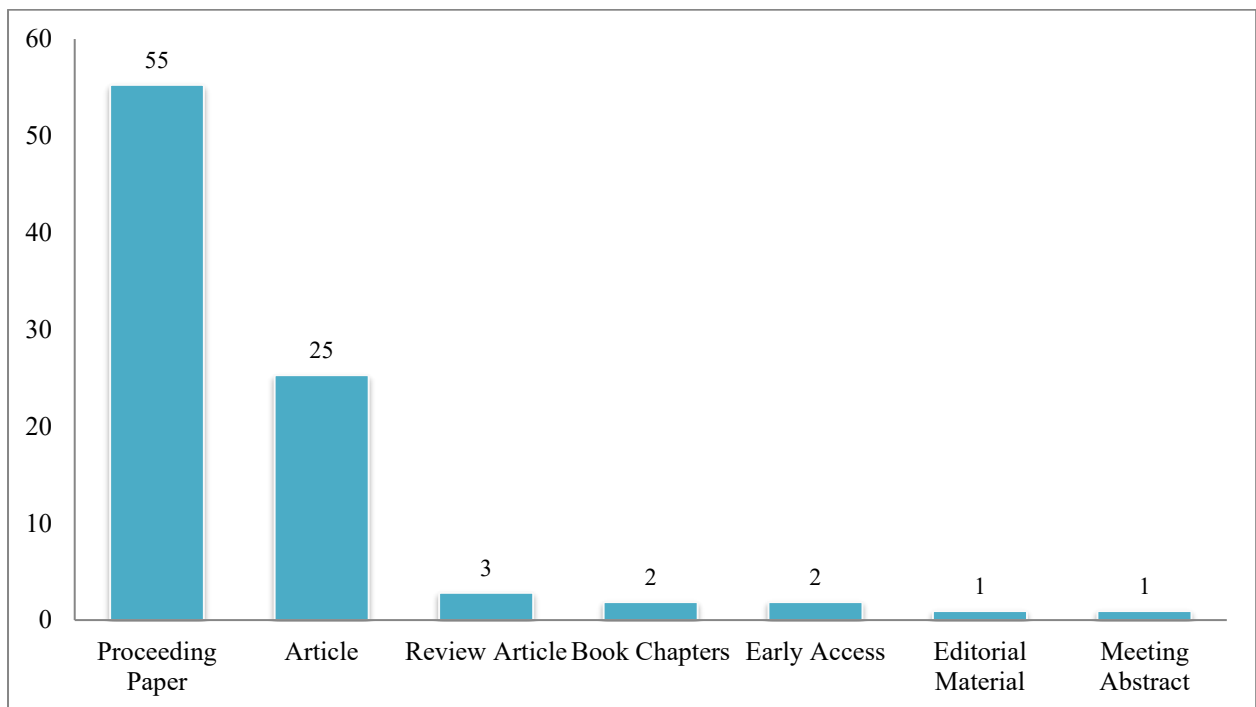


Figure 5 - Document Type Analysis, Source: Authors

4. Keyword Analysis of Publications

A combination of VOSviewer and Bibliometrix tool of R! Programming Language was used to analyse and produce a mapping of the keywords used in the publications. The mapping analysis via VOSviewer was filtered with the condition of keywords appearing at least 3 times. *Figure 6* provides an overview of the top 15 keywords used. The keyword “accessibility” was found to be the most used keyword with an occurrence value of 19. “Accessible Games” keyword is the second most appeared keyword with a frequency of 16. The 3rd, 4th and 5th place are “Video Games” (7 appearances), “Games” (6 appearances) and “Serious Games” (5 appearances) respectively. The bibliometric mapping of keywords in *Figure 7* gives the visualisation of this analysis.

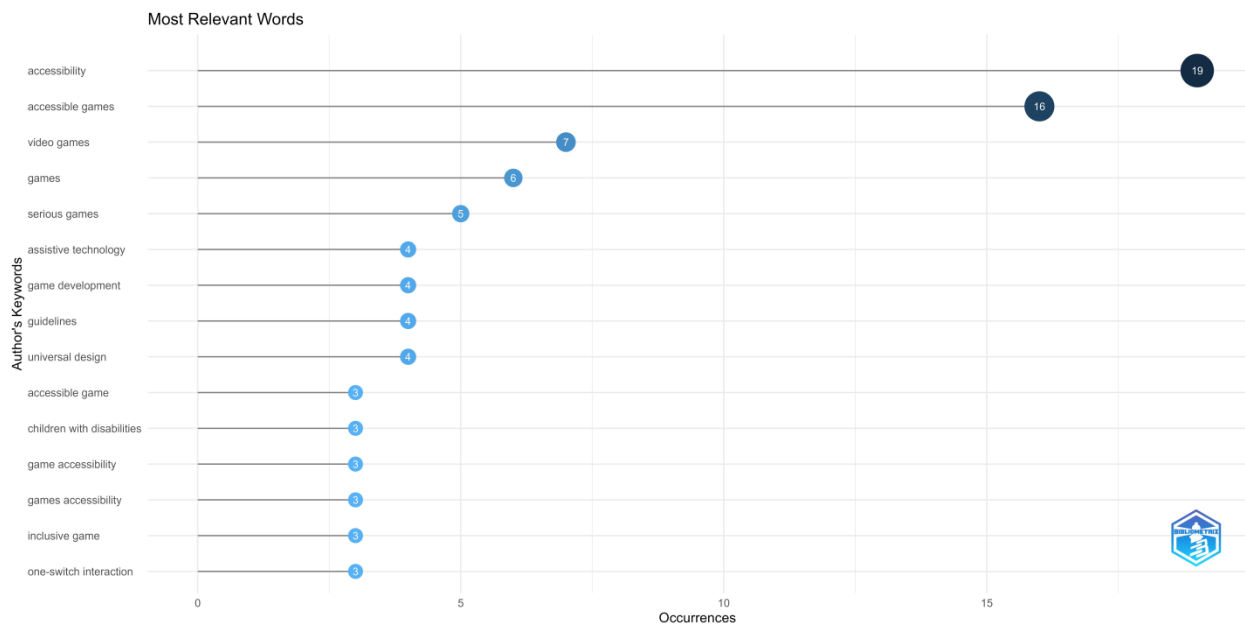


Figure 6 - Keyword Analysis, Source: Authors

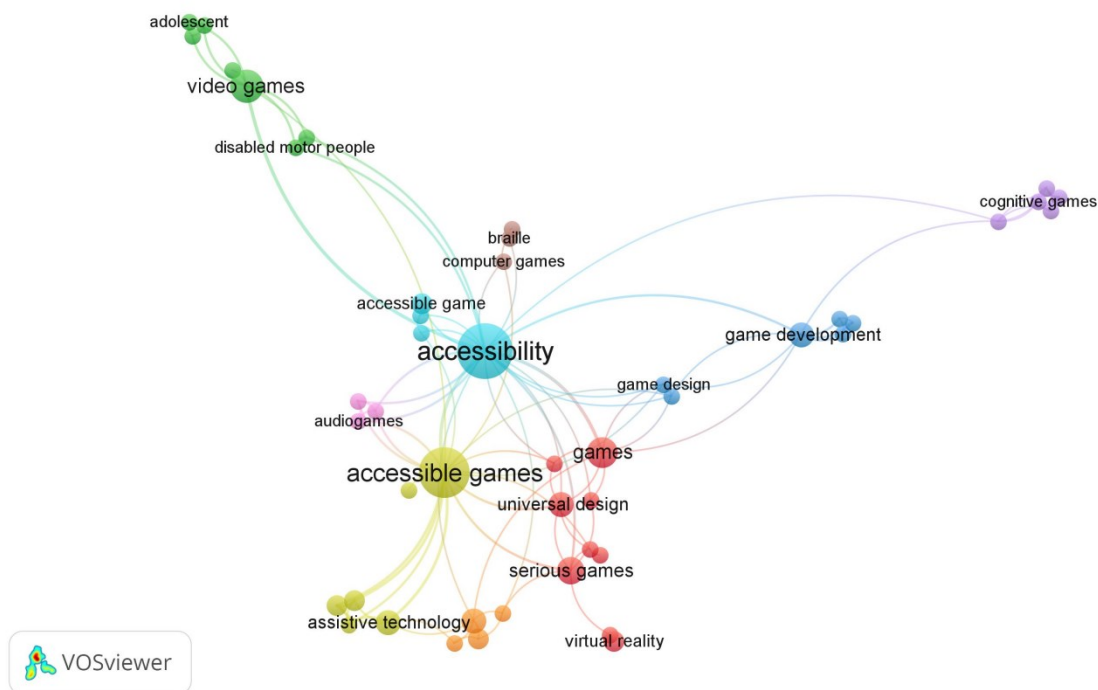


Figure 7 - Bibliometric Map of Keywords, Source: Authors

5. Title and Abstract Analysis by Years

The title and abstract analysis was performed via Bibliometric tool of R! Programming Language. For both analysis, the top 5 themes were selected and illustrated in *Figure 8* and *Figure 9* respectively. Regarding the title analysis, top 5 themes are “Games”, “Accessible”, “Game”,

“Accessibility” and “Impaired”. From the time trend analysis, it can be interpreted that the themes “games” and “accessible” are the most preferred themes in the titles and shows an increasing trend year by year.

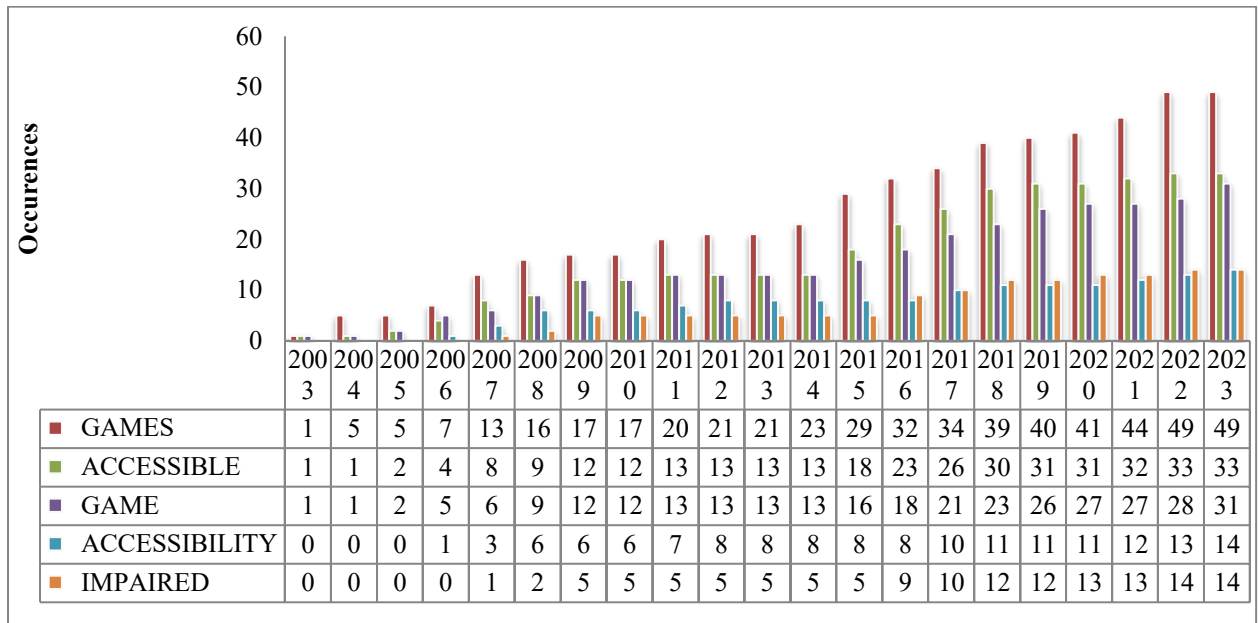


Figure 8 - Time Trend of Titles, Source: Authors

Regarding abstract analysis, the top 5 themes are followed as “Games”, “Game”, “Accessible”, “People” and “Accessibility”. The themes related with games are more popular in abstracts and shows an increasing trend year by year whereas the themes relating to accessibility are less popular but also shows an inclined trend.

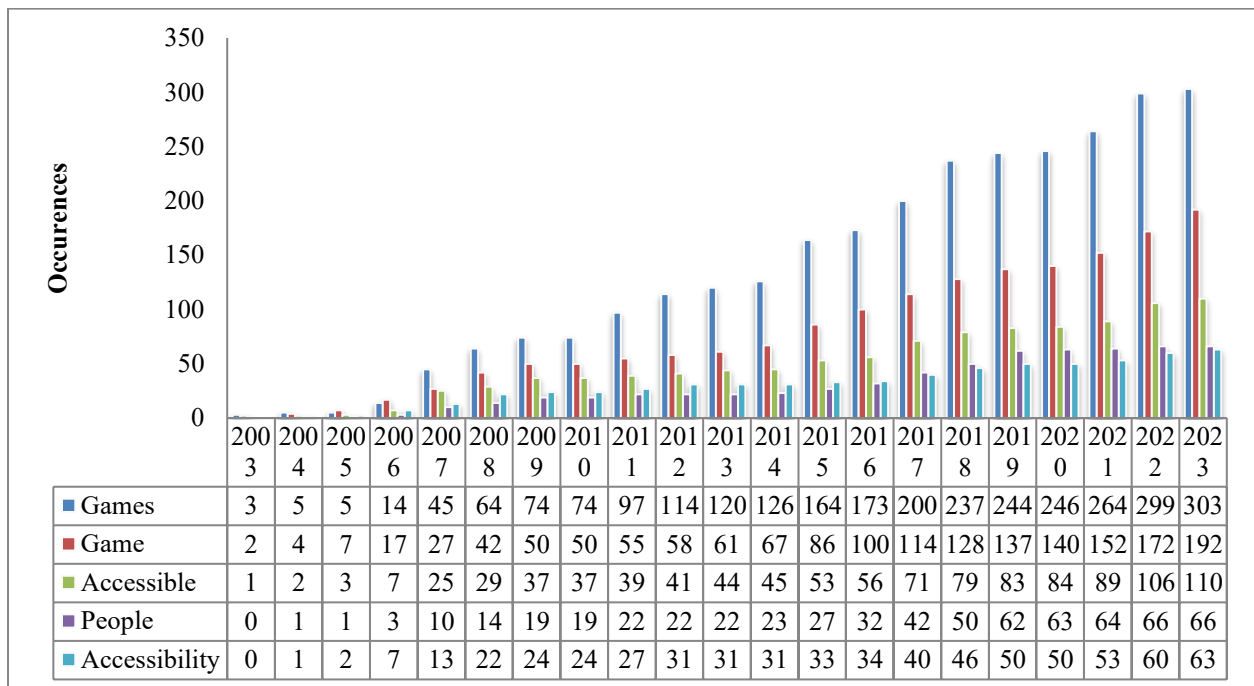


Figure 9 - Time Trend of Abstracts, Source: Authors

4. Conclusion

Accessibility is the crucial right of reaching out education for all. It is a part of reaching out the requirements of equality in relation to sustainable development goals. Higher education instructions need to turn attention on promoting more research on equality and education platforms for all. Therefore having research on accessible games is the one of the example to open academic debate for both sustainable development goals and equality standards to increase the rate of publication and concern about equal opportunities in education for all. Game based learning the adventure of new learning methods and opportunities for the children that shows how new approaches need to be considered in both learning and research. Although new approach as game based learning is popular to approach in the education system for all level of the education, considering accessibility is very crucial to practice inclusive education patterns and equality for all.

Therefore, this study sheds a light to underline how equality as part of sustainable development goals are need to be practiced in all levels of education and how research cross nations need to increase collaboration to produce more research on equity, inclusiveness and accessibility for all. In lifelong learning policy and universities without walls policy, the best practices can be compared and diffused in worldwide.

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