Postmodern Openings
ISSN: 2068-0236 | e-ISSN: 2069-9387
Covered in: Web of Science (WOS); EBSCO; ERIH+; Google Scholar; Index Copernicus; Ideas RePeC; Econpapers; Socionet; CEEOL; Ulrich ProQuest; Cabell, Journalseek; Scipio; Philpapers; SHERPA/RoMEO repositories; KVK; WorldCat; CrossRef; CrossCheck

2022, Volume 13, Issue 3, pages: 01-12| https://doi.org/10.18662/po/13.3/472
Submitted: April 21st, 2022 | *Accepted for publication:* May 25th, 2022

A Content Analysis of Studies on Assistive Technology in Education

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Abstract: Technology advancement provide more effective and efficient ways for the people to perform individual and or collective roles and execution of responsibilities, and this has also resulted to tenacious upsurge in peoples' dependence on technology. As the right for people with disabilities increases, the need to cater for their educational right like every other learner brought about the quest to provide for AT that can best serve those special students. Application of AT can help students with one or more deficiencies, aid information collection process and increase learning motivation. The aim of this study is to conduct content analysis of studies on AT in education and the research sample consist of research publications on AT in education published on Scopus between 2018-2022. Content analysis was conducted on the research publications related to the research and the data gotten were evaluated through descriptive statistical methods (i.e. percentage and frequency) with the intention that research findings will add to the body of literature and create more quest for research interest on AT in education. The findings indicated that, more studies were conducted in the year 2021 compared to others, qualitative research method was applied more in those studies, followed by quantitative and mixed methods, the larger percentage of the studies under review were conducted under special education, and the greater part of co-authorship were local collaboration.

Keywords: *Assistive Technology; Special Education; Education; Adaptive Technology; Rehabilitative Technology.*

How to cite: Bicen, H., & Adedoyin, O.B. (2022). A Content Analysis of Studies on Assistive Technology in Education. *Postmodern Openings, 13*(3), 01-12. https://doi.org/10.18662/po/13.3/472

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1. Introduction

Technology according to Siemens & Tittenberger (2009, p. 5) "has become more prominent in most aspects of society". The technological evolution in society, work-based and schoolwork behavior has always been a contemporary issue in all spheres of academic field with no exception to education sector and educational technology in particular. Technology advancement provide more effective and efficient ways for the people to perform individual and or collective roles and execution of responsibilities, and this has also resulted to tenacious upsurge in peoples' dependence on technology. This advancement is responsible for the ever-expanding modifications in the world we live in today in which the field of education is a subset. The modifications of educational system in many societies has been attached to the current technological advancement (Gönen et al., 2006). In the same vein, Dwyer (1996) also added that the use of technology in instructional activities stimulates "mastery of basic skills, test scores, writing, and engagement in school".

According to Early Childhood Technical Assistance Center, the Technology Related Assistance Act of 1988 popularly referred to as Tech Act gave the earliest definition of Assistive technology (AT) device as any piece, part of tool, or product system, either picked up through commercially means, reformed, or repackaged for the use of uplifting, sustaining, or developing the functional competences of children with one or more forms of disability (Bouck, 2016). Lersilp (2016a) also defined AT in a study as provision of assistance for students in helping them to learn and this assistance may include an individualized aide, underlined school notes, and materials like utensils, hardware, software, etc. This researcher added that AT when supported with educational services can assist in maximization of potentials and abilities of people with disabilities to attain individualized accomplishments. Assistive technology systems can be regarded as the construction and usage of structured knowledge, techniques, processes, and plans that are important to the provision, application, and evaluation of assistive technology products (Khasnabis et al., 2015), and it covers teaching on the application AT and additional technologies that enhance the efficiency of AT (Desmond et al., 2018).

According to World Health Organization, disability is an all-encompassing terminology that covers deficiencies, motion limits, and involvement constraints. Every learner with non-exclusion of those with disabilities caused by movement limitations, visual deficiencies, imperfect verbal exposition, or severe cognitive interruptions possessed the legitimate

right for universal curriculum admittance (Pugach & Warger, 2001) and as the promotion of human rights and equality are on the forefront for people with disabilities, there are upsurge in the chances for learners with disabilities to further their education in higher institution (Lersilp, 2016b).

In spite of the government legislative attention on AT, the application in practice for learners with disabilities does not constantly reflect nor is adequate study being carried out (Okolo & Diedrich, 2014). The comprehensive definition of technology products permits people to take part in and control of their social settings (Desmond et al., 2018), thus AT promotes these participation opportunities for everyone and can function as aids to promote and protect equal satisfaction of all fundamental human rights (Borg et al., 2011; Buckingham, 2011).

Lindeblad et al., (2017) study reveals contemporary attestation to the effectiveness of AT, the implication of the study shows that AT as applications on smartphones and tablets might help students with reading deficiencies, and it can assist the information collection process and as well improve learning motivation. Absence or limited existing content analysis on studies published on AT and education created a research vacuum that needed to be filled and this present study will provide the significant trends and advancement in the field of AT and education.

The major target of this study is to explore the current state of research on the studies published on AT and education, with prime emphasis on the research trends, nature of collaboration between authors, research methods and domains. In order to accomplish the above target, this study compiled the existing body of literature on AT and education with the following basic research questions:

1.1. The purpose of the study

1. What is the distribution of studies on the use of AT in education with respect to years of publication?
2. What is the distribution of articles on use of AT in education with respect to number of authors?
3. What is the distribution of studies on use of AT in education with respect to types of co-authorship?
4. What is the distribution of studies on the use of AT in education with respect to research methods used in articles containing use of AT in education?
5. What is the distribution of studies on the use of AT in education with respect to research domain where articles on the use of AT in education are conducted?

2. Research Method

This study basically assessed articles on Using AT in Education through content analysis. Haggarty (1996) define content analysis as a research method that permits collection of qualitative data that will be thoroughly and dependably analyzed in order to generalize with respect to the classes of interest of researcher. In addition, Berelson (1952) also referred to content analysis as organized evaluation of the noticeable content of communication through impartial and quantitative techniques. Researchers are permitted with relative simplicity to filter through huge volumes of data with an organized approach in content analysis (Stemler, 2000).

2.1. Research Sample

The sample of this study consists of published academic articles on Assistive Technology and Education on Scopus between 2018-2022. The adoption of Scopus database as the source of data for this study is reliant on supports from existing studies such as Kawuki, Yu, and Musa (2020), and Akintunde et al. (2021) that has buttressed the extensive coverage of the database.

2.2. Data Analysis

Data analysis is regarded as an essential and energetic procedure for recognizing and knitting together of the evolving subjects, fundamental concepts or components of connotation and material gotten from academic writings. Thus, data gotten from this study were analyzed through descriptive analysis techniques using percentage and frequency. The percentages of the data depending on the frequencies were computed to meet the answer of each research question with tabular expositions.

2.3. Scanning Conditions

In the process of determining the articles to the used in this content analysis research, the researchers adopted some screening and selection conditions to be met by each article in order to qualify as source of data. After meeting those conditions, the researcher searched on the basis of the keywords “assistive technology", "adaptive technology", "rehabilitative technology" and "pedagogy", "teaching", "education" in the database of “Scopus”, that covers articles published for the past five years, starting from 2018-20222. As a result of the selection benchmarks, articles outside the theme of education, book chapters, conference proceedings were excluded from the scope of the study.

Table 1 - Database and search string employed for data retrieval

Database	Search String
Scopus	TITLE-ABS-KEY ((("assistive technology" OR "adaptive technology" OR "rehabilitative technology") AND ("pedagogy" OR "teaching" OR "education"))) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018)) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j"))

Source: Authors' own conception

Data gathering was carried out on 18th of April, 2022 using the above search string, returning 385 document results. After the screening and selection process, 221 articles related to assistive technology were assessed appropriate for the determined conditions and these studies were assessed with respect to "publication years, number of authors, research methods, research domain and types of co-authorship".

3. Research Findings

In this section, the results of the content analysis were presented in tabular format in accordance with the research questions.

3.1. Distribution of studies on use of AT in education with respect to years of publication.

The distribution of studies on use of AT in education with respect to years of publication were examined with Table 1 below that shows the years of publication, frequency and percentage.

Table 2 Distribution of studies on use of AT in education with respect to years of publication

Years	No. of Articles	%
2022	18	8.1
2021	75	33.9
2020	41	18.6
2019	42	19.0

2018	45	20.4
Total	**221**	**100**

Source: Authors' own conception

From Table 2, 18 articles covering 8.1% were published in the year 2022, 75 articles covering 33.9% were published in 2021, and 41 artcles amounting to 18.6% were published in 2020 on the use of AT in education. In the 2019, 42 articles claiming 18.6% were published, while 2018 recorded 45 publications covering 20.4%.

3.2. Distribution of studies on AT in education with respect to number of authors.

The distribution of studies on use of AT in education with respect to number of authors were examined with Table 2 below that shows the number of authors, frequency and percentage.

Table 3 Distribution of studies on use of AT in education with respect to number of authors

Number of Authors	No. of Articles	%
1	37	16.7
2	57	25.8
3	44	19.9
4	31	14.0
5	23	10.4
6	8	3.6
7	6	2.7
8	7	3.2
9	2	0.9
10	1	0.5
12	2	0.9
14	1	0.5
15	1	0.5
17	1	0.5
Total	**221**	**100**

Source: Authors' own conception

From Table 3, 37 articles covering 16.7% were published by single authors on the use of AT in education, 57 articles covering 25.8% were co-

authored by double authors, 44 articles claiming 19.9% were co-authored by 3 separate authors and 31 articles covering 14% were co-authored by 4 separate authors. 23 articles with 10.4% were co-authored by 5 separate authors while 10 authors, 14 authors, 15 authors and 17 authors claming 0.5% each co-authored one article rescpectively.

3.3. Distribution of studies on AT in education with respect to type of Co-authorship

The distribution of studies on AT in education with respect to types of co-authorship were examined with Table 3 below that shows the types of co-authorship, frequency and percentage.

Table 4 Distribution of studies on AT in education with respect to type of co-authorship

Type of Co-Authorship	No. of Articles	%
Local Co-authorship	152	83
International Co-authorship	32	17
Total	**184**	**100**

Source: Authors' own conception

From Table 4, 157 articles covering 83% were co-authored locally while 32 articles amounting to 17% were co-authored internationally to sum up the total number of co-authored studies on AT in education to 184 studies.

3.4. Research methods used in articles containing use of AT in education

The research methods used in articles containing use of AT in education were examined with Table 3 below that shows the types of research, frequency and percentage.

Table 5 Research Methods used in articles containing use of AT in education

Research Methods	No. of Articles	%
Mixed Method	28	12.7
Quantitative Method	76	34.4
Qualitative Method	117	52.9
Total	**221**	**100**

Source: Authors' own conception

From Table 5, 28 articles covering 12.7% adopted mixed research method on AT in education and 76 articles covering 34.4% applied quantitative research method while 117 articles claiming 52.9% used qualitative research method.

3.5. Research Domains where studies on AT in education were conducted

The research domains where articles on AT in education are conducted were examined with Table 5 below that shows the research domains, frequency and percentage.

Table 6 Research Domains where studies on AT in education were conducted

Research Domains	No. of Articles	%
Computer Aided System	1	0.5
Digital Game-Based Learning	1	0.5
Early Childhood Education	2	0.9
Education Management System	1	0.5
Engineering Education	2	0.9
Higher Education	22	10.0
Language Education	3	1.4
Medical Education	9	4.1
Occupational Therapy Education	1	0.5
Open Education	1	0.5
Primary Education	5	2.3
Problem Based Learning	1	0.5
Secondary Education	1	0.5
Social Care Education	1	0.5
Special Education	165	74.7
Sports Science Education	2	0.9
Technical Education	1	0.5
Universal Design Learning	2	0.9
Total	**221**	**100**

Source: Authors' own conception

From Table 6, the major part of the studies were carried in the academic field of Special Education with 165 articles covering 74.7%, followed by Higher Education with 22 articles covering 10%, Medical Education with 9 articles covering 4.1%, Primary Education with 5 articles covering 2.3%, and Language Education with 3 articles covering 1.4% while Early Childhood Education, Sports Science Education and Engineering

Education, Universal Design Learning recorded 2 articles each with 0.9% respectively. The remaining research domains such as Technical Education, Open Education and others recorded an article each with 0.5% respectively.

4. Discussion

According to the result on the number of publications for the years under review (2018-2022), it has been confirmed that the highest number of publications was done in 2021 with 33.9%, followed by 2018 with 20.4%, 2019 with 19%, 2020 with 18.6% and 2022 with 8.1%. The results also indicated that there was a steady decline in academic research interest on AT in education prior to 2021 where there was upsurge in the research interest. The upsurge in 2021 can be linked to the massive reliance of education on technology due to the Covid-19 pandemic and this claim has been confirmed by Adedoyin and Soykan (2020), where the researchers gave research innovations as one of the opportunities emergency remote learning during Covid-19 pandemic. This result is also in tandem with Floyd, Smith Canter, Jeffs & Judge (2008) study that shows that there is recurrent theme that claimed little or limited study on AT in the past. A critical look at the number of publications with respect to the number of authors, show that the collaborative effort of researchers is more compared single researchers because 16.7% of all publications were handled by single researchers while the remaining 83.3% belong to the collaborative work of two or more researchers. These high rate collaborative research works otherwise known as co-authorship can also be linked to some factors such as economic, intra–scientific, mobility and ever-changing means of communication as identified by Glänzel & Schubert (2004).

The result shows that 52.9% of the studies applied qualitative research method, 34.4% used quantitative while the remaining 12.7% adopted mixed research method. This result is quite understandable when we take cognizance of the environment and subjects (i.e. AT and mostly special students) under examination. Since qualitative research strive to know about a phenomenon by targeting the complete picture and depth instead of splitting it to variables or numerical dissection of data (Ary et al., 2010), it becomes very suitable and or choice of research method with highest rate of application on AT in education.

The larger percentage of all the studies under examination were conducted in the field of Special Education, since AT is originally meant for people with one form of disability or more (Bouck, 2016; Lersilp 2016a). This study is limited to education theme, the data used is limited to just five years (i.e. 2018-2022), gotten from a single database (i.e. Scopus). Further

studies can consider data sourcing from other databases and as well cover more number of years.

5. Conclusion

The steady degeneration of research interest noticed in this study prior to 2021 will serve as a wake-up call for scholars to refocus their research attention on the subject matter for the purpose of exploring additional potentials of AT in education. It is important to commend the collaborative work between authors of studies on AT in education, since the number of co-authorship is far greater when compared with single authorship. However, the number for local collaboration between authors is a lot higher when compared with collaboration that cut across international borders. Thus, collaborative work between authors should focus more on international collaboration in order to take into account the cultural dimensions and also engage in comparative analysis. Application of mixed research method is on the lower side, it should be noted that one of the major reasons for combining qualitative and quantitative method is to effectively strike out the limitations of the two research methods and also have stronger confirmations. Since this study is limited to the field of education, the bulk of research concentration on Special Education is understandable. However, there is need to direct research focus on other fields in education in order to have an all-inclusive exploration on AT in education.

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