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Progress and Trends in Oral Health Educational Interventions in Children's - A Bibliometric Analysis

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Abstract

Oral health education interventions have been developed and implemented in many countries to improve the oral health status of the children .This study was aimed to evaluate the impact/influence of scientific publications , researchers and institutions conducting research and to identify the content, trends, context of interventions use in children's oral and dental health. After finalising the research question, the Scopus, pubmed, cinnhal database was used to search systematically for related keywords from 1997 to 2022. VOS viewer software was applied to illustrate the topics and trends of interventions involved in children's oral and dental health. Apps, games, Videos, Audio visual modelling, stories, visual pedagogy, intervention for specially abled, oral health eaducational interventions were the index keywords used for the search engines. The study also identified a gap in the published literature in applying newer intervention techniques, such as the Ipad and gamification, in oral and dental health research and practice. There is a growing tendency to use digital technologies in children's oral and dental health in recent years. Although the types and categorisations of the intervention are typically diverse during the timeframe and by the area of dental services and oral health, identifying and categorizing these technologies based on oral health services and other interventions could familiarise oral health policymakers with the application of the technology and help them design technology-based interventions to improve children's oral health.

Keywords: Poor Dental Health, Dental Hygiene, Oral Health Education, Dynamic

Introduction

Dental health is vital to a child's overall wellbeing since it affects their capacity to eat, communicate, sleep, and develop. In addition to harming life quality, poor dental health is associated with major health problems like heart disease and malnutrition. Children's oral health issues are becoming a serious public health concern, which emphasises the need for focused education and interventions.[1] With childhood behaviours carrying over into adulthood, preventative and hygiene-focused education programs have become crucial for establishing healthy habits in kids. Given the rising prevalence of gum disease and cavities in children globally, these issues must be addressed.[2]

The World Health Organisation (WHO) has created international initiatives to enhance children's oral health because it understands how important it is. These approaches emphasise education-based awareness-building, oral health integration into primary care, and community-based prevention. Since many oral disorders, such as dental caries, can be prevented with proper cleanliness and a balanced diet, preventive steps are essential.[4] In this endeavour, educational interventions play a pivotal role by providing children with the necessary knowledge and abilities to practise good dental hygiene.[5] These initiatives provide supportive environments that greatly lower children's risk of oral diseases by including parents, teachers, and healthcare professionals.[6]

The usefulness of various educational programs to enhance children's dental health has drawn more attention in recent decades. These interventions include both contemporary techniques like digital storytelling and smartphone apps, as well as more conventional techniques like role plays and classroom instruction.[7] Education about oral health has been changed by technology, becoming more dynamic and interesting.[8] Traditional and technology-based approaches to educational interventions can be broadly classified, each having pros and cons of their own.[13] The target audience, the resources at hand, and the cultural environment are few examples of the variables that influence the approach choice.[14] Because technology is engaging and can keep children interested, using it in oral health education through online platforms, smartphone apps, and games has become more and more common in recent years.[15] Research indicates that young people who use these strategies are more likely to remember the material and take up good habits.[17] However, underprivileged groups continue to have inadequate access to dental health education, which raises the frequency of oral disorders. These groups include children from low-income households and those living in rural areas.[19] Creating treatments that are both accessible and customised for these populations is imperative.[20]

Bibliometric analysis, a scientific method that uses quantitative techniques to analyze published research, has become an increasingly popular tool for evaluating the progress and trends in oral health educational interventions.[9] It has aided scholars in locating seminal works, and significant writers, and developing patterns within a certain discipline. This method has been very helpful in comprehending how oral health education has changed over time and how it affects children's oral health outcomes.[10]

The purpose of this study was to investigate the developments and patterns in children's oral health education programs. The study aimed to determine important research areas, the most popular teaching

strategies, and the nations and organisations that have made contributions to this subject by examining published literature.[11] The purpose of all this information was to assist researchers and regulators in creating more successful initiatives to enhance the oral health of young people. Assessing co-authorship patterns, keyword co-occurrence, and citation trends about advancements in oral health education programs for children globally are the objectives of this bibliometric analysis.

Methodology

This study had utilized a comprehensive bibliometric analysis to assess the progress and trends in oral health educational interventions among children. Bibliometric analysis, a quantitative research method, had systematically reviewed and evaluated academic literature, allowing researchers to map the intellectual structure of a particular research area, assess the influence of individual works, and explore relationships within a specific field. This method had been chosen due to its ability to handle large datasets and provide in-depth insights into the research landscape over time. By employing advanced bibliometric tools, such as VOS viewer, this study had aimed to capture the breadth of research on oral health education for children, analyse its evolution, and highlight influential contributions. The following sections outlined the detailed methodology employed in this study, from formulating the research question to interpreting the final results.

1. Formulation of the Research Question

The research question guiding this bibliometric analysis had been: “What are the progress and trends in oral health educational interventions among children?” This question had been crafted to explore the evolution, scope, and impact of scientific research in the area of oral health education for children. It had focused on identifying key research developments, prominent contributors, influential publications, and overall trends in the field. The clear articulation of this question had provided a structured framework for the entire analysis, ensuring alignment across all stages, from literature collection to data analysis.

The specificity of the research question had been designed to capture various aspects of oral health education interventions, such as traditional methods (e.g., classroom-based teaching and role plays) and modern, technology-driven approaches (e.g., digital games and mobile applications). The research had aimed to investigate the effectiveness of these interventions, the geographic distribution of research efforts, and the collaboration networks within the scientific community. By addressing these components, the study had aimed to provide a comprehensive overview of the trends and progress in the field of oral health education for children. The studies were included from all around the world and as the keywords were used for children all those studies including children in it were used for the analysis.

2. Development of the Search Strategy

A rigorous and structured search strategy had been developed to capture the full scope of literature relevant to oral health educational interventions in children. This search strategy had been crafted using a systematic approach, identifying key constructs that had served as the basis for the literature search. These constructs had been divided into three main categories: Population, Intervention, and Outcome.

- Population Keywords: Broad search terms such as "child," "children," "kids," and "minors" had been employed to ensure the inclusion of all studies focusing on paediatric populations.
- Intervention Keywords: Keywords such as "digital stories," "educational games," "mobile applications," "chalk and talk methods," and "role-play" had been

used to capture a wide range of intervention-related terms.

- Outcome Keywords: Keywords such as "oral health," "dental health," "oral hygiene," and "dental hygiene" had been employed to focus the search on studies measuring oral health outcomes.

The search string had combined these constructs using Boolean operators (AND, OR) to ensure the retrieval of all relevant literature. The search had been tailored for each database to account for their specific indexing systems, search functionalities, and terminologies.

The final search strategy had been:

TITLE-ABS-KEY (child) OR TITLE-ABS-KEY (kids) OR TITLE-ABS-KEY (children) OR TITLE-ABS-KEY (minors) AND TITLE-ABS-KEY (story AND telling) OR TITLE-ABS-KEY (stories) OR TITLE-ABS-KEY (digital AND stories) OR TITLE-ABS-KEY (games AND in AND educations) OR TITLE-ABS-KEY (games AND based AND learning) OR TITLE-ABS-KEY (educational AND games) OR TITLE-ABS-KEY (digtal AND games) OR TITLE-ABS-KEY (motivational AND interviewing) OR TITLE-ABS-KEY (oral AND health AND talk) OR TITLE-ABS-KEY (audio) OR TITLE-ABS-KEY (video) OR TITLE-ABS-KEY (audio AND video) OR TITLE-ABS-KEY (chalk AND talk) AND TITLE-ABS-KEY (powerpoint) OR TITLE-ABS-KEY (presentation) OR TITLE-ABS-KEY (demonstration) OR TITLE-ABS-KEY (tv) OR TITLE-ABS-KEY (ipad) OR TITLE-ABS-KEY (cards) OR TITLE-ABS-KEY (flash AND cards) OR TITLE-ABS-KEY (flipcharts) OR TITLE-ABS-KEY (models) OR TITLE-ABS-KEY (roleplay) OR TITLE-ABS-KEY (skits) OR TITLE-ABS-KEY (drama) OR TITLE-ABS-KEY (webinar) OR TITLE-ABS-KEY (distant) OR TITLE-ABS-KEY (distant AND learning) OR TITLE-ABS-KEY (media) OR TITLE-ABS-KEY (mobile) OR TITLE-ABS-KEY (mobile AND apps) OR TITLE-ABS-KEY (mobile AND application) AND TITLE-ABS-KEY (oral AND health) OR TITLE-ABS-KEY (dental AND health) OR TITLE-ABS-KEY (oral AND hygiene) OR TITLE-ABS-KEY (dental AND hygiene))Additional filters had been applied, such as restricting the search to English-language articles published after 1967, to ensure a consistent temporal framework.

3. Validation and Sensitivity Analysis

To ensure the accuracy and reliability of the bibliometric findings, a sensitivity analysis had been conducted. This had involved re-running the analyses using variations in the search parameters, such as adjusting the publication year range or including additional keywords. The results of this bibliometric analysis had been cross-validated by comparing the findings with existing bibliometric studies in related fields, such as dental public health and education. This step had confirmed the validity of the trends identified in the literature.

4. Selection of Databases and Search Execution

Three major scientific databases had been selected for this bibliometric analysis: PubMed, Scopus, and Dimensions. These databases had been chosen for their extensive coverage of interdisciplinary and health-related research.

- PubMed: Chosen for its comprehensive biomedical and dental research focus.
- Scopus: Selected for its broad multidisciplinary coverage and inclusion of both scientific articles and conference proceedings.
- Dimensions: Included to capture a wider array of research outputs beyond traditional journal articles.

Searches had been conducted in each of these databases using the tailored search strategy, with the search limited to articles published in English, from 1967 to the present.

5. Data Extraction and Processing

Once the searches had been completed, the identified articles had been subjected to a rigorous screening process.

- Title and Abstract Screening: Titles and abstracts had been reviewed for relevance.
- Full-Text Review: A detailed full-text review had been conducted to assess each study's relevance and quality.

The data extracted by entering the search strategy keywords in the search section by using appropriate boolean operators, then the data of the articles was extracted by creating a CSV file , the selected articles had been organized into CSV files, forming the basis for the bibliometric analysis.

6. Data Analysis Using VOS viewer

The bibliometric analysis had been conducted using VOS viewer, a tool for constructing and visualizing bibliometric networks.

- Keyword Co-occurrence Analysis: Identified major themes and research topics.
- Authorship and Collaboration Networks: Revealed key contributors and collaboration networks.
- Citation Analysis: Traced the development of research areas and identified influential studies.

VOS viewer had generated several visualization maps, including keyword, authorship, and citation maps.

7. Interpretation of Findings

The interpretation of the results had focused on the following key aspects:

- Trends in Research Topics: Noting the transition from traditional to modern, technology-driven interventions.
- Geographical Contributions: Uncovered regional trends and disparities in research output.
- Influential Authors and Studies: Identified key contributors and foundational works.
- Gaps in the Literature: Highlighted areas for future research, especially in underserved populations.

Results

Co-authorship analysis

Co-authorship analysis examines the interactions among scholars in a research field. Since co-authorship is a formal way of intellectual collaboration among scholars it is therefore important to understand how scholars interact amongst themselves (including associated author attributes such as affiliated institutions and countries). With the increasing methodological and theoretical complexity in research, collaborations among scholars have become a commonplace.

1. Authors

When the co authorship analysis was done keeping the unit of analysis as authors and setting the threshold of minimum 2 number of documents of an author it was found that 1081 authors were present however only 5 met the threshold level. The total link strength was established between 12 authors where in it was found that for 1 document there were authors which obtained a citation of 135. However, it was observed that there was no link strength between these authors (figure.1)

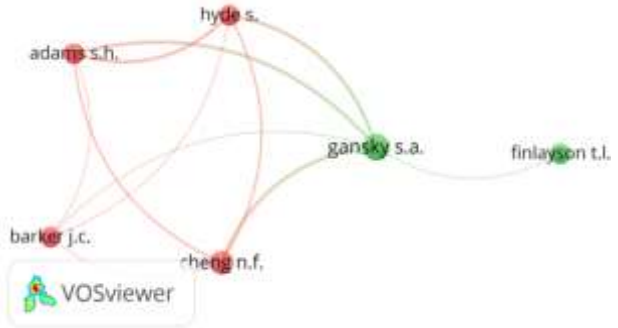

Figure 1: Co Authorship Analysis for Authors

2. Organization

When co authorship analysis was done keeping unit of analysis as organization it was observed that out of 693 organization 24 meeting the threshold of minimum of 2 documents and minimum of 2 citation per document it was found that there were 25 universities that were meeting the threshold limit. It was observed that deakin university had a maximum of 2 Documents having 71 citations (Figures 2)

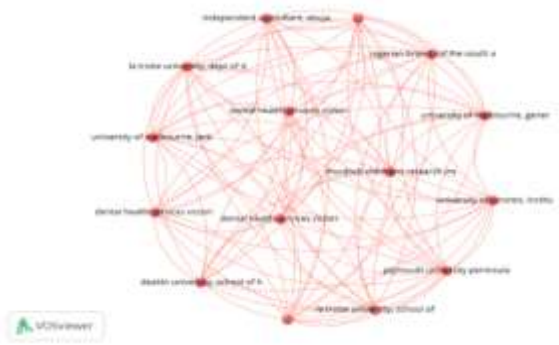

Figure 2: Co Authorship Analysis for Organization (Visualization)

3. Countries

The co authorship analysis done for the countries revealed that of the 125 countries only 84 met the threshold of minimum of 2 documents per country and minimum of 2 citation per country.

The largest connected data set consisted of 51 countries, of these 50 countries studied it was found that the highest Documents and Citation was observed for USA with 77 documents and 1784 citations respectively of these only 16 presented largest linked item. The overlay visualization portrays that the largest publication and citation is obtained by US followed by UK followed by Australia, India etc. While these countries have 11,6 respectively higher number of publication period of 2017- 2020 countries like India UK have been publishing in recent time period. (Figure.3)

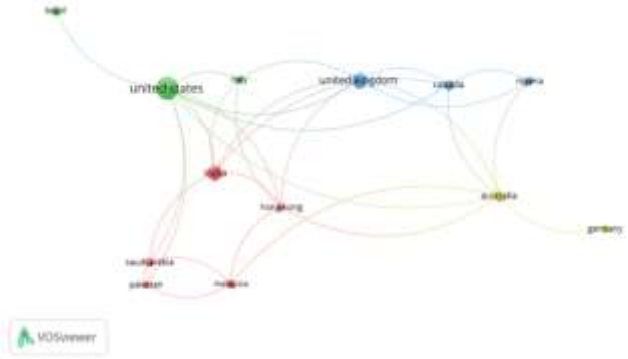

Figure 3: Co Authorship Analysis for Country

Co- Occurrence

The co-word analysis is a technique that examines the actual content of the publication itself. The words in a co-word analysis are often derived from "author keywords", and in its absence, notable words can also be extracted from "article titles," "abstracts," and "full texts" for the analysis. Similar to co-citation analysis, the co-word analysis assumes that words that frequently appear together have a thematic relationship with one another.

Author Key Words

Keeping the minimum threshold of 2 key words it was found that there were 2717 key words of which 857 met the threshold limit of which however there were more than 60 truncated words which were repeated after appropriate removal it was found that the final set consisted of 857 items having link strength between them. The overlay visualization depicted that the highest occurring key words were, mouth hygiene health education, health promotion video recording however it

was found that in recent era a much interest in developed in motivational interviewing and interpersonal communication a new concept generation acting on primary health care is established, (Figure 4.)

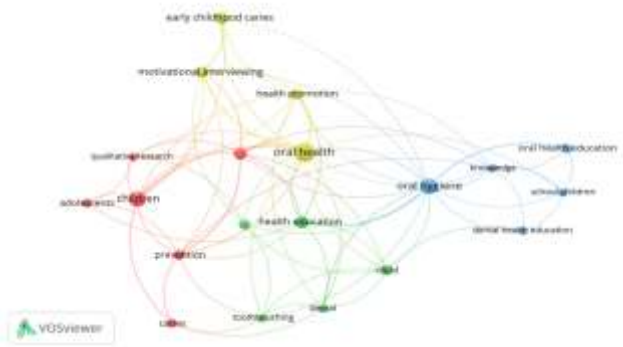

Figure 4: Co Occurrence of Author Keywords with Citations and Total Link Strength (Overlay Visualization)

Citation Analysis

Citation analysis is a basic technique for science mapping that operates on the assumption that citations reflect intellectual linkages between publications that are form when one publication cites the other in this analysis, the impact of a publication is determined by the number of citations that it receives. The analysis enables the most influential publications in a research field to be ascertained. Though there are a variety of methods (e.g., network metrics) to determine the importance of publications in a research field, the most objective and straightforward measure of its impact is its citation.

1. Documents

Of the 1942 Documents studied it was found that only 1407 met the threshold of having minimum of 2 citation The highest citation was obtained by Author Ludlow JB, Davis Ludlow, Brooks and Howerton WB (2006) wherein the document received the highest citation of 590. However, there were no links present between these documents.

2. Sources

The citation analysis for Source unit revealed that for a minimum of 2 documents and 2 citation per source out of 109 sources 93 met the threshold, The analysis revealed that BMC Oral Health had obtained the highest citation for 339 published documents followed by Dento maxillofacial radiology journal which had received 2904 citations for 119 documents published however it was also observed that there were no link strength present between them it was found that BMC Oral health has obtained these higher citation post 2020.(Figure.5)

Figure 5: Overlay Visualization of Analysis of Citation for Sources

3. Authors

There were 1081 Authors of which only 14 met the threshold of having 2 documents with 2 citation it was elaborated that desilva a.m. al had highest citation of 52 however there was again no link strength between authors(Figure 6.)

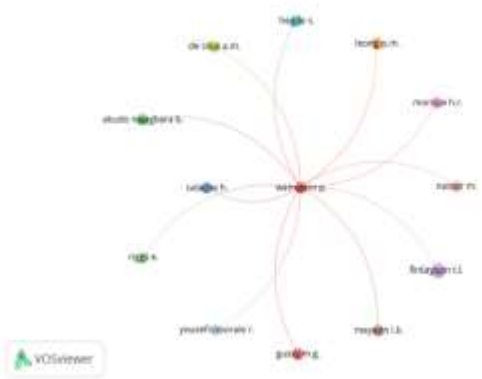

Figure 6: Overlay Visualization of Citation for Authors

4. Countries

Citation analysis for countries portrayed that of the 51 countries 15 met the threshold of having citations. The trend depicted that USA had the most citation of 1794 followed by Austria 707 whereas India was observed to be having citation of 395 for 29 documents published. It was observed that in recent time it was UAE, Egypt, Qutar, Nepal publishing more literature. (figure.7)

Figure 7: Overlay Visualization of Citation for Countries

Discussion

This bibliometric analysis has provided an in-depth view of the progress and trends in oral health educational interventions for children. Oral health is not merely a local health concern but a global public health priority that plays a crucial role in overall health and well-being, particularly in children. As research shows, poor oral health can affect various aspects of a child's life, including eating habits, speech development, sleep patterns, and overall growth and development[12]. Furthermore, oral health problems in childhood, such as dental caries, have been linked to systemic conditions such as malnutrition, cardiovascular diseases, and respiratory issues[13]. Therefore, understanding and addressing the growing prevalence of oral diseases among children through targeted educational interventions is essential[14].

The evolution of oral health education has seen a marked transition from traditional educational interventions to more modern, technology-based approaches. Traditional methods, including chalk-and-talk, role plays, flashcards, and flipcharts, have long been utilized to deliver oral health education to children[15]. These methods are effective in settings where resources may be limited, and they provide a basic framework for children to understand essential oral hygiene practices[16]. However, these traditional approaches face limitations in terms of scalability, interactivity, and engagement, especially with younger audiences.

The rise of technology-based interventions has opened new avenues for improving oral health education, making it more interactive and accessible[17]. Digital games, mobile applications, and educational videos have gained prominence due to their ability to engage children in an enjoyable and informative way. Studies have shown that children retain oral health knowledge better when taught through interactive and engaging methods such as digital storytelling and online platforms[18]. These digital approaches allow children to learn at their own pace and have made it easier for educators to scale interventions, reaching larger audiences across different regions[19]. Furthermore, the integration of oral health education into digital platforms supports personalized learning experiences, which have been shown to improve retention and behavior change in children[20].

The role of the World Health Organization (WHO) in promoting oral health educational interventions for children is a key factor in the global efforts to address oral health issues. WHO's strategies emphasize community-based preventive programs and the integration of oral health into primary care systems, which are vital to addressing the root causes of oral diseases and improving access to care[21]. Educational interventions are essential for instilling healthy habits early in life, as the behaviors children develop are likely to continue into adulthood[22].

Despite these advancements, there remain significant challenges in the field of oral health education. One

major issue is the unequal access to oral health education in underserved populations. Children from low-income families and rural areas are often more susceptible to oral diseases due to a lack of education and access to healthcare services[23]. Addressing these inequalities requires the development of tailored interventions that can overcome barriers related to geographic location, socioeconomic status, and access to digital technology[24]. Targeted interventions that are culturally and contextually relevant must be developed to bridge this gap.

Another critical challenge is ensuring the sustainability of educational interventions over time. Short-term interventions, while effective in improving oral health knowledge and behavior in the immediate term, may not result in long-term behavioral change without continuous reinforcement[25]. Longitudinal studies are needed to assess whether improvements in children's oral health behaviors, initiated through educational interventions, are maintained throughout childhood and into adulthood[26]. Policymakers and educators must consider strategies for the ongoing support and reinforcement of these behaviors through long-term follow-up and the inclusion of oral health in broader health curricula in schools and communities[27].

Moreover, this bibliometric analysis has revealed gaps in the current literature on oral health educational interventions. While considerable progress has been made, the existing body of research has limited data on interventions that target marginalized and underrepresented populations, such as children in low-resource settings or those with disabilities[28]. Future research must explore innovative and inclusive educational methods that consider the diverse needs of these populations and ensure that interventions are accessible, equitable, and sustainable over the long term[29].

Overall, the findings from this bibliometric analysis provide valuable insights into the effectiveness of different educational methods, the key contributors to oral health education research, and the challenges that must be addressed to improve children's oral health globally. By identifying these gaps, the study highlights the need for more research in underserved areas and calls for the development of comprehensive, long-term strategies that integrate oral health education into broader public health initiatives[30].

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