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Intellectual landscape of scholarly work on 21st century skills: A bibliometric and science mapping analysis

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Abstract: A quick search on Google Scholar for the exact phrase '21st century skills' resulted in three thousand plus results. More than two-third of these are dated within the last decade, indicating growing attention to the topic in the academia. The purpose of the current study is to investigate existing literature on 21st century skills by employing techniques of bibliometric and science mapping analysis to provide a helicopter view of scholarly work on 21st century skills. The search was conducted on SCOPUS database during 2021 using the keyword '21st century skills' which produced 1644 results. Further refinements were made using publication year, document type and language reducing the sample size to 1281 documents. Data were analysed employing various bibliometric indicators such as number of publications, contributing authors, institutions and countries, citation, co-citation, and keywords. The results indicated an exponential growth in the number scholarly publication on the topic since 2010. Similarly, a positive trend in average citations was also observed in recent years. USA was the biggest contributor to the number of publications, followed by Indonesia, and Malaysia respectively. With respect to author collaboration, Nussbaum, M. was found the highest collaborator, followed by Griffin P., and Sharples M. while among the institutions, University of Melbourne was at the top. Analysis of the keywords revealed that, specific 21st century skills, learning tools and processes, technological advancement, and education and training are amongst the most common research themes. Findings of the current study provide insights into future research trends on the topic of 21st century skills.

Keywords: *21st century skills, Bibliometric analysis, Intellectual landscape, Learning opportunity, Science mapping.*

1. Introduction

The concept of 21st century skills has garnered increasing attention in light of global economic and technological transformations that have resulted in changes in labour market demands (Dede, 2010; Fadel et al., 2015). According to Trilling and Fadel (n.d.), the abilities that are included in this category are critical thinking, problem-solving, collaboration, and creativity. The incorporation of these competencies into the educational curricula is indicative of the acknowledgement at the national level (National Research Council, 2012). Proficiency in such competencies is deemed essential for individuals to flourish in the contemporary intricate and swiftly evolving society. As a result, a significant corpus of literature has surfaced, delving into the academic discourse on the proficiencies required for success in the 21st century.

The overall purpose of this study is to perform a bibliometric and science mapping analysis on the scholarly literature pertaining to 21st century skills. Specifically, it aims to identify the primary contributors, journals, and themes within this field. To this end, we engaged bibliometric analysis which is a statistical approach that is employed to investigate the publication and citation patterns of scholarly

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articles (Leydesdorff & Rafols, 2009). Moreover, utilisation of science mapping analysis allows researchers to effectively recognise knowledge domains and their interconnections, thereby facilitating the identification of research trends, collaborations, and knowledge gaps (van Eck & Waltman, 2010). Through the integration of these two approaches, the present investigation endeavours to furnish a holistic comprehension of the corpus of scholarship pertaining to 21st century skills, as well as to pinpoint potential lacunae and prospects for future research endeavours.

In line with the overall purpose of the study, the study is guided by the following research questions.

1. What is the current trend in publication and citation on the topic of 21st century skills?
2. What is the geographical distribution of publications on the topic of 21st century skills?
3. What are the patterns of collaboration that exist between authors and institutions towards publications on the topic of 21st century skills?
4. What are the major themes that have been explored on the topic of 21st century skills?
5. What are the trendy topics identified timely evolution of keywords associated with publication on the topic of 21st century skills?

2. Twenty-First Century Skills Frameworks: A Critical Examination

The advent of the knowledge-based economy and constant worldwide changes led to the immergence of 21st century skills and their respective frameworks of reference (Binkley et al., 2011; Dede, 2010; Romero et al., 2015a). Throughout literature, one can identify various definitions and classifications of 21st century skills with multiple perspectives. For instance, Lotta and Miller (2011) articulated that the core skills of the 21st century include strong communication and collaboration skills, technological expertise, innovative and creative thinking skills, and problem-solving techniques. On the other hand, Binkley et al. (2011) consider 21st century skills as ways of thinking, working, and living in connected, media-rich worlds. With an ICT-focused perspective, Dede (2010) defined the concept with a list of newly required abilities including "information problem solving" or "the ability to rapidly filter huge amounts of incoming data; extracting information valuable for decision making;" and "the ability to separate signal from noise in a potentially overwhelming flood of incoming data" (p. 5). Descriptions of 21st century skills, therefore, stipulate the notion that, a consensual shared definition of the concept is lacking in literature. Yet, we believe that the essence of all the descriptions highlight what students can do with knowledge, and how they apply what they learn in authentic contexts, just as Lotta and Miller (2011) proclaimed.

The framework of 21st century skills was initially developed in a workshop held by the National Research Council (2008), with the aim of preparing students for future workplaces (Jang, 2016). Following this initial commencement, several other frameworks that explain 21st century skills were developed by different education or employment related institutions. These frameworks were based on educational needs analysis and categorization of skills (Romero et al., 2015a), while majority of the frameworks were consistent with a central focus on metacognitive abilities such as innovative thinking, creative problem solving, communication, and collaboration.

In another research, Voogt and Roblin (2012) identified the most well-known eight frameworks for 21st century competences, and developed a meta-analysis of the frameworks found in 32 documents. The authors presented an exhaustive list of skills found in the reviewed frameworks by categorizing them according to their shared presence in the frameworks. As stated by the authors, the most frequent skills in the selected frameworks were communication, collaboration, ICT literacy, and social and/or cultural skills. On the contrary, risk taking, managing and solving conflicts, and sense of initiative and entrepreneurship were mentioned less in these frameworks.

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Table 1.
Summary of 21st century skills.

Name of the framework	Year	Major skills areas
EnGauge 21st century skills	(2003)	Digital age literacy, inventive thinking, effective communication, and high productivity
OECD (DeSeCo)	(2005)	Using tools interactively, interacting in heterogeneous groups, and acting autonomously
European parliament and council	(2006)	Communication in the mother tongue as well as in foreign languages, mathematical competence, basic competences in science and technology, digital competence, study skills, social and civic competences, sense of initiative and entrepreneurship, cultural awareness and expression
The P21 framework for 21st century learning	(2007)	Learning and motivation skills, information, media and technology skills, and life and career skills
ATC21S	(2012)	Ways of thinking, tools for working, ways of working, and ways of living in the world
UNESCO (LMTF)	(2013)	Physical well-being, social and emotional skills, culture and the arts, literacy and communication, learning approaches and cognition, numeracy and mathematics, and science and technology

As seen from the above literature, frameworks related to the conceptualisation of 21st century skills illustrate commonalities and differences that are worth to be acknowledged as the skills vary in their numbers and characteristics. Besides the metacognitive abilities, concepts related to integration of technology are found to have a central focus in most of the frameworks as it highlights the need to handle technology in the digital age (Laar et al., 2017).

van Laar and his colleagues (2017) conducted a review on determinants of 21st-century skills, and provided a comprehensive overview of empirical studies measuring 21st century skill determinants. As reported in the review, current literature base shows the highest number of research focusing on critical thinking followed with creativity and problem solving. Of the 83 papers reviewed, the least number of research were conducted on skills of technical and information. It was also testified that most of the studies were empirical surveys followed with performance tests and experiments as research methods.

Researchers have highlighted an increasing need to identify the gap on studies related to 21st century skills (Geisinger, 2016; van Laar et al., 2017a). Thus, it necessitates extensive explorations that would have a powerful impact on, not only the skills development of the students, but also for other researchers in the field (Chalkiadaki, 2018). Additionally, despite the body of research available on 21st century skills, few efforts have been made to obtain data concerning the global scientific output of 21st century skills (Voogt & Roblin, 2012). Therefore, we believe that it is crucial to investigate the corpus of literature to review and synthesize sources in databases in which the papers were published in the realm of 21st century skills.

3. Methods

In this bibliometric review, we adopted science mapping (see Hallinger, 2019; Hallinger and Nguyen, 2020; Punnakitikashem and Hallinger, 2020) to explore the corpus of knowledge on the topic of 21st century skills. In science mapping, researchers explore the knowledge base using graphical visualisations to display the connections among various bibliometric indicators within a given topic of exploration (Small, 1997; van Eck and Waltman, 2014).

Our aim of this study was concentrating on all the studies related to 21st century skills that are obtainable from Scopus database. Scopus was chosen because of its status for being the largest curated indexing database of peer-reviewed literature (Kushairi & Ahmi, 2021; Purkayastha et al., 2019).

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3.1. Searching and Retrieving Data

On July 06, 2021, we conducted the search on Scopus database to gather all the academic publications on 21st century skills published from 1997 to 2020. The search was conducted using the search terms ("21*" OR "21-st") AND "century skill*" in the title and abstract fields. In the "document type" field, our search was filtered for articles only at the final publication stage (including both document types of conference papers and reviews), and written and published in English up until the end of 2020. The initial filtering resulted in a total of 1438 entries. Bibliometric information of these papers were subsequently retrieved, including author name(s), author affiliation(s), subject category(ies), journal name(s), keyword(s), publication title(s), and publication year(s). Next, based on identification, screening, suitability, and inclusion criteria of PRISMA declaration - Preferred Reporting Items for Systematic reviews and Meta-Analyses (Moher et al., 2009), a total of 1281 paper were deliberated for this review. Figure 1 shows PRISMA representing the flow chart used in the selection process.

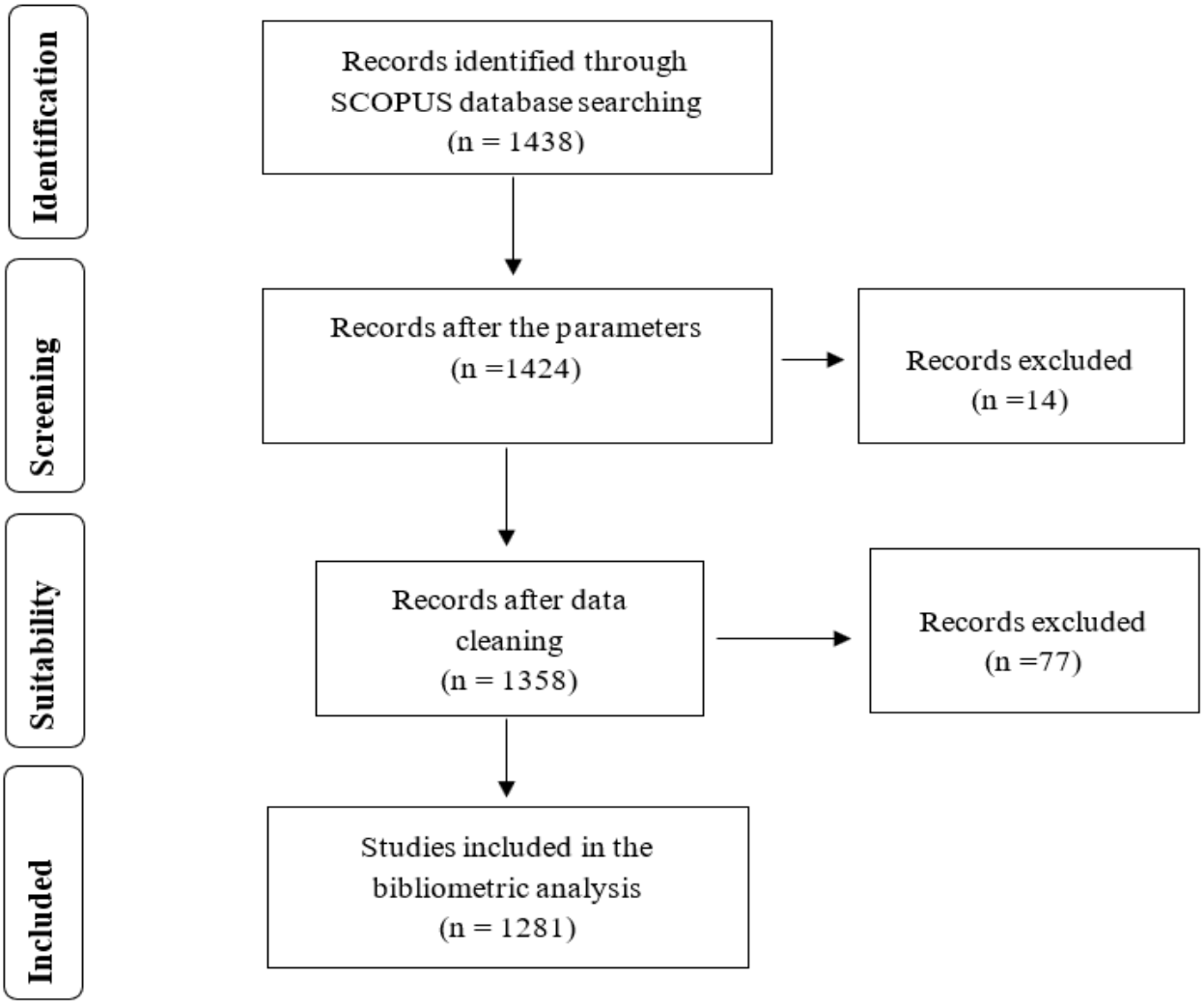

Figure 1.
PRISMA flow diagram showing the flow of the search in the identification and screening of sources for the bibliometric analysis of 21st century research.
Source: (PRISMA: Preferred reporting items for systematic reviews and meta-analyses).

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3.2. Data Analysis

The data file downloaded from Scopus database (n=1281) was exported into a comma-separated values (.csv) which was then cleaned and prepared for further analyses. Two main types of software were adopted to analyse the data and present findings. Knowledge mapping (network analysis) was performed using the software, VOSviewer (www.vosviewer.com), in which the networks depict relationships among network elements in terms of 'link strength' between indicators such as author keywords, countries, institutions, and authors. Such networks are helpful in mapping the scope and structure of the academic disciplines while discovering key research clusters (Donthu et al., 2021). Visualisation of these bibliometric networks reveal the strength of the relationship through the closeness of the nodes (Fabrikant, Montello and Mark, 2010). Additionally, the patterns of publications and citations were generated using Microsoft Excel in which charts and tables were employed to present findings.

4. Findings and Discussions

The findings of the current investigation follow the order of research objectives outlined at the beginning of this paper. Additionally, customary to many of the existing bibliometric papers, the discussions are presented along with the findings rather in a standalone section.

4.1. Trend In Publication and Citation

Corresponding to our first research objective, Figure 2 shows the chronological trend in publication and citation of scholarly work on 21st century skills. According to the results, regardless of the slight downfall in 2011, there has been an overall exponential growth in the scholarship on the topic since 2008. Starting with as less as five SCOPUS publications in 2008, the output has steadily and tremendously increased to 296 in 2020. This pattern of increase in the number of publications is reported in a number of previous bibliometric studies (see for example, (Bozkurt et al., 2021; Hallinger, 2019b). However, unlike some of the publication domains that showcase a long history of publications (see for example, Hallinger and Kovačević (2019), the topic of 21st century skills – as the name implies – is found to be a relatively new area in publication. In fact, the oldest paper that we can spot in our data was published in 1997 – even after which there was virtually no interest on the topic until around 2006.

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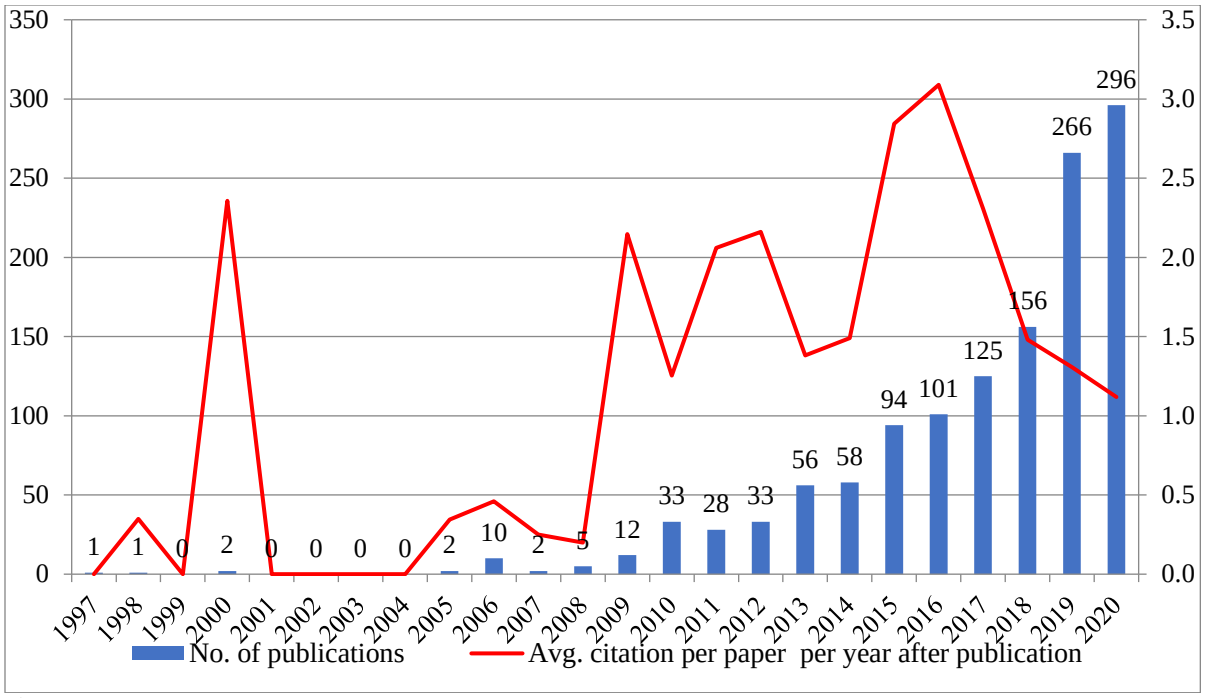

Figure 2.
Trend in publications and citations of scholarly productions on 21st century skills.

Apart from the number of publications, Figure 3 also illustrates the citation trend of publications on 21st century skills. Instead of pure citation count, the illustration is based on normalised citation count. The normalisation is done by dividing the total number of citations attracted by all the publications in a given year by the number of publications produce in the same year and then again dividing by the number of years after publication. In this way, the line graph in Figure 3 indicates that, overall, there has been a steady increased in citation since 2009, and it has been above 1 since then. This indicates that on average each publication is cited at least once in a given year. Our findings are in line with the majority of existing work that report an increase in average citation (see for example, Shareefa and Moosa, 2020). Furthermore, the fall in average citation since 2016, as shown in Figure 3, does not necessarily indicated lack of researchers' interest for publications in recent years. Rather, it is possibly because of the time required for any publication to reach a wider audience, and subsequently to attract more citations (Moosa & Shareefa, 2020).

Based on the above, we argue that 21st century skills is a topic that is relatively new in publication arena, which is gaining increasing attention from researchers. Three years that recorded the highest normalised citations are 2016, 2015 and 2009 respectively. The document that attracted the highest number of citations in 2016 (cited 298 times) is on the topic of game-based learning and 21st century skills by (Qian & Clark, 2016). Similarly, the highest cited articles in 2015 (cited 810 times) is on the use of flipped classroom in higher education (O'Flaherty & Phillips, 2015). Likewise, the most cited publications in 2009 (cited126 times) is titled '21st century skills: the challenges ahead' by (Rotherham & Willingham, 2009). Two of these highly cited articles are literature reviews. Owing to the currency of the topic, and referring to the constant increase in normalised citations, we postulate that this interest may continue to increase over the coming years.

4.2. Geographical Distribution of Publications

Our second research objective was to explore the global distribution of scholarly publications on 21st century skills. Results of the analysis, shown in Figure 3, depict that with 372 publications, USA is

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the biggest contributor in terms of the number of publications on the topic. This is followed by Indonesia (164 publications) and Malaysia (84 publications) respectively. Reflecting on these figures, one could argue that, despite many publications that depict a Westerns dominance (see for example, Punnakitikashem and Hallinger (2020b)), the topic of 21st century skills witnessed significant contributions from the East. Furthermore, it is also noted that the distribution of 86 contribution countries is widespread across the globe despite the relative less contribution from the continents of Africa and South America. Since 21st century skills is a fundamental element across numerous domains of human civilization, future empirical research on the topic from these least contributing regions are highly encouraged.

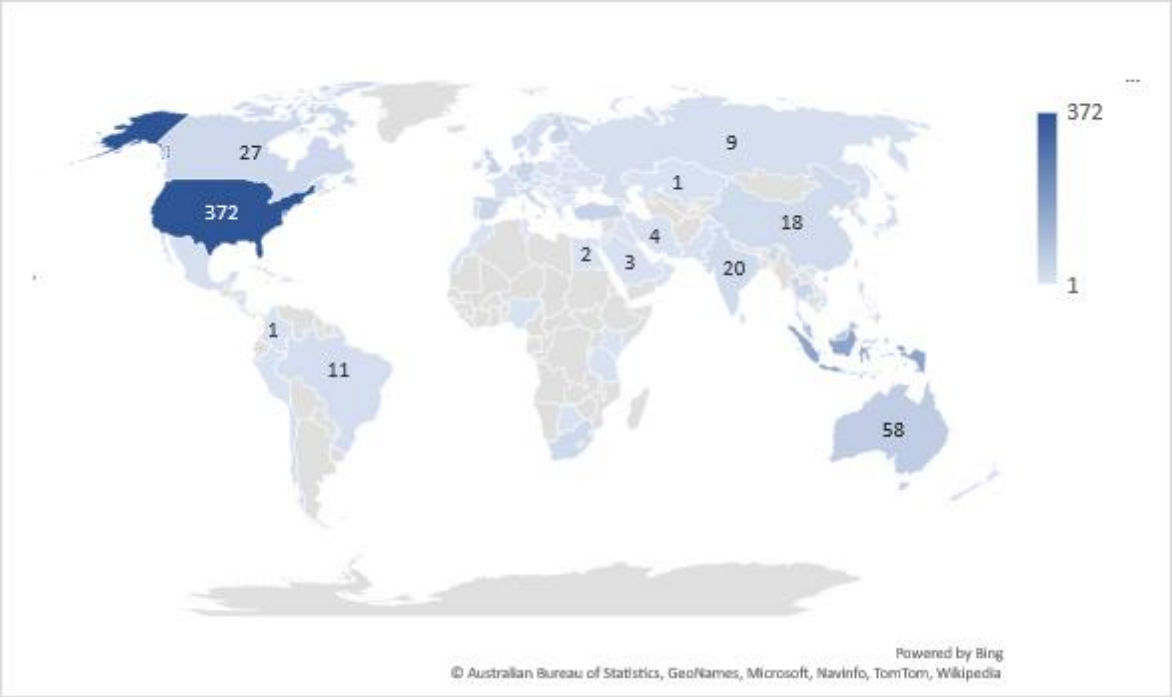

Figure 3.
Geographical distribution of scholarly productions on 21st century skills.

4.3. Collaboration Between Authors and Institutions

Our third research objective was to investigate collaboration between authors as well as between institutions that can be observed from the existing publications on 21st century skills. We generated co-authorship networks using VOSviewer in order to visualise the pattern of collaboration with respect to each of the unit of analysis. In this regard, Figure 4 portrays the existing collaboration network among authors that has contributed towards production of the publications in our bibliometric data file. Of the 376 unique authors that were involved in these publications, only 119 had some collaborations, and Figure 5 illustrates the network of relationships among these 119 authors. The larger circles depict more collaborations.

Subsequently, the results in Figure 5 indicate that Nussbaum M. is the is the greatest collaborator (link strength = 29), followed by Griffin P. (link strength = 22), and Awwal N. (link strength = 19). Apart from simply observing the pattern of collaboration, we also scanned through the number of publications by these authors just to see if there is a possible association between the number of collaborations and publications. The results revealed that Nussabaum M. contributed to only four publications whereas Griffin P. and Awwal N. contributed to five and seven publications respectively. Moreover, it was also noticed that, down the line, there was another author named Care E. with seven

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publications as well. A closer look at the figures reveals that the difference between the total and unique collaborations that Awwal N. and Care E. had is much bigger compared to those in the top of the list. Unlike some previous studies that demonstrated some kind of positive association between author collaboration and the number of publications (Zhang et al., 2019), the current demonstrated no such association. This indicates the significance of strengthening existing collaborations among authors to promote global and cross-cultural perspectives on the topic of 21st century skills.

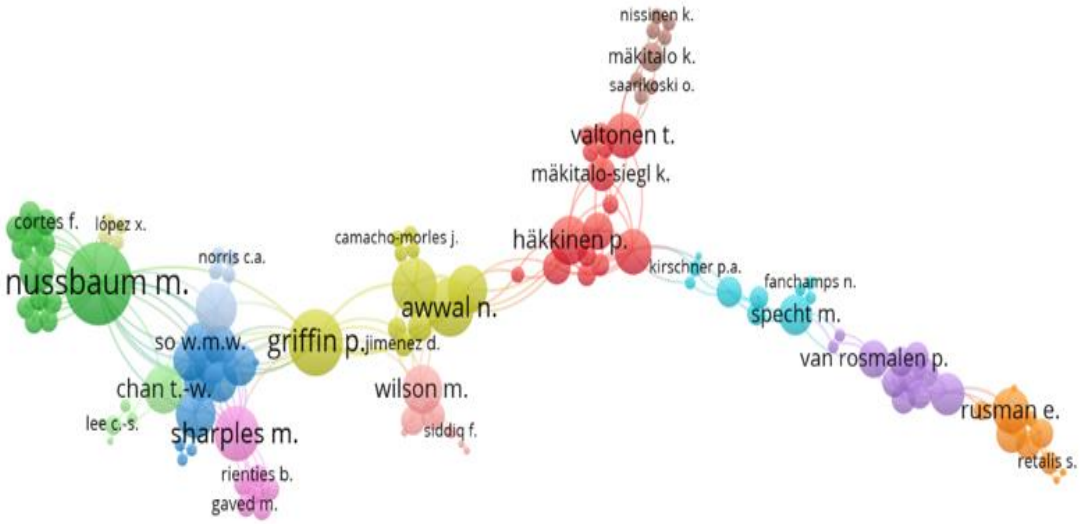

Figure 4.
Author collaboration network based on authors.

Comparing these findings with that of the preceding citation analysis, we observed that collaborations does not necessarily have a positive association with the impact in terms of citations. For instance, Nussbaum who is the greatest collaborator in our data, has attracted 124 citations for the author's most cited article on 'assessment of 21st century ICT skills in Chile: Test design and results from high school level students' (Claro et al., 2012). On the other hand, it is noticed that author has collaborated with numerous others in any given publication. In this respect, the authors second most cited article on 'E-learning in school education in the coming 10 years for developing 21st century skills: Critical research issues and policy implications' is produced in collaboration with 13 other authors (Kong et al., 2013).

Next, as part of our third research objective, we investigate the co-authorship network based on institutions, which is shown in Figure 6. The size of nodes in Figure 5 represents the total number of (unique) links as opposed to the total link strength. Accordingly, the results indicate that University of Melbourne (14 links, with 4 documents), followed by university of Michigan and the Open University of UK (12 links with 2 documents). In additions to this, several institutions from a handful of countries demonstrates significant collaboration among them, each having 11 collaborations (1 document). Unlike the case if author collaboration, findings from the institutional collaboration indicate a positive association between collaboration and the number of publication output. We went further deeper into exploring the publication outputs of these collaborations. In this regard, the most impactful work, based on the citation count, contributed the university if Melbourne is the topic of e-learning for developing 21st century skills (Kong et al., 2013) followed by 'Children's Creativity: A Theoretical Framework and Systematic Review' (Kupers et al., 2019). This in-depth exploration, nonetheless, was challenging as the same institute is enlisted either at different levels (for example with and without faculty names being

preceded) or with varying details (for example with and without street address). Hence, greater scrutiny is required in entering such data into the SCOPUS data bases.

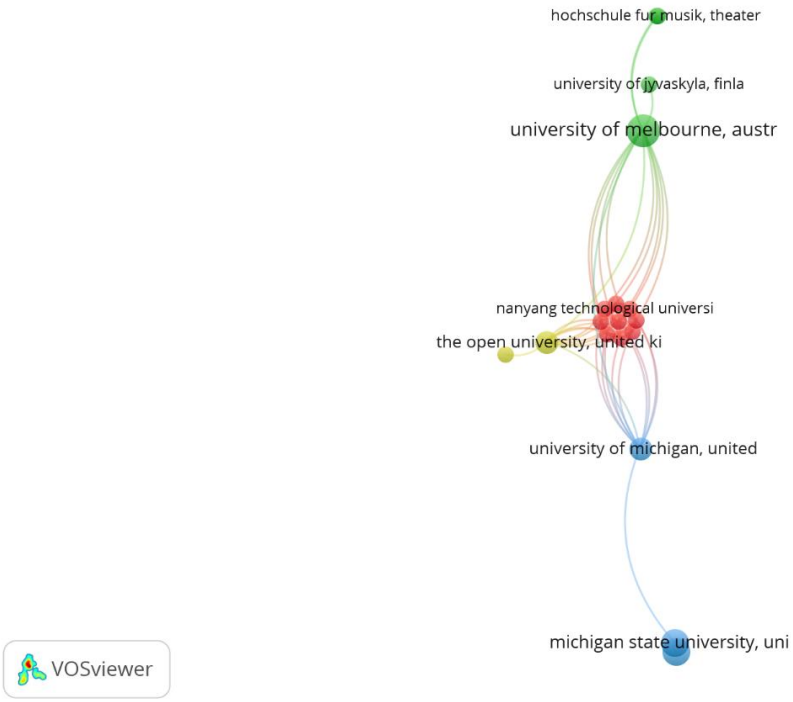

Figure 5.
Author collaboration network based on author.

4.4. Major Themes That Have Been Explored

In order to elicit the thematic knowledge embedded in the publications on 21st century skills, we generated a bibliometric network (shown in Figure 6) based on keyword co-occurrence of all keywords with a threshold of three repetitions. A keyword thesaurus was also applied in the analysis while '21st century skills' being the search terms was excluded. The results illustrate several clusters – for brevity, only the most significant three are discussed here. As depicted in Figure 6, with a frequency of 375, the highest occurring key work in cluster 1 (in red) is 'students'. This cluster is composed of 69 keywords indicating the diversity of concepts explored in relation students. These keywords were grouped into several categories, the most significant of which are those that revolves around (i) teaching strategies, (ii) core skills of communication, critical thinking, problem solving and reasoning, (iii) innovations and ICT, (iv) teaching & learning materials and some general aspects of education system, (v) academic discipline, and (vi) industry.

In the category of teaching strategies, some articles explored the topic of flipped classroom (Chis et al., 2018) while others studied cooperative as well as problem-based learning (Mellon et al., 2017). Likewise, while some articles dealt with collaboration and communication skills (Gkemisi et al., 2016), others were focused on problem-solving skills (Jamaludin & Hung, 2017). As for the category of innovation and ICT some authors presented top most technologies for 21st century skills (Tomei, 2013) when other diverted attention to developing ICT skills (Rampai, 2016). With regard to the category of teaching and learning material, Sugiyanto et al. (2021) explored development of teaching materials in Geogrpaphy while others looked at more broader aspects like designing the education system (Ringvold & Digranes, 2017). With respect to various discipline that were studies in relation to 21st century skills

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include science (Osman & Marimuthu, 2010), mathematics (Li et al., 2013), physics (Tuan Soh et al., 2010), computing (Gutierrez et al., 2018), and engineering (Hirsch et al., 2012). As for the final sub-category of keyword in cluster 1, researchers have focused on product design (Thumlert et al., 2018), vocational education and apprenticeship (Kotsifakos et al., 2020), and industrial revolution (Abdurrahman, 2019).

The most significant key word from cluster 2 (in green) which has a total of 68 keywords is teaching (appeared 174 times). Similar to cluster one, the keywords in this cluster are diverse, and can be classified into a number of different groups. The most significant of these are (i) ICT, technological innovations, mobile and smart technologies, (ii) learning theories and learning modalities, (iii) teacher education, training, and professional development, and (iv) social and psychological perspectives. As for the first categories of keywords, authors have delved into exploring virtual reality and gaming (McCreery et al., 2011), use of mobile in teaching and learning (O'Bannon & Thomas, 2014), and use of social media in education (Krutka & Carpenter, 2016). With respect to learning modalities, researchers have ventured into e-learning (Ghavifekr, 2017), mobile learning (Hernawati et al., 2020), and multi-modal learning (Starr et al., 2018). On the part of teacher education, topics such as teachers' perspectives of using smart technologies (Seifert, 2015) and teachers' digital literacy have been explored (Güneş & Bahçivan, 2018). With regard to the final category, scholars have studied language development (Black, 2009), social and emotional skills (Primi et al., 2016), and attitudes towards STEM (Srikoon & Khamput, 2021).

As for the third cluster (in dark blue), the most significant keyword is 'computational thinking' (with a frequency of 43). This keyword is unfortunately hidden behind the node for the keyword 'students' and can be viewed via the link given blew the map. Similar to the preceding clusters, cluster 3 also demonstrates a diversity of aspects which can be grouped into several categories. One of the significant sub-cluster of keywords in this theme is concerned with learning strategies and designs. Topics investigated in this stream include experiential learning (Hondzel & Hansen, 2015), inquiry-based learning (Abdurrahman et al., 2019), and constructivism. Another considerable sub-theme of keywords represents thinking and problem-solving skills where in researchers have explored into critical thinking (Jatmiko et al., 2018) and complex problem solving (Herde et al., 2016). Digital and smart technologies is the next substantial sub-group of keywords in which scholars have investigated on digital skills (van Laar et al., 2017b), augmented reality (Schrier, 2006), and computer programming (Thomas et al., 2011). The final important sub-them apparent in this cluster is student assessment and feedback. As indicated by the keywords, a clear focus is made in studying about assessment for learning (Rusman et al., 2014) and feedback (Nurdini et al., 2020).

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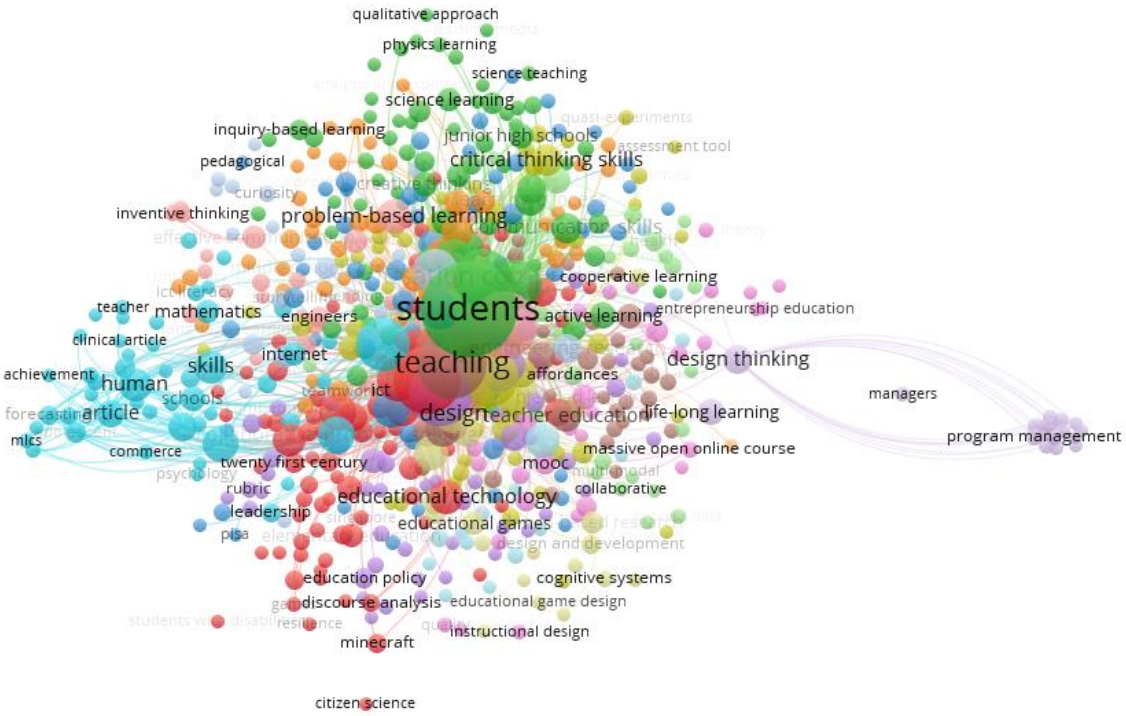

Figure 6.
Themes of knowledge on 21st century skills based on keywords.
Source: The interactive map can be viewed at the following link: https://app.vosviewer.com/?json=https://drive.google.com/uc?id=1Js5MbPOqZ16EzLNO7JQzvtztEIs4UV9T

4.5. Trending Research Areas On 21st Century Skills

In addition to conducting a thematic analysis of keyword as reported above, we also used VosViewer to visualise the chronological appearance of these keywords in the associated publications, the results of which is shown in Figure 7. In Figure 7, the layout of the map is the same as that of Figure 6 except for the colour - the concepts in yellow are the most recent whereas those in purple are the oldest. Accordingly, as illustrated in Figure 8, in the beginning (around 2015) the focus of research on 21st century skills was concentrated more humanistic aspects of teaching and education in general. However, the recent focus of the topic has been directed towards (i) critical, creative, and innovative thinking ((Nur et al., 2020), (ii) learning strategies that underpin constructivist philosophies (Anagün, 2018), (iii) programming, augmented reality and gaming (Romero et al., 2015b), and (iv) the scientific disciplines (Osman & Marimuthu, 2010; Rizki & Priatna, 2019; Tuan Soh et al., 2010).

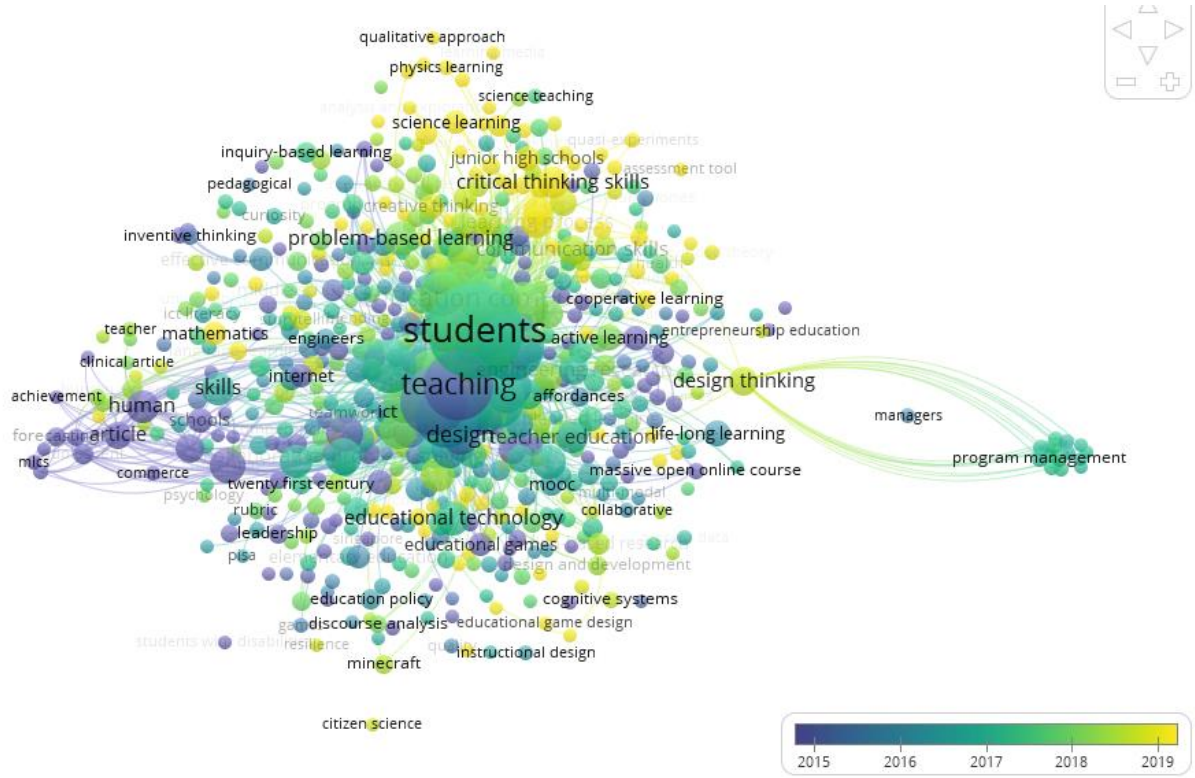

Figure 7.
Evolution of the concepts over time.

5. Conclusion and Recommendations

The current investigation explored the trends in publication, citation, geographical distribution, and collaboration among authors and institutions in the scholarly work on 21st century skills. The bibliometric study reveals that there has been a substantial growth in the number of publications on the topic since 2008, with an overall exponential growth trend. The citation trend also depicts an increasing trend, with an average of one citation per publication per year. USA is the biggest contributor to publications on the topic, followed by Indonesia and Malaysia. While the distribution of 86 countries is widespread across the globe, Africa and South America are relatively underrepresented. The study also indicates that collaboration among authors and institutions is limited, and there is significant scope for improving collaborative efforts.

The findings of this study have several implications for researchers and policymakers interested in 21st century skills. First, the substantial growth in the number of publications on the topic indicates a growing interest in the topic among researchers. Policymakers can use this information to develop policies that encourage further research on the topic. Second, the increasing citation trend suggests that the research in this field is gaining importance and is making a significant contribution to the body of knowledge. Researchers should take note of this trend while designing their studies to align their research interests with the current trends. Third, the geographic distribution of publications indicates that the topic is gaining attention worldwide, with significant contributions from the East. Policymakers and researchers should focus on developing collaborations with the underrepresented regions to ensure that the research is diverse and representative of the global population.

Fourth, the limited collaboration among authors and institutions highlights the need for fostering collaboration to promote high-quality research and avoid duplications of efforts. Policymakers and funding agencies can incentivise researchers to collaborate by providing grants or fellowships that are

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contingent on collaborative efforts. Researchers can also initiate collaboration by attending conferences and workshops, publishing joint papers, and exchanging resources. Last, the chronological evolution of keywords indicated that more emphasis should be placed on ways of fostering critical and creative thinking by using constructivist teaching philosophies. While researchers may deploy there investigations on this domain, educational practitioners may also exert emphasis on teaching philosophies associated with 21st century skills.

That being said, the current study limits our understanding of the subject to the methodology and data sources that were engaged. We relied on data from a single source, namely SCOPUS. While a number of previous bibliometric studies also engaged only SCOPUS data, we acknowledge that incorporating data from multiple sources such as Web of Science (WoS) and PubMed may either be slightly different or substantiate our findings. Furthermore, the bibliometric analysis that we have engaged, by its very nature, do not allow in-depth analysis of the content of scholarly work. In order to gain such insights, it is necessary to extend the study into systematic literature reviews that could synthesise essential concepts that are incorporated in the scholarship on 21st century skills. By working together, researchers and policymakers can ensure that the research on 21st century skills is comprehensive, diverse, and representative of the global population, and contributes to the body of knowledge on the topic.

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