education sciences

MDPI

Article

Digital Education and Artistic-Visual Learning in Flexible University Environments: Research Analysis

Mariana-Daniela González-Zamar [1,*], Emilio Abad-Segura [2,*], Antonio Luque de la Rosa [1] and Eloy López-Meneses [3,4]

1 Department of Education, University of Almeria, 04120 Almeria, Spain; aluque@ual.es
2 Department of Economics and Business, University of Almeria, 04120 Almeria, Spain
3 Department of Education and Social Psychology, Pablo de Olavide University, 41013 Seville, Spain; elopmen@upo.es
4 Research Institute in Social Sciences and Education, University of Atacama, 1530000 Copiapó, Chile
* Correspondence: mgz857@ual.es (M.-D.G.-Z.); eas297@ual.es (E.A.-S.)

Received: 12 September 2020; Accepted: 20 October 2020; Published: 22 October 2020

Abstract: The constant development of digital technologies has allowed living in a digital environment based on connections, also transforming the context of the educational process. Experiences show that digital technologies have influenced the way of learning and, consequently, the way of teaching. Learning in the digital age is a complex process since it is a multifaceted and diverse action. The aim of this research is to identify global trends in digital education and its link with the learning of artistic and visual education in higher education settings, during the period 2000–2019. For this, bibliometric techniques have been applied to 1291 documents, obtaining results from the scientific activity of the main authors, research institutions, and countries that promote this topic. The data show increasing relevance, particularly in the last three years. The main subject area is the social sciences. The study has detected the lines of research that are related to the Internet, education, visuals, computer programs, learning, digital media literacy, and educational technology. This work contributes to the academic, scientific, and institutional debate to enhance decision-making based on existing information.

Keywords: digital education; art; visual; learning; university; scientific research

1. Introduction

In recent years, the eruption of digital technology (DT) and the Internet have caused relevant changes in our society, shaping what we could define as a new cultural paradigm. Immersed in a Digital Age (DA), that is, a technological society where habits and lifestyles have been transformed by the constant and unstoppable development of DT and the Internet [1,2], modifying individual behaviors and organizational and productive models. Technological tools and virtual space have given rise to new forms of communication, work, information, entertainment, and, in general, participation and living in a networked society [3,4]. In this context, education, as a process based on knowledge, communication, and social interactions, has been influenced by the expansion of the digital revolution causing, in most cases, changes and transformations in its actors, teachers, and students, and adaptations in the educational institutions themselves.

The adaptation of both the contents and the teaching methodologies has become necessary, and indispensable, in a constantly changing social context, where young people, in general, are born surrounded by screens and digital stimuli and in this way, acquire differentiating characteristics in relation to previous generations [5,6].

Therefore, considering this context, actions are urgently needed to promote the development of skills for the access and use of digital tools and products, as well as the inclusion of languages and forms of artistic and visual expression, be it still or moving images, in ways that allow the student to interpret and rework the information they receive, process, and use.

Information and communication technologies (ICTs) have given rise to new literacies that will enhance the skills and competencies of professionals in the 21st century. One of them is creativity, which, developed in young competent students and digital experts, will allow them to respond to the social demand for new professional profiles, that is, creative, leading, and socially responsible citizens. For all this, it is necessary to develop communication skills based on digital social media.

However, this technological transformation is not predetermined only by technology, nor is it only or primarily an instrumental matter. Technological transformation accompanies and, to a certain extent, causes other processes of changes of a cultural, social, and organizational nature, among others. This is the new challenge that educational institutions must face and, especially, those located in the final stages of the training process, such as the university [7–9]. Reality shows that DT has influenced the way of learning and, consequently, the way of teaching typical of the teaching community.

Take as a reference the theory of connectivism: it refers to the concept of learning typical of a society based on a network of networks [10,11]. Connectivism is the theory of learning representative of the DA, which analyzes the way in which we learn in a digital society that is articulated in a network. It is based on connectivity, that is, on the creation of connections. Thereby, connectivism is the incorporation of principles explored by theories of chaos, networks, complexity, and self-organization. For this, connectivism is presented as another learning theory, which emphasizes the social role and cultural context in the learning experience. It may or may not be an individual activity, and offer various additional modes of learning, all driven by the presence of ICT and by a continuous process of building networks [12–14].

Connections and the way information flows result in knowledge, existing beyond the individual. Learning transforms into the ability to identify significant flows of information and to follow these flows. Consequently, decision making is itself a learning process. The choice of what to learn and the meaning of incoming information is seen as a changing reality. It is important to bear in mind that knowledge must be configured in a suitable environment that enables connected knowledge: spaces that allow people to converse, deliberate, organize meetings, share ideas, and dialogue that are informal, unstructured, flexible, rich in communication tools, constant over time, safe for trust and comfort, simple, decentralized, and connected, and in which there is a high tolerance for experimentation and error [15,16]. All of this requires higher education institutions (HEIs) to make their educational procedures and administrative structures more flexible, to adapt to more flexible study modalities and environments.

In this digital context, visual artistic learning is of interest in the integral formation of the student. The creative act is the result of the interaction of three components: knowledge, creative thinking capacity, and motivation for the task. To these ingredients must be added technical capacity and aesthetics, which require the development of one's own artistic activity. If artistic activities are developed within the educational process, whatever their scope, their field of influence and the contribution of meanings can be even greater [9,17]. In this way, creative skills can (i) become a tool that favors the transmission of other learning, (ii) allow meaningful experimentation with diverse cultural forms, (iii) facilitate the symbolic creation of individual identity signs, or (iv) produce the creative materialization of group feelings within a joint learning process.

At present, artistic-visual learning is setting a trend with impacts in studies and proposals applied to the field of education, and in the development of creative thinking skills [18]. Contributions have circled around terms, such as innovation, creativity, immersion, imagination, technology, and information, which define visual learning. This has been reflected in a significant increase in scientific publications of impact in the global academic sphere [19–21]. Some immersive experiences of great application interest in flexible university environments are provided by the inclusion of interfaces that offer virtual

realities [22,23] that replace the real environment with a simulated one, constituting a resource that generates interest and motivation in students [24].

Nevertheless, what is sought is to incorporate attractive digital interfaces that promote visual experiences and promote digital creativity in students, offering added value to education and issues that are sometimes complex to address. Another of the tools applied in university settings is augmented reality. Considered a modification of the virtual experience, it facilitates the mixing of digital and physical information in real time, making it possible both to see and to interact, in real time, with virtual images superimposed on the real world [25]. Here, the individual is located at the same time between the real and the virtual world; that is, there is an overlap of virtual objects in the real environment. This involves the use of mobile devices, to facilitate their incorporation into the educational sector and is positioned among students as a motivating instrument [26]. These and other digital tools applied, for example, to artistic and visual production, imply a change in the possibilities offered by DT in the exchange of artistic objects with cultural, heritage, and educational media [27].

Consequently, the motivation of this analysis is to detect trends in scientific activity related to digital education (DE) and its link with the learning of artistic and visual education in higher education (HE) settings. It is key to understand the application of DE as a didactic instrument to include it in the educational environment and teaching activity.

The European Higher Education Area (EHEA), as the regulatory framework of the university, highlights the importance of the acquisition of digital skills by students to favor the treatment of available information. The key is to combine a teaching model that enhances the use of ICT, increasing the students' flexibility, self-regulation, adaptation, and self-learning [28]. Staying active in the DA requires a strategic vision led by institutional management, shared by the entire university community, and supported by the digital training of academics, students, and staff.

The incorporation of DT in HE implies the obtaining of competences and skills according to the needs of the DA, where the information is usually available to students and is immersed in the learning processes. Consequently, students can acquire autonomy, discipline, and motivation skills, in addition to improving academic performance [29].

In the literature review carried out, studies that address this issue have been found, so that the research question refers to analyzing the scientific production of DE and artistic-visual learning in flexible university environments over time. Moreover, to get answers to the research questions posed, 1291 scientific journal articles from the Scopus database were examined. In this study, the bibliometric method was applied to gather the knowledge base on DE and its link with the learning of artistic and visual education in HE. When analyzing research trends on the subject in question, results were obtained on the scientific productivity of the journals, authors, research institutions, and countries that carry out the most research, as well as the network of countries by co-authorship. Knowledge of these productivity indicators allows the scientific community to be offered information for decision-making related to such policies, strategic planning of university activity, and research funding, among others.

The findings showed the contributions of this research, which have made it possible to identify the main driving agents, predict future trends, and reveal critical knowledge gaps. It can be concluded that DE has positioned itself as an instrument with numerous applications in HE and has also become a field of research with exponential growth. For its part, the impact of visual learning on the development of the skills to be achieved in students acts as an instrument in the development of critical and divergent thinking. Furthermore, this research work is aimed at all those researchers, teaching staff, and others interested in related areas, so that they can continue investigating and experimenting, both at a theoretical and practical level, in addition to having data on the optimal decision-making process.

This research is structured as follows. Section 2 justifies the significance of the research topic, conducting a review of the base concepts of this study. Section 3 describes the applied methodology. Section 4 displays the main findings and discussions in a broad context. Section 5 offers conclusions.

2. Backgrounds

The study of DE and artistic-visual learning in flexible university environments is based on the analysis of a series of theoretical principles and basic concepts, which define the framework in this area of knowledge.

Currently, technologies in the digital society are presented as those key computer tools that, in addition to being used for the learning and development of special skills in students, they also act as support to teachers by proposing a new technology and scenography framework that provides other methods of communication. The inclusion of ICT has meant that the exchange is open and shared, both synchronously and asynchronously, generating new rich learning environments in its wake, originating variants in learning environments, such as b-learning or e-learning [30,31]. In this way, b-learning is combined training or blended learning, which contemplates multiple scenarios and where face-to-face, synchronous, and e-learning activities are harmonized. With this, different resources are made available to students as reference material which favor the deepening of knowledge beyond the classroom itself. In this sense, they are positioned as emerging modalities with their own identity, while their evolution takes place through face-to-face and virtual contexts.

Using digital tools (interactive whiteboards, tablets, etc.) and analogical (non-digital tools such as video cameras, paper, etc.) at the same time promotes greater collaboration and helps many students to do the process of more visual thinking; even students report that they learn more in blended learning environments. These are organized as a mixed modality that contributes a paradigm shift compared to traditional modalities, making pedagogy and technology converge [32].

Flexible university learning environments mean being able to adapt the use of resources such as staff, space, clustering, technology, and time, for better personalization of teaching. Flexibility is understood as the option of offering students the ability to choose how, what, where, when, and with whom to participate in learning activities while they are at an HEI. By virtue of it, not only must the technological component act in this flexibility, but there must also be institutional flexibility and flexibility from the perspective of teaching and learning [6,10,21]. For all this, it is important to have infrastructures and policies that help implement the methodology that we always want to use, being necessary to apply strategic incentives and give adequate support to participatory and pedagogic change.

For a few decades, the information and knowledge society has impacted on the individual. This is distinguished by information technology (IT), which allows its organization in networks, in addition to offering the possibility of accessing, sharing, and processing data [33]. It stands out for the relevance assumed by ICT [34,35], which influences a large part of our lives and how we learn. These have originated a pedagogical change, which fosters real experiences focused on more interactive learning [36,37]. DE is a reality today, especially with the global pandemic of COVID-19, which has allowed its recognition as an essential technology at all levels of the education system globally [38].

DE refers to both face-to-face and distance education that make use of DT, and whose objective is the acquisition of competencies and skills to learn in a permanent training process [39]. It is any type of learning that is accompanied by technology or instructional practice that makes effective use of technology. It covers the application of a wide spectrum of practices that include blended and virtual learning. In consequence, digital learning also includes e-learning. A digital learning strategy can include any or a combination of the following: adaptive learning; badging and gamification; blended learning; e-textbooks; learning analytics; mobile learning, such as mobile phones, laptops, computers, iPads; personalized learning; open educational resources (OERs); technology-enhanced teaching and learning; virtual reality; augmented reality; etc. Using mobile technologies, digital learning can be carried out in various environments, since mobile technologies give us this advantage.

Traditionally, distance education has been defined as one in which students and teachers are geographically separated [40,41]. Two essential elements are highlighted in this definition: (i) distance education is oriented towards a geographically dispersed population, and (ii) education is carried out through non-contact communication. These characteristics have led to the separation of face-to-face

education methodologies from distance education methodologies. However, the essential characteristic of isolation and separation experienced in recent months by the COVID-19 pandemic, between teacher and student, tends to disappear, more and more rapidly, with the use of DE technologies. In this way, both the geographical dispersion factor and the non-face-to-face communication factor decrease, somehow bringing the distances between the protagonists closer together, and recognizing that the most effective option for learning is face-to-face learning sharing the same environment [42]. Due to the advancement of pedagogical and technological theories in the field of education, both face-to-face and at a distance, it is now possible to develop a DE system that serves to improve the teaching and learning processes of students who decide to learn at any time and anywhere, in addition to those who decide to go to a classroom to continue their face-to-face training process [15,43].

In the age of knowledge, DE allows progress in other educational models and paradigms other than the master class, distinguished by the rigidity and impersonality that characterized education for decades. In this way, the teacher ceases to be the transmitter of knowledge, to become a guide and facilitator of the students' learning process, both in the methodologies applied in the classroom and making use of other more innovative ones that include DT [22,44].

In this way, learning in the DA can be defined as diverse, disorderly learning that is far from traditional perfectly packaged and organized knowledge. Networked knowledge is based on co-creation, which implies a change in mentality and attitude, going from being mere consumers of the content produced by other people to experts and amateurs themselves being co-creators of knowledge [2,15,45]. For this reason, learning in the DA has become especially complex, since being a multifaceted and integrated process, a change in any individual element entails the alteration of the global network. In the same way, this complexity and diversity in the network give rise to connected and specialized nodes, which means having a partial knowledge of reality and living in continuous certainty in suspense. Online learning is continuous, and it is not an activity that occurs outside of our daily life or exclusively in formal educational contexts. Nowadays, it has gone from stopping life when we learn to learn in sync with life [12,46].

Learning means knowing how to make decisions, since reality constantly changes, so it is more important to know what and how [47]. In network learning, knowledge is created and configured by the combined activity between people. For this reason, knowing means being connected, that is, in constant dynamism.

In this context, art is understood as all that creation and representation made by people who try to express and show a perception about their worlds, showing different feelings, emotions, ideas, and visions of the world, through various resources. For its part, the adjective artistic is used to refer to things related to an aesthetic and communicative purpose. This indicates that an individual can be creative in various forms of expression, such as music, writing, dance, or theater [48].

Artistic-visual learning is considered of great interest. The main component of this approach is directly related to the notion of creativity. Creativity consists of a basic characteristic of the human mind and that, potentially, is found in all individuals. Imagination is the engine of creativity, which allows us to think about things and situations that are not perceived through the senses [49].

In this manner, the art allows students to develop creativity, flexibility, expressiveness, and the ability to adapt to different life situations. There is evidence that creative learning is an emotional discipline that requires deep reflection and intellectual rigor [50,51]. It is necessary to incorporate it as an objective in flexible university environments to develop artistic thinking as a stage related to sensitivity, imagination, and creativity.

Returning to the creative approach, this model includes the concepts linked to creative personal expression [52], the development of genius and creative capacity [53], and art as expression [54]. A common aspect of all these approaches to artistic-visual learning is that they reflect on how the expression of personal impulses is generated, stimulating the process of creative production, regardless of guidelines that are derived from traditional training or formal teaching structures and artistic learning.

Within the educational field, the presence of the visual artistic imaginary acquires great importance, becoming a stimulus in the generation of new expressionist, visual, and artistic movements. This approach allows the student to express their emotional interior, also trying to solve or, at least, dialogue with their concerns. For such effects, the students raise their emotions and then define them; the teacher generates questions and/or situations to contribute to the verbalization and formalization of individual feelings and subsequent visual presentation of their emotions.

On the other hand, there are some principles that should be considered in artistic education and, with it, what we can call artistic experience [55]. The first principle is related to the primary objective of visual arts education, that is, to put in the foreground what the arts have different, which means that justifications should not be sought for why the arts exist, but rather to value them for what they possess that is different from other disciplines and for their intrinsic value, which allows aspects of the world to be made visible with plastic and visual resources, showing students the significant character that art itself possesses [31,40]. The importance of art is that it expresses the vision of a community, so its function, and that of art, is to fulfill the aesthetic and recreational needs of the human being. Art has historically been a visual witness to the evolution and ideas of the human being.

Arts education should help students to learn to create and experience the aesthetic characteristics of images and to understand their relationship with the culture of which they are part [56]. Educational programs must consider a conception of the visual in an integrated way and, thus, have a look at the aesthetic that considers the different visual forms that are in culture. Artistic-visual learning offers the student the possibility of directly testing their stimuli, offering significant value to learning [57].

Creativity linked to learning can provide a platform to improve the well-being of students, allowing children to contribute to innovation from their school circle, and understanding creativity as the basis of their future [58,59]. In this order, it is more useful to encourage the development of children's creativity and imagination through creative practice, than simply to achieve a satisfactory grade at the end of an assignment [17,52].

The arts show students how to make optimal decisions about qualitative relationships, that is, problems can have more than one solution, while questions can have more than one answer [60]. It is demonstrable that the arts are integrated with other subjects. A large volume of research has focused on analyzing the advantages of the use of artistic-visual learning in educational environments [30–32,44], in relation to higher levels of academic performance, motivation in learning, interest by the subject, and participation in the content [61,62]. Currently, we have become accustomed to a world where change occurs with unprecedented speed. This forces one to question the notion of knowledge in its various spheres.

For its part, environments refer to everything that surrounds something or someone. In other words, university environments are the settings where students and the entire university community carry out their academic activity [63]. The evolution towards digital, started in the university, has meant transformations in flexible university environments, turning them into true sustainable, social, and egalitarian spaces [64].

Digital transformation is reformulating the way organizations are created, operated, and developed. This also introduces profound changes in the ways of communicating, working, and functioning, even in universities. The use of technologies has inevitably become a key element in university teaching, where the context of digital transformation will make it crucial for these institutions to fulfill their mission. Members of the university community, therefore, will require an increasingly demanding level of digital competence [65].

In short, each period has increased both the quality and the quantity of documents on educational education and artistic-visual learning in educational settings. This indicates the interest in this topic by education researchers. Emerging technology and innovative learning modalities have eliminated the barriers of traditional education, allowing access to quality education through ubiquitous and accessible technologies for all [66–68].

3. Materials and Methods

From mathematical and statistical methods applied to literature, bibliometrics analyzes the scientific production of a certain field of knowledge. Bibliometric indicators measure certain aspects of scientific activity, offering valid information to evaluate its evolution [69]. This method was started by Garfield in the mid-20th century, and it has since become widespread in scientific research and has contributed for decades to reviewing knowledge across multiple disciplines [70].

The aim of this research was to show the evolution of scientific production with respect to DE and artistic-visual learning in flexible university environments. To achieve the proposed objective, a quantitative analysis was carried out using bibliometrics. Likewise, the explicit objective of this methodology is to search, identify, organize, and examine trends in this topic. Over the past few years, searching online databases has allowed researchers to review intrinsic knowledge in different scientific fields [71,72].

The applied method consisted of conducting a search in the Scopus database, using the key terms of this research topic: "education", "art", "visual", and "digital". The Scopus database was used to apply bibliometric techniques to the sample of articles. This database is the world's largest citation and abstract database of peer-reviewed research literature, including the most cited journals in each field of study. Moreover, Scopus provides a wide variety of data in each of the publications, which allows the comparison of different analyses and the download of useful information for the analysis process in different formats.

The process followed in the selection of the sample conforms to the flowchart of Figure 1, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [73]. In phase 1 (Identification), 107,365 records from the Scopus database were identified, considering all the fields for each of the key search terms (education, art, visual, and digital), all types of documents, and all data in the range (all years—August 2020). Search terms were identified from the initial literature review. In phase 2 (Screening), the option of "article title, abstract, and keywords" was chosen in the field of each term, so that 103,964 records were excluded. Subsequently, in phase 3 (Eligibility), of the 3671 records, only articles were selected as the type of document, to ensure the quality derived from the peer-review process. In this phase, 2124 documents were excluded. In the last phase, phase 4 (Included), of the 1547 records, 256 documents were excluded, by limiting the period analyzed from 2000 to 2019, and excluding the thematic areas that distorted the sample. The final sample included 1291 articles, both open access and non-open access.

Basically, the search selected records from the subfields title, abstract, and keywords, in the period that contains the last 20 years, in the same way that it has been applied successfully in several studies that have used bibliometric methodology [74,75].

The indicators of scientific production considered were the distribution by years of the published articles, and the productivity of authors, countries/territories, and institutions. The quality indicators used were the h-index, the total number of citations, and the SCImago Journal Rank (SJR) indicator, which measures the quality of the scientific journals included in Scopus [76,77].

VOSviewer software tool (version 1.6.15, University of Leiden, Leiden, The Netherlands) has been used for the mapping. It allows one to process keywords and cluster analysis, to show network maps, by co-authorship and co-occurrence methods. This tool allows one to expose the indicators of collaborative structure, which measure the links between authors, institutions, and countries/territories [78,79], in addition to identifying research trends by the grouping of keywords in the period examined [80].

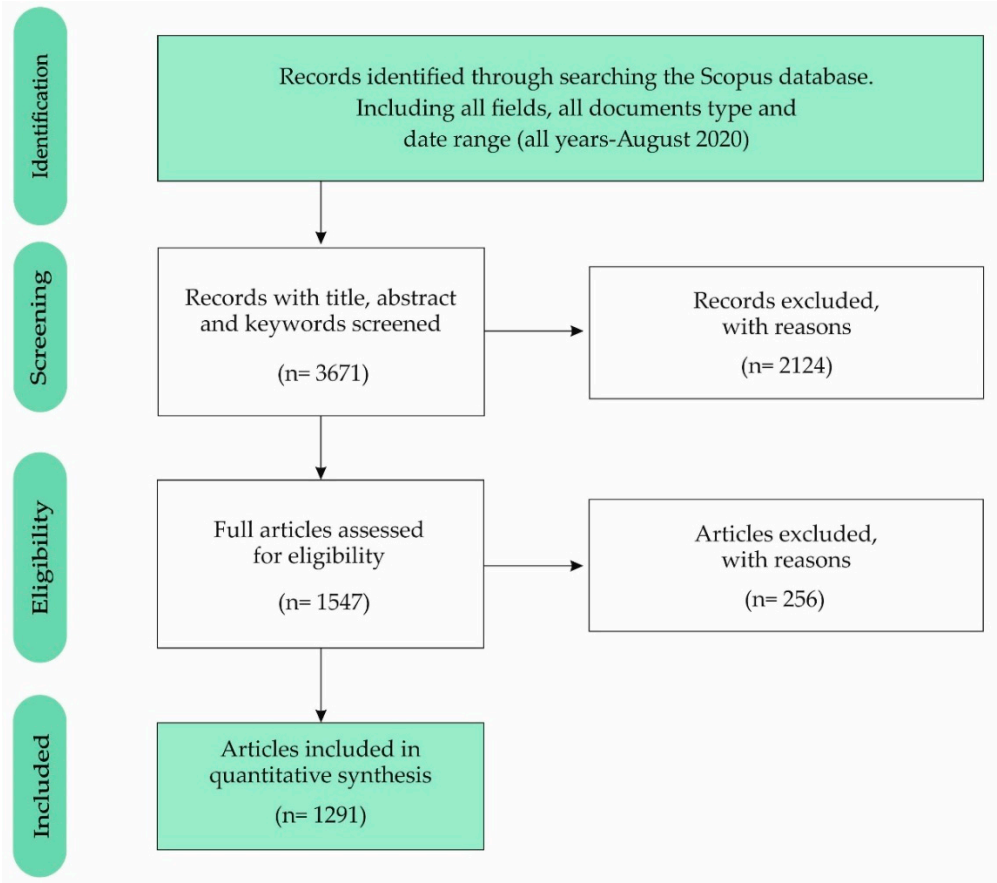

Figure 1. Flowchart of the selected sample based on Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).

4. Results and Discussion

4.1. Scientific Production

Figure 2 displays the evolution of the articles published on DE and artistic-visual learning in flexible university environments, from 2000 to 2019. In this period, interest in this research has increased, especially in the last 3 years (2017–2019). Thereby, if looking at 2000–2010, only 288 articles were published on this topic, assuming 22.3%; in the following period (2011–2019), the number of articles rose to 1003, which is 63.52% of the total production. Likewise, the year in which more publications were produced was 2019, with 221 articles (14%).

It is noteworthy the considerable increase in the number of articles published in the last 3 years (2017–2019), from 123 articles to 221, assuming a percentage increase of almost double (7.79% to 14%). The total number of publications in this triennium is 502 articles (38.88%).

This explains that during the first years of the period studied, the basic theoretical and conceptual articles of DE and artistic-visual learning in HE were published; while in the following years, the contributions were directed to the analysis of particular cases, in order to develop this field of research [81–83].

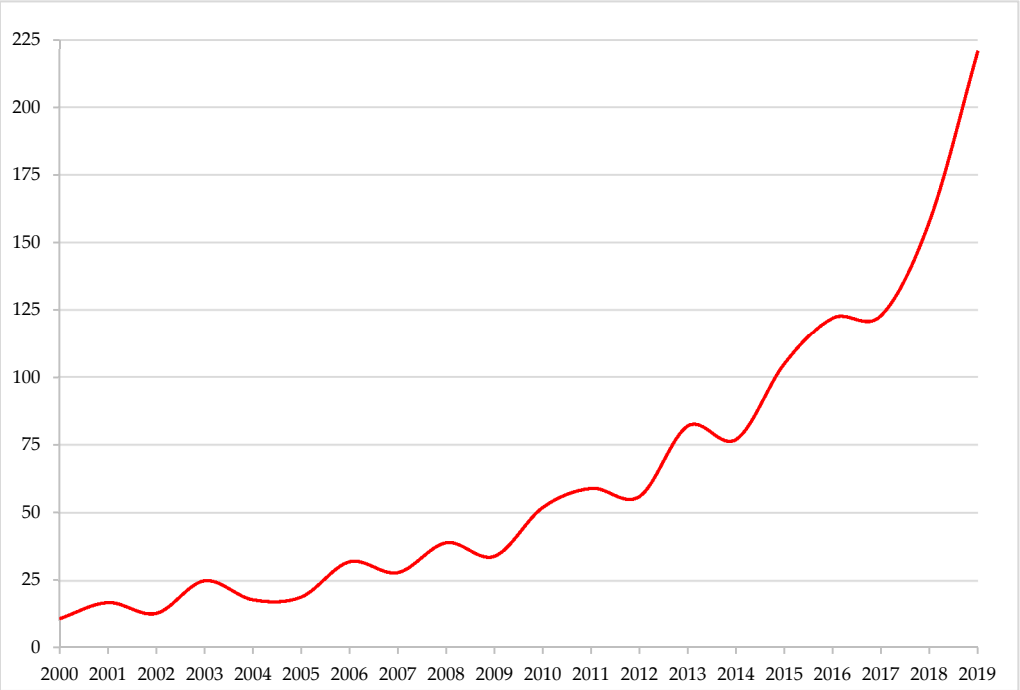

Figure 2. Growth of scientific production (2000–2019).

4.2. Subject Area and Journal

In the 2000–2019 period, there are different subject areas where articles related to DE and artistic-visual learning in the context of HE were found. According to the Scopus database classification, the 1291 articles analyzed are classified into 27 thematic areas, where an article can be classified in more than one category, depending on the publisher's interest.

Figure 3 presents how the thematic classification of articles on DE and artistic-visual learning in flexible university environments has evolved in the period 2000–2019. The social sciences category is the one that stands out during the entire period studied, encompassing 53.99% (697) of the articles published. It is followed by the categories computer sciences, with 23.16% (299), and arts and humanities, with 19.44% (251). Medicine, with 18.98%, and engineering, with 15.80%, are the following categories in order of importance. The rest of the subject areas do not reach 4% of published works. The five most important categories represent 89% of the documents published in this field of research from 2000 to 2019.

The association of publications, especially, with the social sciences and computer science categories makes sense. This research studies the trends of the scientific production related to DE and its link with artistic-visual education in flexible university settings, to generate a quality education related to technological advances [84].

Regarding the characteristics of the articles of the main journals in the publication on DE and artistic-visual learning in flexible university environments, by country, among the 10 most important journals in the publication on this subject, those of European and North American origin stand out: the United Kingdom (4), the United States (4), Germany (1), and Turkey (1). The journal that has published the most articles about this area of study has been the *International Journal of Art and Design Education*, with 22 publications. It is followed by the *Journal of Adolescent and Adult Literacy*, with 19; the *International Journal of Emerging Technologies in Learning* and *Reading Teacher*, with 11 each; and in fifth place is *Computers and Education*, with 10. The *International Journal of Art and Design Education* also stands out because it has a higher impact factor, with SJR 2019: 3.047, followed by the *Journal of Adolescent and Adult Literacy* (SJR 2019: 0.592), and the *International Journal of Art and Design Education*

(SJR 2019: 0.293). The journal with the longest period of publications in this ranking is the *International Journal of Education in Art and Design*, which ranges from 2000 to 2019.

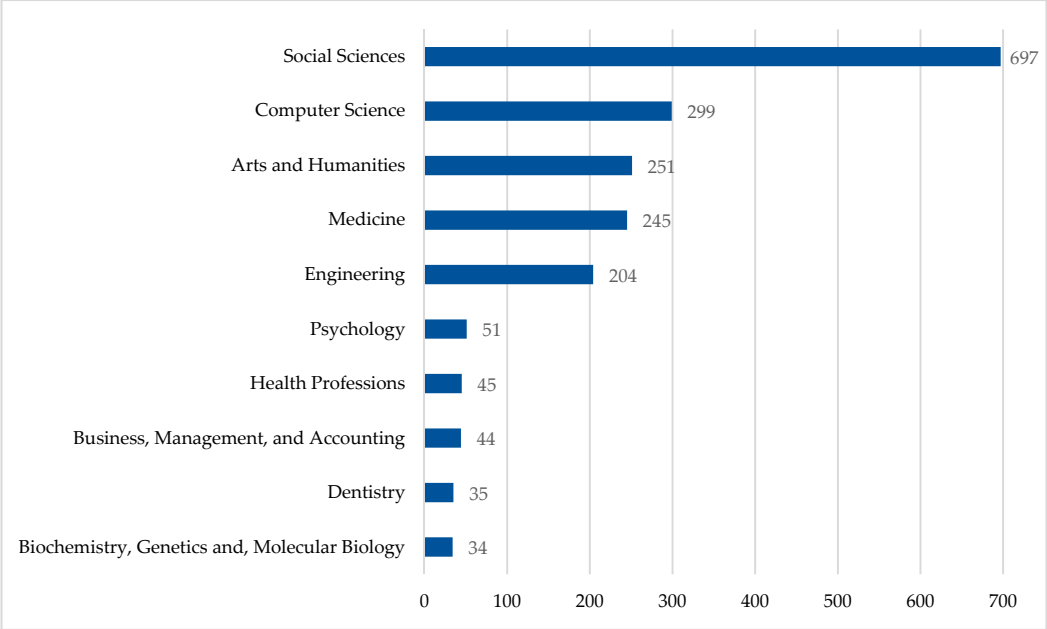

Figure 3. Main subject areas by articles (2000–2019).

4.3. Productivity of Authors, Research Institutions, and Countries

Table 1 presents the main variables of the articles by the 10 most productive authors in the publication on the subject examined during the period 2000–2019. The authors who have published the most articles on the research topic are Marner and Örtegren, affiliated to Umeå Universitet (Sweden), and Patton to Virginia Commonwealth University (United States), all of them with 4 articles each. They are followed by Alvermann (The University of Georgia, United States) and Beacham (University of Aberdeen, United Kingdom), with 3 contributions each.

Table 1. Top 10 authors (1992–2019).

Author	A	Affiliation	Country	1st A *	Last A *	Keywords *
Marner, A.	4	Umeå Universitet	Sweden	2012	2014	Screen Culture—Digital Media—Multivoicedness
Patton, R.	4	Virginia Commonwealth University	United States	2014	2016	Art Education—Media Arts—Digital
Örtegren, H.	4	Umeå Universitet	Sweden	2012	2019	Digital Media—Art—Digital Image
Alvermann, D.	3	The University of Georgia	United States	2003	2017	Art—Digital Media—Technology
Beacham, N.	3	University of Aberdeen	United Kingdom	2000	2004	Teaching—Visual Information—Education
Gratton, D.G.	3	University of Iowa	United States	2014	2016	Education—Teaching—Digital
Knochel, A.D.	3	Pennsylvania State University	United States	2014	2019	Digital Scholarship—Ecology—Real-time
Kwon, S.R.	3	Loma Linda University	United States	2015	2016	Education—Teaching—Image
Ma, M.	3	Staffordshire University	United Kingdom	2010	2014	Computer Games Art—Learning Styles—Real-time Rendering
Meier, C.	3	Universidad de La Laguna	Spain	2018	2019	Education—3D Scanners—Activity of Designs

A: number of articles; 1st A: first article; Last A: last article; Keywords: three main keywords; (*): in this research topic.

It is notable that, in Table 1, five authors are of European origin: the United Kingdom (2), Sweden (2), and Spain (1), while five are of North American origin. Likewise, three authors published the last article in 2019, the last year analyzed in this study, which indicates the importance and interest of the research topic [85,86].

Figure 4 shows the collaboration map between the main authors who have published on the research topic, based on co-authorship. The colors represent the different clusters formed by the

working groups in the production of articles, and the size of the circle varies depending on the number of articles by each author. The main authors are grouped into six clusters.

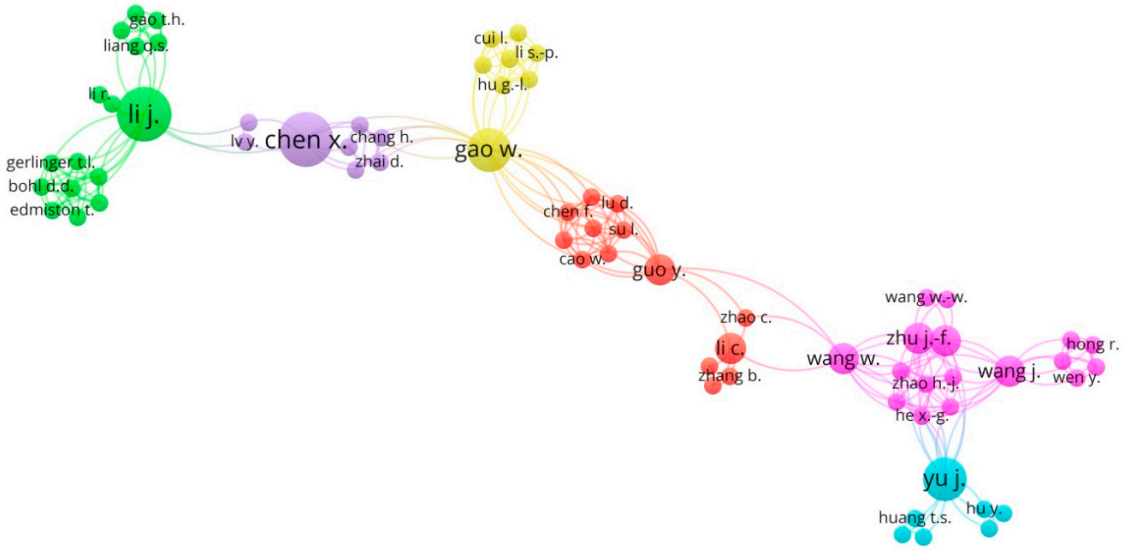

Figure 4. Network of authors based on co-authorship (2000–2019).

Cluster 1 (pink) presents the collaboration between He, X.; Hong; Hu; Lu, H.; Tong; Wang, J.; Wang, M.; Yang; Zhao; and Wang, W.; among others. Group 2 (green) groups Bohl; Campbell; Edmiston; Gao; Gerlinger; Khorsand; Li, J.; Li, R.; Liang; Liu; Louie; and Mikhail; among others. Cluster 3 (red) contains a number of authors, including Cao; Chen; Cui, D.; Guo, Y.; Jiao, Q.; Lu, D.; Lu, G.; Li, C.; and Xiao, Q. Cluster 4 (yellow), among others, groups Cui, L.; Gao, W.; Hu, G.-L.; Zhang, Q.; Zhang, Z.-H; and Lan, Y.-J. Cluster 5 (purple) is made up of authors Chang, H.; Chen, X.; Cui, B.; Guo, M.; Liu, X.; Zhai, D.; and Zhen, Y. Finally, cluster 6 (cyan) is made up of Hu, Y.; Jiang, W.; Luo, J.; Huang, T.S.; Peng, R.; Yang, J.; and Yu, J.

The grouping based on co-authorship denotes a wide variety, where Asian authorship stands out in line with the affiliations of these authors, which contribute to investigating the existing relationship between DE and artistic-visual learning in the context of HE [32,87,88].

Table 2 displays the five most productive research institutions in the publication of documents related to the subject studied during the period 2000–2019. Australia, with two institutions, is the country/territory with the largest presence in this ranking. Among them, Monash University ranks first, with 12 articles and 207 citations. This institution presents the highest average of citations of articles per year (17.25), and the second-highest h-index (5) in this ranking.

Table 2. Top 5 research institutions (2000–2019).

Research Institution	Country/Territory	A	TC	TC/A	h-Index *	1st A *	Last A *
Monash University	Australia	12	207	17.25	5	2003	2018
The Glasgow School of Art	Scotland	9	37	4.11	4	2012	2019
Indiana University Bloomington	United States	8	71	8.88	3	2004	2019
Chinese Academy of Sciences	China	7	115	16.43	6	2005	2018
The University of Sydney	Australia	7	114	16.28	5	2006	2019

A: number of articles; TC: number of citations for all articles; TC/A: number of citations by article; h-index: Hirsch index; 1st A: first article; Last A: last article; (*) in this research topic.

It is also noteworthy that three research institutions have made contributions to the topic during 2019, and the other two in 2018, which confirms the interest in DE and artistic-visual learning in the field of university education [21,89]. Furthermore, except for The Glasgow School of Art (Scotland), which published the first article on this subject in 2012, the rest of the research institutions (in this

ranking) contributed their first articles during the previous decade. This validates the evolution of this field, since numerous research institutions have joined the contribution of articles with the development of this technology, and its link with university education [90].

Regarding the countries/territories with the highest scientific production on this topic, in first place is the United States, with the most published articles (374), with the highest total number of citations (3164); it has an average of 8.15 citations for each article, and with the highest h-index (27). The United Kingdom is the second country/territory with both the highest number of articles (171), as well as the total number of citations (1434) and the h-index (19). This circumstance indicates the interest of US and English publications on the application of DE and artistic-visual learning in the context of HE [91–93]. By number of articles, after these two countries, we find Spain (81), China (71), and Australia (62).

Fifty-nine percent of the contributions on the subject examined globally, that is, 759 articles, have been developed by five countries: the United States, the United Kingdom, Spain, China, and Australia. The remaining five countries (Canada, Brazil, Turkey, Italy, and Taiwan) have supported 16% of the articles on this subject. Among these, only Canada (52) exceeds 50 articles published during this period.

Figure 5 displays a network map between the main countries based on the co-authorship method. The countries have been grouped into 6 clusters. Cluster 1 (pink color), the most numerous, is led by the United Kingdom and it is associated with Spain, Iran, Sweden, Hungary, France, Finland, Germany, Lithuania, Argentina, Austria, Serbia, Poland, and Colombia, among others. Cluster 2 (green), led by Italy, is made up of Belgium, Cyprus, Greece, Malaysia, Israel, Iraq, Malta, Switzerland, Ukraine, Pakistan, and Saudi Arabia. Cluster 3 (red) is headed by the Netherlands and includes China, Australia, Denmark, Hong Kong, Japan, Singapore, South Africa, South Korea, Tanzania, and Viet Nam. Cluster 4 (yellow) is headed by Canada, Morocco, Kenya, Bangladesh, Qatar, Norway, Taiwan, and Thailand. The fifth cluster (purple), led by the United States, is made up of Ireland, India, Indonesia, Cameroon, Mexico, Turkey, and Zambia. The sixth cluster (cyan) is led by Slovenia and is associated with Brazil, Chile, Estonia, Latvia, Peru, and Portugal.

Figure 6 shows the network map for the keywords of the research articles on DE and artistic-visual learning in flexible university environments in the period 2000–2019. Hence, five lines of research elaborated by the driving agents of this field of research have been detected, which are grouped under the terms “Internet”, “education”, “visual”, “computer program”, “learning”, “digital media literacies”, and “educational technology”.

The first line of research, associated with the term “Internet” (pink), includes keywords such as middle aged, methodology, videorecording, child, three dimensional imaging, communication, digital imaging, young adult, simulation, information processing, computer interface, multimedia, immersive, real time, navigation, image enhancement, real time system, user experience, user interfaces, object recognition, information technology, learning algorithms, machine learning, learning performance, 3D, interactivity, and virtual laboratory.

The second line of research, associated with the term “art education” (green), groups keywords such as digital libraries, design, digital technologies, learning systems, design education, visualization, art education, visual communication, arts computing, artistic education, art appreciation, artistic expression, visual art education, visual literacy arts, theatre, craft, creation, creative process, education computing, augmented reality, digital storytelling, computer graphics, art therapy, multimedia systems, digital art, digital signal processing, teaching and learning, online learning, motivation, robotics, artificial intelligence, innovation, visualization, and digital animation.

The third line, linked to the term “constructivism” (red), associates keywords such as motivation, assessment, authentic, engagement, self-assessment, struggling learners, interest, mentoring, constructivism, critical analysis, psychology, cognition, learning style, virtual learning environment, information processing, mobile application, perception, smartphone, ethnography, qualitative, reading strategies, and nonfiction.

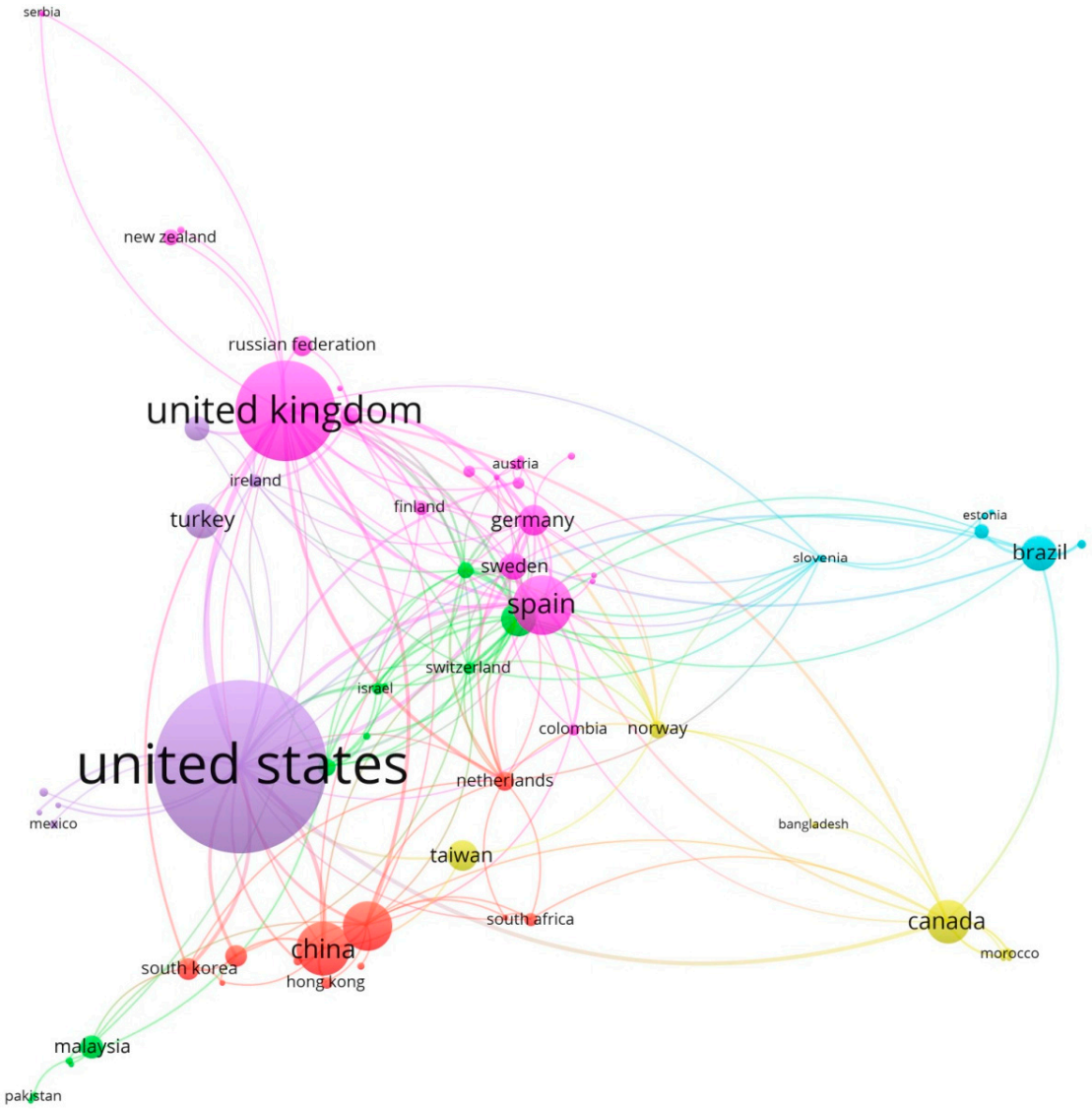

Figure 5. Network of countries/territories based on co-authorship (2000–2019).

The fourth line, led by the term "computer program" (yellow), is associated with keywords such as video recording, image analysis, image quality, data base, audiovisual equipment, information storage and retrieval, telecommunication, imaging system, publication, information, standardization, information systems, microcomputers, and video graphics array.

The fifth line of research, headed by the term "learning" (purple), includes keywords such as prospective study, universities, wellbeing, social interaction, personal experience, visual information, cognitive defect, working memory, word recognition, and socialization.

The sixth line of research, headed by the term "digital media literacies" (cyan), includes keywords such as visual literacy, methods and materials, university students, identity, teaching strategies, and sociocultural.

Finally, the seventh line of research, headed by the term "educational technology" (orange), includes keywords such as educational measurement, image processing, skill, imaging, workflow, or self-evaluation.

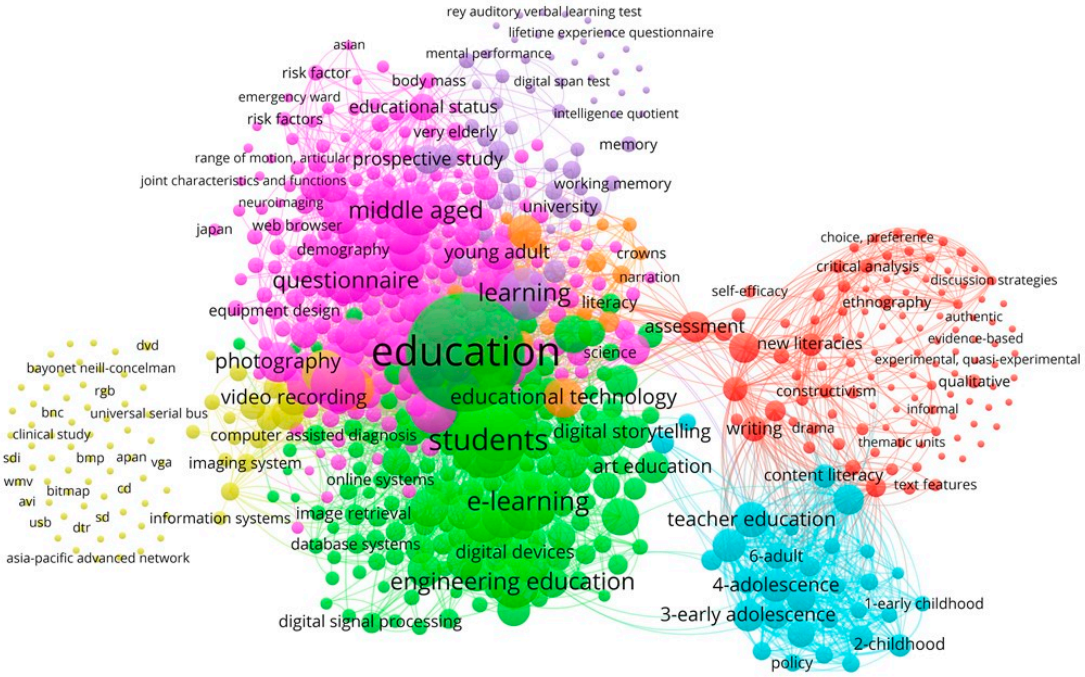

Figure 6. Keywords network based on co-occurrence (2000–2019).

These lines of research bring together all the concepts related to DE and artistic-visual learning in flexible university environments. They include different aspects related to technologies [94] and their applications in the education sector [95], artistic-visual sector [96], and HE [97], as well as with the use of technologies in the education sector [98]. In all this context, digital transformation has meant that the use of technologies has become a key factor in university teaching, so that all members of the university community will require a more demanding level of digital competence. That is, this level will be required by students who, in general, have acquired it as part of their social activity and identifying characteristic of Generation Z to which they belong, and will also be required by university faculty and all staff in the service of educational institutions [14,65].

In this sense, it is observed that research on this topic continues to advance at a global level, to which other concepts and strategies related to technologies, HE, and art education are added, such as arts computing, virtuality continuum, digital image storage, 3D virtual reality, digital art, interactive learning environment, game-based learning, mixed reality, Internet of things (IoT), ubiquitous computing, ubicomp, wearable computing, pervasive computing, ambient intelligence, augmented virtuality, calm technology, visual field, visual impairment, Everyware IoT, tactile feedback, robotics, and remote sending.

Figure 7 displays the progress of each cluster by differentiating the period in which it appeared and its evolution during the analyzed period, from 2000 to 2019. In this way, it is observed that the presence of blue clusters is reduced, which is in accordance with new technologies and the development of scientific production on this subject. It is observed that the clusters in green color and their various shades emerge from the year 2005 onwards, which allows us to observe the progress in this theme. Since 2010, green clusters have been displayed with yellow tones, which allude to the growth of scientific production in that period and to the issues related to technology, DE, and visual learning. The last keywords associated with this topic, in yellow, are related to digital and immersive technology, university education, digital art learning, deep learning or mobile learning (m-learning).

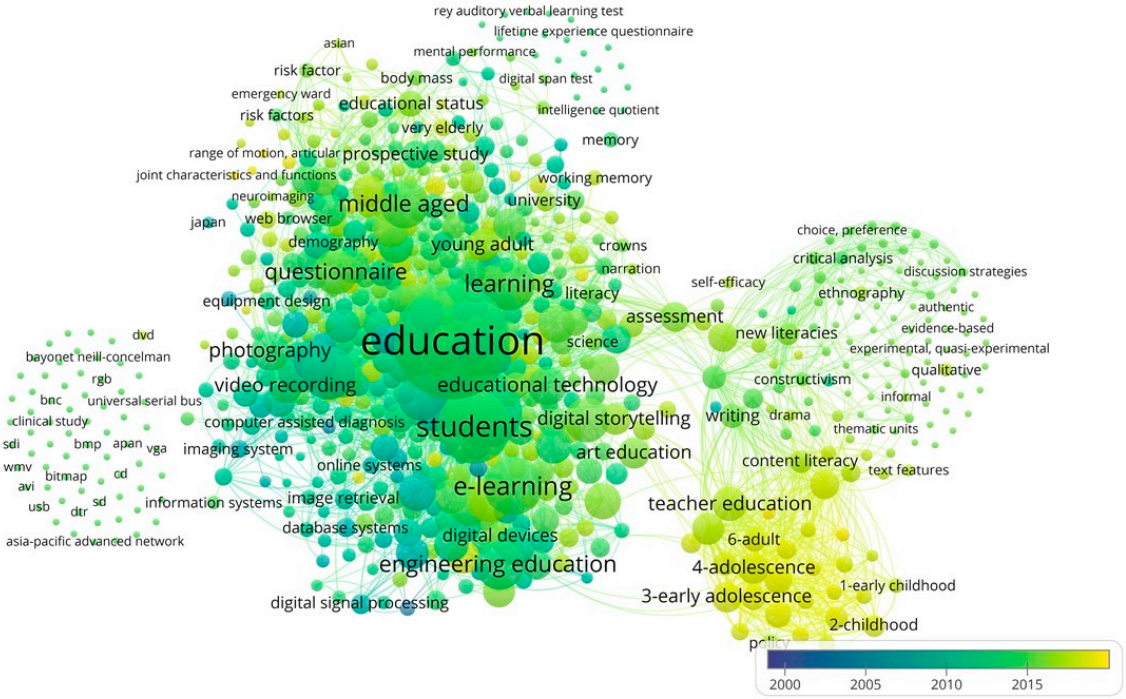

Figure 7. Evolution of keywords network based on co-occurrences (2000–2019).

This examination allows us to recognize the importance of keywords based on the time they have appeared in the research. The most pioneering ones have been a reference for the later ones. The presence of seven clusters allows us to understand how DE and artistic-visual learning in flexible university environments comprise different lines of study in research activity—artistic, social, and technological. In this regard, as future directions of research studies, the following have been detected: (i) study the effectiveness of immersive technologies to improve digital art learning; (ii) link DE with increased virtuality; (iii) evaluate the use of DE in diagnosing the attitudes and qualities of future teachers; and (iv) analyze digital learning in university contexts through artistic-visual tools and digital art, historical and artistic heritage, immersive art, and interactive and three-dimensional (3-D) experiences of space.

Along these lines, HEIs are making a great effort to include new technologies in various areas, especially those related to culture and art, although sometimes the efforts are not reflected on campus; research works such as the one presented act as a background that provides new research tools.

5. Conclusions

The aim of this research study was to analyze the evolution of scientific production and global trends on DE and artistic-visual learning in flexible university environments, during the period 2000–2019. Accordingly, a bibliometric analysis of 1291 scientific articles acquired from the Scopus database was developed.

The growth of the number of articles, the thematic areas where these were classed, the journals where they were published, the authors, the institutions, and the most productive countries were detected. Moreover, the key current and future lines of research were detected. Scientific production has increased particularly between 2017 and 2019, where 502 articles have been published, which exemplifies 38.88% of the topic, confirming the global relevance and impact of this topic research.

Similarly, authors, institutions, and the most prolific territories connect their articles to the areas of knowledge of education and technology. Moreover, the most productive territories in this research topic are the United States, the United Kingdom, Spain, China, and Australia. This study has also detected the most significant areas of knowledge where publications are classified—social sciences,

computer science, and arts and humanities—which responds to the multidisciplinary nature of the research acquired this theme, linked to education, technology, art, and computing. The three thematic areas concentrated 96.59% of the total.

The most productive journal on the research topic has been the *International Journal of Art and Design Education* with 22 published articles. It is also the journal with the highest number of citations, with the best average number of citations per article, and with the highest h-index for articles published on this thematic area. It is necessary to point out that 50% of the 10 journals that contribute the most to this topic are positioned in the first quartile of Scopus.

The authors who have published the most on this subject are Marner, Patton, and Örtegren. On the other hand, Traxer and Thomas are the authors with the highest number of citations. Likewise, the most productive institutions in this research area are Monash University (Australia), The Glasgow School of Art (Scotland), and Indiana University Bloomington (United States).

The main countries that have made a greater effort in this area of research, in order of importance, are the United States, the United Kingdom, Spain, and China. Hence, the United States presents the highest number of published articles (374), citations (3164), and average number of citations per article (8.15). As for the countries that have made the greatest international collaboration in their work, they have been the United States and the United Kingdom.

This research has some constraints. Principally, these come from (i) the intrinsic characteristics of the quantitative analysis of the bibliometric method, (ii) the issue that some authors publish only some articles with high impact in a field of research, (iii) this methodology could be extended with other databases or quantitative or qualitative tools, and (iv) other types of documents could also be included in the search.

Future lines of research on this topic could focus on (i) studying the effectiveness of immersive technologies to improve the learning of digital art; (ii) linking DE with increased virtuality; (iii) evaluating the use of DE in the diagnosis of the attitudes and qualities of future teachers; or (iv) analyzing digital learning in university contexts through artistic-visual tools and digital art, historical and artistic heritage, immersive art, and interactive and 3-D experiences of space.

Furthermore, DE research is multidisciplinary, broadening the vision of applications in architecture, mathematics, engineering, marketing, psychology, languages, and the initial training of university and postgraduate teachers. Contributions must support DE mobile applications, especially in moments of maximum interest of remote use. The relationship with other immersive technologies and their application in inclusive HE is of interest, as well as connecting m-learning to optimize the performance and motivation of students in HE.

The use of DE in art education is suitable to be applied due to its potential to bring students closer to the possibility of making use of 3D virtual objects and models that favor their learning, based on innovative systems of representation of reality through digital software technology. Accordingly, DE is part of teaching and digital resources propose an innovative and attractive technological framework that adapts the digital world that surrounds the student outside the classroom to them, as a didactic and educational resource.

The findings attained are useful for researchers, academics, and managers of HEIs since scientific activity in this field has been estimated. There is also an upward trend in research on DE and artistic-visual learning in flexible university environments worldwide, with optimal publication levels in recent years, facilitating the use of visual and artistic DT as a complement to teaching.

Author Contributions: Conceptualization, methodology, software, formal analysis, resources, data curation and writing—original draft preparation, E.A.-S. and M.-D.G.-Z.; investigation, validation, writing—review and editing, visualization, supervision, project administration, E.A.-S., M.-D.G.-Z., E.L.-M. and A.L.d.l.R.; funding acquisition, E.L.-M. and A.L.d.l.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Towers, A.; Towers, N. Re-evaluating the postgraduate students' course selection decision making process in the digital era. *Stud. High. Educ.* **2018**, *45*, 1133–1148. [CrossRef]
2. Park, K.B. Citizenship in the Digital Network Era. *Soc. Stud. Educ.* **2019**, *58*, 1–11. [CrossRef]
3. Gupta, R. Beyond the Textbook: Performing Arts Go High Tech. *Child. Educ.* **2019**, *95*, 57–61. [CrossRef]
4. Tarigan, T.E.; Buwono, R.C.; Redjeki, S. Extraction Opinion of Social Media in Higher Education Using Sentiment Analysis. *Bit-Tech* **2019**, *2*, 11–19. [CrossRef]
5. Gauthier, T. Exploring Employer Perspectives of Community College Career and Technical Programs. *Career Tech. Educ. Res.* **2020**, *45*, 63–76. [CrossRef]
6. Del Gobbo, D. "Design Thinking" Grows Up. *J. Act. Sci. Technol. Educ.* **2020**, *11*, 31–35. [CrossRef]
7. Sweller, J. Cognitive load theory and educational technology. *Educ. Technol. Res. Dev.* **2019**, *68*, 1–16. [CrossRef]
8. Howard, M.C.; Gutworth, M.B. A meta-analysis of virtual reality training programs for social skill development. *Comput. Educ.* **2020**, *144*, 103707. [CrossRef]
9. Gauthier, T. Exploring Administrator Perspectives of Community College Career and Technical Programs. *Career Tech. Educ. Res.* **2019**, *44*, 57–81. [CrossRef]
10. Conradie, P.W. Supporting Self-Directed Learning by Connectivism and Personal Learning Environments. *Int. J. Inf. Educ. Technol.* **2014**, *4*, 254–259. [CrossRef]
11. Park, K.B. The Understanding of Connectivism and the New Paradigm of Learning and Teaching in Social Studies. *Soc. Stud. Educ.* **2017**, *56*, 65–74. [CrossRef]
12. Renda, G.; Kuys, B. Connectivism as a Pedagogical Model within Industrial Design Education. *Procedia Technol.* **2015**, *20*, 15–19. [CrossRef]
13. Bessette, L.S. Connectivism in Higher Ed: Tools, Tactics, Triumphs. *Women High. Educ.* **2014**, *23*, 6–7. [CrossRef]
14. Park, K.B. Digital Citizenship and Connection Competency. *Soc. Stud. Educ.* **2018**, *57*, 1–15. [CrossRef]
15. Gomez, C. Create awareness of, excitement for universal design beyond the classroom. *Disabil. Compliance High. Educ.* **2015**, *20*, 2. [CrossRef]
16. Motley, P. Critique and process: Signature pedagogies in the graphic design classroom. *Arts Humanit. High. Educ.* **2016**, *16*, 229–240. [CrossRef]
17. Orr, S. Risk-taking in creative education. *Art Des. Commun. High. Educ.* **2019**, *18*, 3–7. [CrossRef]
18. González-Zamar, M.-D.; Abad-Segura, E. Implications of Virtual Reality in Arts Education: Research Analysis in the Context of Higher Education. *Educ. Sci.* **2020**, *10*, 225. [CrossRef]
19. Abad-Segura, E.; González-Zamar, M.-D.; López-Meneses, E.; Vázquez-Cano, E. Financial Technology: Review of Trends, Approaches and Management. *Mathematics* **2020**, *8*, 951. [CrossRef]
20. Feng, Z.; González, V.A.; Amor, R.; Lovreglio, R.; Cabrera-Guerrero, G. Immersive virtual reality serious games for evacuation training and research: A systematic literature review. *Comput. Educ.* **2018**, *127*, 252–266. [CrossRef]
21. Merchant, Z.; Goetz, E.T.; Cifuentes, L.; Keeney-Kennicutt, W.; Davis, T.J. Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Comput. Educ.* **2014**, *70*, 29–40. [CrossRef]
22. Sun, H.; Hujun, B. Two-handed assembly with immersive task planning in virtual reality. *Virtual Real.* **2002**, *6*, 11–20. [CrossRef]
23. Tan, Y.; Niu, C.; Zhang, J. Head-Mounted, Display-Based Immersive Virtual Reality Marine-Engine Training System: A Fully Immersive and Interactive Virtual Reality Environment. *IEEE Syst. ManCybern. Mag.* **2020**, *6*, 46–51. [CrossRef]
24. Xia, Z.; Hwang, A. Self-position awareness-based presence and interaction in virtual reality. *Virtual Real.* **2019**, *24*, 255–262. [CrossRef]
25. Cabero, J.; Barroso, J.; Llorente, C. La realidad aumentada en la enseñanza universitaria. *Redu. Rev. De Docencia Univ.* **2019**, *17*, 105. [CrossRef]
26. Chandrasekera, T.; Yoon, S.-Y. The Effect of Augmented and Virtual Reality Interfaces in the Creative Design Process. *Int. J. Virtual Augment. Real.* **2018**, *2*, 1–13. [CrossRef]

27. Younan, S.; Treadaway, C. Digital 3D models of heritage artefacts: Towards a digital dream space. *Digit. Appl. Archaeol. Cult. Herit.* **2015**, *2*, 240–247. [CrossRef]
28. Abad-Segura, E.; González-Zamar, M.D. Effects of Financial Education and Financial Literacy on Creative Entrepreneurship: A Worldwide Research. *Educ. Sci.* **2019**, *9*, 238. [CrossRef]
29. Kori, K.; Pedaste, M.; Leijen, Ä.; Tõnisson, E. The Role of Programming Experience in ICT Students' Learning Motivation and Academic Achievement. *Int. J. Inf. Educ. Technol.* **2016**, *6*, 331–337. [CrossRef]
30. Rupčić, N. Learning-forgetting-unlearning-relearning—The learning organization's learning dynamics. *Learn. Organ.* **2019**, *26*, 542–548. [CrossRef]
31. Rai, L. The shifting landscape of open and distance learning. *Open Learn. J. Open Distance E-Learn.* **2019**, *35*, 1–3. [CrossRef]
32. Amirat, A. Use of information and communication technologies in e-learning and scientificresearch. *J. Distance Learn. Open Learn.* **2019**, *7*, 130–159. [CrossRef]
33. Lin, C.-L.; Chen, S.-J.; Lin, R. Efficacy of Virtual Reality in Painting Art Exhibitions Appreciation. *Appl. Sci.* **2020**, *10*, 3012. [CrossRef]
34. Tsolakidis, C.; Zouboula, N.; Fokides, E.; Vratsalis, C. Virtual Reality and Museum: An Educational Application for Museum Education. *Int. J. Emerg. Technol. Learn.* **2008**, 3. [CrossRef]
35. Kali, Y.; Sagy, O.; Benichou, M.; Atias, O.; Levin-Peled, R. Teaching expertise reconsidered: The Technology, Pedagogy, Content and Space (TPeCS) knowledge framework. *Br. J. Educ. Technol.* **2019**, *50*, 2162–2177. [CrossRef]
36. González-Zamar, M.-D.; Abad-Segura, E. La Realidad Aumentada como recurso creativo en la educación: Una revisión global. *Rev. Creat. Soc.* **2020**, *32*, 164–190. [CrossRef]
37. López-Meneses, E.; Vázquez-Cano, E.; González-Zamar, M.-D.; Abad-Segura, E. Socioeconomic Effects in Cyberbullying: Global Research Trends in the Educational Context. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4369. [CrossRef] [PubMed]
38. Erkut, E. Higher Education after Covid-19. *Yuksekogretim Derg.* **2020**, *10*, 125–133. [CrossRef]
39. Hinchliffe, G. Education, Learning and Freedom. *J. Philos. Educ.* **2017**, *51*, 430–442. [CrossRef]
40. Dene Poth, R. Professional Learning Networks and Mentoring in Education. *J. Digit. Learn. Teach. Educ.* **2020**, *36*, 80–81. [CrossRef]
41. Maunah, B. The Contribution of Family and Community Education in Realizing the Goals of School Education. *Am. J. Educ. Learn.* **2019**, *4*, 292–301. [CrossRef]
42. Nabukeera, M. The COVID-19 and online education during emergencies in higher education. *Arch. Bus. Res.* **2020**, *8*, 183–190. [CrossRef]
43. Opdecam, E.; Everaert, P. Choice-based learning: Lecture-based or team learning? *Account. Educ.* **2019**, *28*, 239–273. [CrossRef]
44. Widari, I.; Jazadi, I. Constructivist learning paradigm in the introduction to education subject. *J. Educ. Learn.* **2019**, *13*, 57. [CrossRef]
45. Dopico, E. Pedagogical Debates on Educational Innovation. *Am. J. Educ. Learn.* **2020**, *5*, 62–71. [CrossRef]
46. Prabandaru, R.D.; Lismadiana, L.; Nanda, F.A. Problem-based learning approach to improve service skills of badminton in physical education learning. *Int. J. Educ. Learn.* **2020**, *2*, 14–24. [CrossRef]
47. Joel, O.P. Learning Environment, Achievement Motivation and Career Decision Making among Gifted Secondary School Students. *Am. J. Educ. Learn.* **2019**, *4*, 50–61. [CrossRef]
48. Rusu, M. 1. Emotional Development through Art Expressions. *Rev. Artist. Educ.* **2017**, *14*, 227–238. [CrossRef]
49. Doyle, D.; Robinson, A. Artist interview: Annabeth Robinson, 20 March 2010. *Metaverse Creat.* **2016**, *6*, 87–99. [CrossRef]
50. Walker, C.M.; Winner, E.; Hetland, L.; Simmons, S.; Goldsmith, L. Visual Thinking: Art Students Have an Advantage in Geometric Reasoning. *Creat. Educ.* **2011**, *02*, 22–26. [CrossRef]
51. Rolling, J.H. The arts and the creation of mind. *J. Curric. Stud.* **2006**, *38*, 113–125. [CrossRef]
52. Karwowski, M. The Dynamics of Creative Self-Concept: Changes and Reciprocal Relations between Creative Self-Efficacy and Creative Personal Identity. *Creat. Res. J.* **2016**, *28*, 99–104. [CrossRef]
53. Hosseini, A.S. The Effect of Creativity Model for Creativity Development in Teachers. *Int. J. Inf. Educ. Technol.* **2014**, *4*, 138–142. [CrossRef]

54. Glăveanu, V.P. Creativity development in community contexts: The case of folk art. *Think. Ski. Creat.* **2013**, *9*, 152–164. [CrossRef]
55. Kaplan, D.E. Creativity in Education: Teaching for Creativity Development. *Psychology* **2019**, *10*, 140–147. [CrossRef]
56. Boysen, M.S.W.; Larsen, C.T. Does handoffs promote creativity? A study of a pass-the-baton approach to the development of educational games. *Think. Ski. Creat.* **2019**, *31*, 262–274. [CrossRef]
57. Watt, A.; Maddock, S. Computer games technology and higher education. *Virtual Real.* **2000**, *5*, 185–194. [CrossRef]
58. Klimenko, O.; Botero Castello, A.M. Concepciones de algunos docentes universitarios al respecto de la articulación de la creatividad en sus prácticas de enseñanza. *Psicoespacios* **2017**, *11*, 74. [CrossRef]
59. Osborne, J. The 21st century challenge for science education: Assessing scientific reasoning. *Think. Ski. Creat.* **2013**, *10*, 265–279. [CrossRef]
60. Edwards, B.I.; Bielawski, K.S.; Prada, R.; Cheok, A.D. Haptic virtual reality and immersive learning for enhanced organic chemistry instruction. *Virtual Real.* **2018**, *23*, 363–373. [CrossRef]
61. Abdullah, J.; Mohd-Isa, W.N.; Samsudin, M.A. Virtual reality to improve group work skill and self-directed learning in problem-based learning narratives. *Virtual Real.* **2019**, *23*, 461–471. [CrossRef]
62. Yan, Z.; Zha, H. Flow-based SLAM: From geometry computation to learning. *Virtual Real. Intell. Hardw.* **2019**, *1*, 435–460. [CrossRef]
63. Bannerman, C. Reflections on practice as research: The university, the artist, the research endeavour. *Digit. Creat.* **2004**, *15*, 65–70. [CrossRef]
64. Ehtiyar, R.; Baser, G. University Education and Creativity: An Assessment from Students' Perspective. *Eurasian J. Educ. Res.* **2019**, *19*, 1–20. [CrossRef]
65. Pyo, J. Latent Profile Analysis According to the Intelligence-Creativity Mindsets of University Students: Difference in Learning Flow by Laten Group. *Korean Soc. Creat. Educ.* **2019**, *19*, 37–53. [CrossRef]
66. Farmani, Y.; Teather, R.J. Evaluating discrete viewpoint control to reduce cybersickness in virtual reality. *Virtual Real.* **2020**, *24*, 645–664. [CrossRef]
67. Johnson, D.; Damian, D.; Tzanetakis, G. Evaluating the effectiveness of mixed reality music instrument learning with the theremin. *Virtual Real.* **2019**, *24*, 303–317. [CrossRef]
68. Chang, C.-Y.; Debra Chena, C.-L.; Chang, W.-K. Research on Immersion for Learning Using Virtual Reality, Augmented Reality and Mixed Reality. *Enfance* **2019**, *3*, 413. [CrossRef]
69. Glänzel, W.; Abdulhayoğlu, M.A. Garfield number: On some characteristics of Eugene Garfield's first and second order co-authorship networks. *Scientometrics* **2017**, *114*, 533–544. [CrossRef]
70. Nicolaisen, J.; Frandsen, T.F. Bibliometric evolution: Is the journal of the association for information science and technology transforming into a specialty Journal? *J. Assoc. Inf. Sci. Technol.* **2014**, *66*, 1082–1085. [CrossRef]
71. Abad-Segura, E.; González-Zamar, M.-D. Global Research Trends in Financial Transactions. *Mathematics* **2020**, *8*, 614. [CrossRef]
72. González-Zamar, M.D.; Ortiz Jiménez, L.; Sánchez Ayala, A.; Abad-Segura, E. The Impact of the University Classroom on Managing the Socio-Educational Well-being: A Global Study. *Int. J. Environ. Res. Public Health* **2020**, *17*, 931. [CrossRef] [PubMed]
73. Liberati, A.; Altman, D.G.; Tetzlaff, J.; Mulrow, C.; Gøtzsche, P.C.; Ioannidis, J.P.; Clarke, M.; Devereaux, P.J.; Kleijnen, J.; Moher, D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *J. Clin. Epidemiol.* **2009**, *62*, e1–e34. [CrossRef] [PubMed]
74. Abad-Segura, E.; Cortés-García, F.J.; Belmonte-Ureña, L.J. The sustainable approach to corporate social responsibility: A global analysis and future trends. *Sustainability* **2019**, *11*, 5382. [CrossRef]
75. González-Zamar, M.-D.; Abad-Segura, E.; Belmonte-Ureña, L.J. Aprendizaje significativo en el desarrollo de competencias digitales. Análisis de tendencias. *IJERI* **2020**, 91–110. [CrossRef]
76. Kalita, D.; Sai Baba, M.; Deka, D. An Empirical Study on the Asymmetric Behavior of Scientometric Indicator for Journal: A Comparative Evaluation of SJR and H-Index. *SRELS J. Inf. Manag.* **2018**, *55*, 128. [CrossRef]
77. Rousseau, R. Comments on "A Hirsch-type index of co-author partnership ability". *Scientometrics* **2012**, *91*, 309–310. [CrossRef]

78. Hu, Y.; Sun, Z.; Wu, D. Analysis of hot topics in soil remediation research based on VOSviewer. *IOP Conf. Ser. Earth Environ. Sci.* **2019**, *300*, 032098. [CrossRef]
79. Lee, C.I.S.; Felps, W.; Baruch, Y. Mapping Career Studies: A Bibliometric Analysis. *Acad. Manag. Proc.* **2014**, *2014*, 14214. [CrossRef]
80. Van Eck, N.J.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2009**, *84*, 523–538. [CrossRef]
81. Wu, C.-I.; Poo, M. Very fast evolution, not-so-fast publication—A proposed solution. *Natl. Sci. Rev.* **2020**, *7*, 237–238. [CrossRef]
82. Scanes, C.G. Ethics of Publication: Is Publication an Obligation for Researchers? *Poult. Sci.* **2007**, *86*, 2051–2052. [CrossRef]
83. Xiao, G.; Ding, L.; Cogrel, B.; Calvanese, D. Virtual Knowledge Graphs: An Overview of Systems and Use Cases. *Data Intell.* **2019**, *1*, 201–223. [CrossRef]
84. Rodrigues, E.; Pietrocola, M. Between Social and Semantic Networks: A Case Study on Classroom Complexity. *Educ. Sci.* **2020**, *10*, 30. [CrossRef]
85. Meinel, C.; Schweiger, S. A Virtual Social Learner Community—Constitutive Element of MOOCs. *Educ. Sci.* **2016**, *6*, 22. [CrossRef]
86. Abad-Segura, E.; González-Zamar, M.-D.; Luque-de la Rosa, A.; Morales Cevallos, M.B. Sustainability of Educational Technologies: An Approach to Augmented Reality Research. *Sustainability* **2020**, *12*, 4091. [CrossRef]
87. Wang, R.; Lowe, R.; Newton, S.; Kocaturk, T. Task complexity and learning styles in situated virtual learning environments for construction higher education. *Autom. Constr.* **2020**, *113*, 103148. [CrossRef]
88. Riemann, T.; Kreß, A.; Roth, L.; Klipfel, S.; Metternich, J.; Grell, P. Agile Implementation of Virtual Reality in Learning Factories. *Procedia Manuf.* **2020**, *45*, 1–6. [CrossRef]
89. Kabiljo, L. Virtual Reality Fostering Empathy: Meet the Enemy. *Stud. Art Educ.* **2019**, *60*, 317–320. [CrossRef]
90. Peng, X.; Gao, Z.; Ding, Y.; Zhao, D.; Chi, X. Study of ghost image suppression in polarized catadioptric virtual reality optical systems. *Virtual Real. Intell. Hardw.* **2020**, *2*, 70–78. [CrossRef]
91. Davydov, D.S. Innovation in the Sphere of Augmented and Virtual Reality Technologies in EU Member States and Other Countries of the World. *Probl. Econ.* **2019**, *1*, 5–11. [CrossRef]
92. Abad-Segura, E.; González-Zamar, M.-D.; Infante-Moro, J.C.; Ruipérez García, G. Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability* **2020**, *12*, 2107. [CrossRef]
93. Wang, Y.; Nakamura, T.; Sanefuji, W. The influence of parental rearing styles on university students' critical thinking dispositions: The mediating role of self-esteem. *Think. Ski. Creat.* **2020**, *37*, 100679. [CrossRef]
94. Lin, L.; Shadiev, R.; Hwang, W.-Y.; Shen, S. From knowledge and skills to digital works: An application of design thinking in the information technology course. *Think. Ski. Creat.* **2020**, *36*, 100646. [CrossRef]
95. Strelko, O.H.; Berdnychenko, Y.A.; Petrykovets, O.V.; Hrushevska, T.M.; Kruhlyk, M.V. Improvement of The Sorting Yards Operation Technology By Applying A Unified Information Database. Scientific Notes of Taurida National V.I. Vernadsky University. *Ser. Tech. Sci.* **2019**, *5*, 144–148. [CrossRef]
96. Stamelos, G.; Evangelakou, P. The game of rankings in a quality world university space. *Creat. Educ. Innov. Rev.* **2018**, 77. [CrossRef]
97. Barnett, R. Towards the creative university: Five forms of creativity and beyond. *High. Educ. Q.* **2019**, *74*, 5–18. [CrossRef]
98. Vasylenko, I.; Skiba, M.; Ivanchenko, A.; Belyanska, A. Green technologies in educational-educational process. *Ecol. Sci.* **2019**, *1*, 134–137. [CrossRef]