



Research Trends in the Study of ICT Based Learning Communities: A Bibliometric Analysis

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ABSTRACT

The current opportunities to develop and acquire knowledge in the network, Information and Communications Technology (ICT) play a major role in the learning process. This research offers a bibliometric analysis in order to examine the state of the research activity carried out in relation to the learning communities based on ICT. The indicators obtained show steady growth since the study of ICT applied to models of teaching and learning began in the nineties, presenting a significant increase in interest on the subject in the year 2005 and the highest productivity of publications in the years 2010 and 2011. The countries with the largest contribution to the study of ICT in learning contexts are China, the US and Taiwan, leading research processes in the area. It was possible to identify that some of the issues that have emergent behavior are related to knowledge sharing, confidence-building mechanisms and networked learning.

Keywords: bibliometrics, future trends, ICT, virtual learning communities

INTRODUCTION

The massification in access and use of information technologies and communications has become one of the main issues of concern in contemporaneity (Blanchard & Cook, 2012; (Valencia, Benjumea y Rodriguez-Lora, 2014). The configuration and reconfiguration of power relations, as well as changes in the dynamics of social interaction, represent major challenges to modernity (Cheng & Guo, 2015), and that is where the academic approach plays an important role in the understanding and the explanation of the new social, political, economic and cultural emergent phenomena. One of them is the emergence of virtual communities, understood as networks of individuals operating through the Internet, to discuss and develop

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State of the literature

- The integration of ICT in education must be based on four fundamental aspects: access, creation, collection and connection of the contents.
- Virtual learning communities are primarily based on a collaborative environment for training and exchange of knowledge, for this reason, over the years, there have been more frequent implementations of Web 2.0 services and designing databases.
- There are traditionally three types of virtual communities are identified: Virtual Communities of Interest (VCI), Virtual Participation Communities (VPC) and Virtual Learning Communities (VLC).

Contribution of this paper to the literature

- According to the growing and emerging issues identified in the results of the bibliometric analysis, the issues to be highlighted relate to collaborative work are: Web 2.0, trust building and networked learning.
- The proper design of learning environments based on ICT combined with the development and implementation of Web 2.0 applications represent new perspectives and ways to enrich and improve the quality of curriculum and education.
- The accumulation of publications is not present in a few journals, which allows us to infer that knowledge regarding the analyzed discipline is available to the public properly and that it presents high interest by different media.

common interests and objectives on social issues that transcend territorial boundaries. From the interactions that occur in massive role playing games to political revolutions, such as the Arab Spring, they have been some of the manifestations of the importance of these virtual communities today.

One of the phenomena that has transpired in virtual communities is related to the revitalization of collective learning processes (Alfonso, 2002), which some scholars as Coll (2008) have called virtual learning communities. Although the exchange of knowledge at a distance has a background in traditional mechanisms of communication (telephone, mail), virtuality has accelerated times of interaction, and therefore has generated an exponential growth in these practices that have impacted in the work of different actors involved in the academic, productive and social sector (Rivera, Sánchez, Romo, Jaramillo y Valencia, 2013; Valencia, Gonzalez y Castañeda, 2016). The latter is evident in the generation of virtual models of education; virtual learning objects; the offering of online courses as Massive Open Online Courses - MOOC -; open systems for the collective production of software code; blogs, forums, among others.

Since the 1990s, the above practices have been studied by various scholars from around the world, and this has been reflected in the growth of scientific production. Therefore, it is necessary to identify the research trends that have developed in this area with the aim of identifying the main themes developed, their findings and global knowledge networks that have been emerging between those who have been studying this topic.

ICT BASED LEARNING COMMUNITIES

The virtual learning community, is a term that has several meanings (Lee, Vogel, & Limayem, 2003); and to address it, it is necessary to conceptualize what is meant by community and the role of information technology and communications as mediators of learning.

The concept of community is a widely-studied concept and defined by sociology, with multiple definitions and contradictions, for purposes of this research, community is defined as a set of individuals who despite sharing certain interests, traits such as age, language, culture or geographical area, do not necessarily have an objective or objectives Coll (2008).

Now, for any community communication among its members constitutes an essential element (Coll, 2008; Ma, Fan, & Huang, 1999; Manning, Curtis, & McMillen, 1996; Wilson & Ryder, 1998) and this is where Information and communication Technologies (ICT) change the paradigm of territoriality of communities which states that direct communication between its members is only possible if occupying the same physical space (Moffit, 1999 cited in Lee, Vogel, & Limayem, 2003).

When a community uses ICT to maintain and expand communication, a virtual community is said to have emerged (Salinas, 2003; Fortenberry, Smith, McKenna, Knapp, & Cady, 2007; Valencia, Chalela, Bermudez y Bedoya, 2015). The virtual community is defined as "an online social network where people with similar interests, goals or similar practices interact to share information and knowledge while participating in social interactions" (Chiu, Hsu, & Wang, 2006). Although the term has been widely developed, according to Lee et al. (2003), it is the use of information technology for access and communication within the community, the common feature that appears in the multiple definitions of virtual community.

In relation to the above, Coll (2008) distinguishes virtual communities between Virtual Communities of Interest (VCI), "which allow members to get updates on their subject of interest information, anytime, anywhere"; Virtual Participation Communities (VPC), "who gather around a practice" and Virtual Learning Communities (VLC), those formed around a "content or specific learning task".

Thus, the VLC emerges to change traditional learning systems with the help of technology (Hiltz & Turoff, 2002; Liu, 2012; Steinkuehler, 2004). For Bustos & Coll (2010), they constitute "new educational environments, based wholly or partly in ICT". Engestrom presents a broad definition, cited in Ke & Hoadley (2009): "a developed activity system, in which a group of students, united by a common cause and trained by a virtual environment support, participate in collaborative learning in an atmosphere of trust and commitment".

Description of ICT Based Learning Communities

Virtual learning communities have particular characteristics as the deliberate choice of learning (Yoon & Rolland, 2012); the development and use of ICT as a form of communication

(Zheng & Wang, 2008); and the processes of interaction between members of a community that revolve around educational content (Palloff & Pratt, 2007; Salinas, 2003; Lee et al., 2003).

In addition, some authors (Palloff & Pratt, 2007; Pazos, Perez, & Salinas, 2001; Roland, Salvador, & Light, 2013) state that the main characteristics of the VLC are: collaborative learning (Mayorga, Celorrio, Lorenzo, Vélez, Barros, & Verdejo, 2007), since communications and contributions not only occur between teachers and students, but also among students; socially constructed meanings, since the "critical thinking process for structuring knowledge and learning" is fostered (Blanton, Moorman, & Trathen, 1998), through questions and answers about the contents previously established by the members who voluntarily want to be part of the community (Lee & Suh, 2015) and resource sharing among students (de Lima & de Carvalho, 2007), since members are organized to achieve greater understanding of the field of knowledge (Procaci, Siqueira, Braz, & Vasconcelos de Andrade, 2015); even when they are geographically dispersed (Yang, Chen, Kinshuk, & Chen, 2007), have a spirit of cooperation and willingness to share (Salinas, 2003), which ends forming relationships between members of the community in the long term (Lee et al., 2003).

The Generation of ICT Based Learning Communities

The generation of virtual learning communities depends on the ease of access to the Internet that people have in any country in the world. (Barrio & Barrio, 2007; Segura, 2009; Talebian, Mohammadi, & Rezvanfar, 2014).

Therefore, in developed countries, such as members of the European Union or OECD, the ability to access the Internet from home is more than 40% of the population, a ratio that is lower in other regions such as Latin America, the Middle East or Southeast Asia. The same applies to the number of personal computers, since in countries like the US, Japan, South Korea and Scandinavia, more than 70% of households own a computer (Segura, 2009).

By 2014, Internet penetration in North America was 89.6% and 70.4% in Europe; in contrast, Latin America was 52.4%, Asia 34.8% (although in Japan is 86.2%) and Africa was 27.5% (Internet World Stats, 2015); however, the use of ICT in primary education in Africa and the Caribbean is growing rapidly despite infrastructure barriers, costs, human talent and public policy (Scheuermann & Pedró, 2006).

In Europe, for example, 100% of schools have computers; countries like the United Kingdom, the Netherlands, Norway and Denmark have the highest ratios of computers per student, being the European average of 9 students per computer (Barrio & Barrio, 2007). Over 80% of schools in the UK and Scandinavia use ICT in teaching (Empirica, 2006 cited in Barrio & Barrio, 2007); while the European average is 74%. In Latin America, the highest of computers in households average is between 18% and 23%, in countries like Uruguay, Brazil, Mexico and Chile; and between 4 and 5% in countries like El Salvador and Paraguay (Sunkel, 2006). The connection to the Internet from home only reaches 17% maximum (in Uruguay). The number of computers in schools varies widely between countries: Uruguay and Chile above 70%;

Argentina and Mexico about 60% and about 38% Brazil. However, the use of ICT for education by students does not exceed 6% in countries where there is more number of computers per school (Sunkel, 2006).

The Benefits of ICT Based Learning Communities

For a virtual learning community to work, there is a need for a proper assessment of student needs, communication of expectations, creating a positive social environment, the establishment of collaborative projects in small groups, promoting the exchange of information, the availability of technology, and the willingness of participants (Bernard, Rubalcava, & St-Pierre, 2000). The benefits of virtual learning communities are multiple for both professionals and traditional and non-traditional students.

Virtual learning communities facilitate interaction between students, teachers, counselors and other stakeholders within an academic discipline at a low cost. In these communities, members can express their opinions and views, which favor a greater degree of participation compared to traditional academic environments, especially minorities, who have traditionally been underrepresented in society (Scardamalia & Bereiter, 1994).

Another major benefit of these communities is that they allow students to participate in activities at different times and places to achieve their learning goals. Members of the community can choose the resources; define their objectives and themes according to their interests, needs and motivations (Boulay & Van Raalte, 2013; Yang et al., 2007). Virtual communities also allow students to increase their capital and professional skills (Oh, Chung, & Labianca, 2004), permanent access to information enhances creativity and fosters the development of a professional identity (North & Kumta, 2014).

For professionals, virtual learning communities provide the opportunity to enhance their professional approach through the development of new knowledge and skills, leading to a further increase of labor commitment. Through these communities, they can build better professional networks, as there is the opportunity to interact with professionals from around the country or region, contributing to the increase of professional contacts, which have more information to get a better job (Allan & Lewis, 2006; Wellman, Quan Haase, Witte, & Hampton, 2001).

For non-traditional students (i.e. financially independent students, with family, working full time while studying, etc.), these communities allow them to "attend" class while at home with children or in their spare time. Virtual communities respect the needs of the members thereof. It also facilitates communication with peers to help each other through online study groups or chat rooms (Boulay & Van Raalte, 2013). In this sense, belonging to these communities helps problem solving, stress reduction, and increased confidence, and that collaboration improves learning (Scardamalia & Bereiter, 1994).

Finally, virtual learning communities provide the opportunity for some individuals to explore new roles, evaluate them and decide whether to accept them or not. In these communities, it has demonstrated this process of exploration and evaluation of possible functions, and adopting new identities (Allan & Lewis, 2006).

METHODOLOGY

The term bibliometrics originates with Pritchard (1969) who suggested that bibliometrics is the science that studies the nature and course of a discipline (as will lead to publications) through the calculation and analysis of the facets of written communication; However, when making a bibliometric analysis one should bear in mind that full access to scientific production is unreachable (Arguimbau, Fuentes, & Gallifa, 2013), therefore, options should be raised to gather information from an area of specific research (Fields, 2008). As an alternative to this analysis bibliometric studies emerge, which indicate the evolution of the research process of a discipline of knowledge (Fields, 2008), but for this to be considered reliable sources and rigorous knowledge, being the choice of database which will get the information the fundamental aspect in initiating this process (Norris & Oppenheim, 2007).

Bibliometrics in the field of "Virtual Learning Communities" was made from the data of academic publications reported by the Scopus database, as this provides tools to manage information and meets other criteria such as the number of citations and the accessibility that make it be used in this type of analysis in the literature (Hall, 2011).

Subsequently, the search equation was defined according to the object of the bibliometric study analysis. For this purpose, the following were considered as search criteria equivalent to ICT based learning communities (learning-group-digital, digital-students-academic, knowledge-community-virtual, virtual-community-education, education terms Learning-Community- virtual, student-virtual-access, and learning-students-virtual). In addition, those terms were searched in the title and keyword fields, and no time restriction for a broader analytical horizon. Finally, the following search equation was obtained:

TITLE ((learning W/2 group W/2 digital) OR (students W/2 academic W/2 digital) OR (knowledge W/2 communit W/2 virtual) OR (education W/2 communit* W/2 virtual) OR (education W/2 communit* W/2 ICT) OR ("learning communit*" W/2 virtual) OR (student* W/2 virtual W/2 access) OR (Learning W/2 students W/2 virtual)) AND KEY ((learning W/6 group W/6 digital) OR (students W/6 academic W/6 digital) OR (knowledge W/6 communit* W/6 virtual) OR (education W/6 communit* W/6 virtual) OR (education W/6 communit* W/6 ICT) OR ("learning communit*" W/6 virtual) OR (student* W/6 virtual W/6 access) OR (Learning W/6 students W/6 virtual)) OR ABS ((learning W/6 group W/6 digital) OR (students W/6 academic W/6 digital) OR (knowledge W/6 communit* W/6 virtual) OR (education W/6 communit* W/6 virtual) OR (education W/6 communit* W/6 ICT) OR ("learning communit*" W/6 virtual) OR (student* W/6 virtual W/6 access) OR (Learning W/6 students W/6 virtual)).*

The search equation raised yielded 226 records of academic publications related to the theme, which were then processed and interpreted using Microsoft Excel and Data Analyzer (Thomson Reuters software) to identify indicators of quantity, quality. In addition, free software CYTOSCOPE for calculating indicators of structure and network topology maps of authors used.

Among the indicators calculated in this study are indicators of activity (amount) for viewing the actual state of science, within which are the number and distribution of publications, productivity, dispersion of publications and collaboration in publications. On the other hand, are impact indicators (quality), which are designed to assess the incidence of authors, works and / or magazines in a specific area or discipline (Camps, 2008; Durieux & Gevenois, 2010) Finally, there are indicators that measure structural connections between different authors and publications (Rueda, Gerdri & Kocaoglu, 2007).

RESULTS

Based on the indicators proposed in the methodology, then the results found in this investigation are presented:

Indicators quantity

This section presents the bibliometric indicators of amount calculated for the area of ICT-based learning communities, according to the search equation obtained.

In **Figure 1**, the indicators show a growth in interest in the subject from 2006, 2010 and 2011 being the most productive years with 28 articles published in each. From 2012 comes a decrease in interest in the subject, while a decrease is evident in the number of publications.

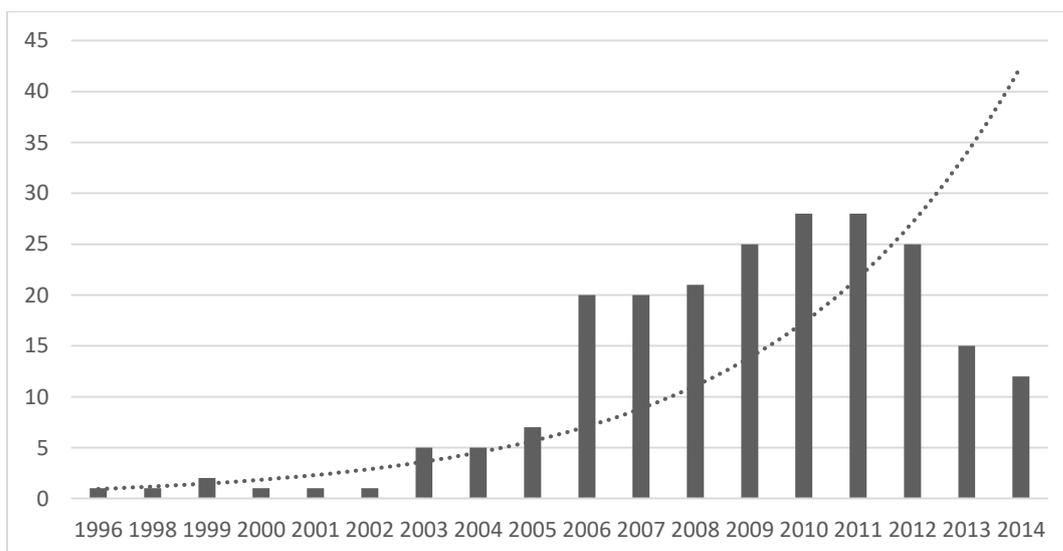


Figure 1. Number of publications per year (Source: compiled from bibliometric analysis)

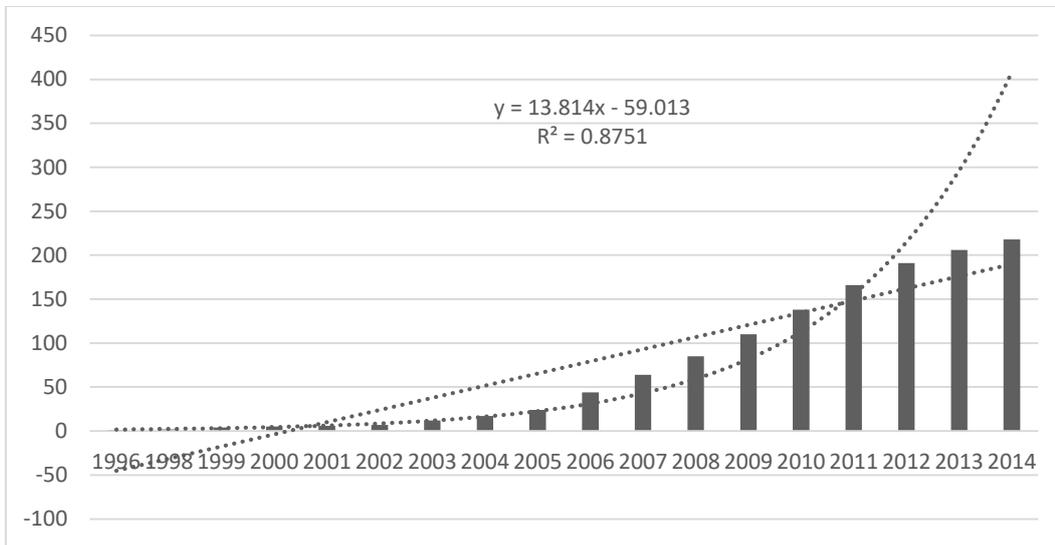


Figure 2. Number of accumulated publications per year (Source: compiled from bibliometric analysis)

It is evident that the amount of accumulated per year publications presents an exponential growth curve, thus fulfilling the law of exponential growth exhibited by Price, which states that scientific information is growing at exponential rates where every 10 to 15 years existing information doubles (Fernández, Torralbo, & Vallejo, 2004). Moreover, the coefficient of determination (R^2) equivalent to 0.8751 indicates that the exponential trend line is reliable. From the above, one can also infer that the number of publications on the subject of ICT based learning communities has increased significantly (see [Figure 2](#)).

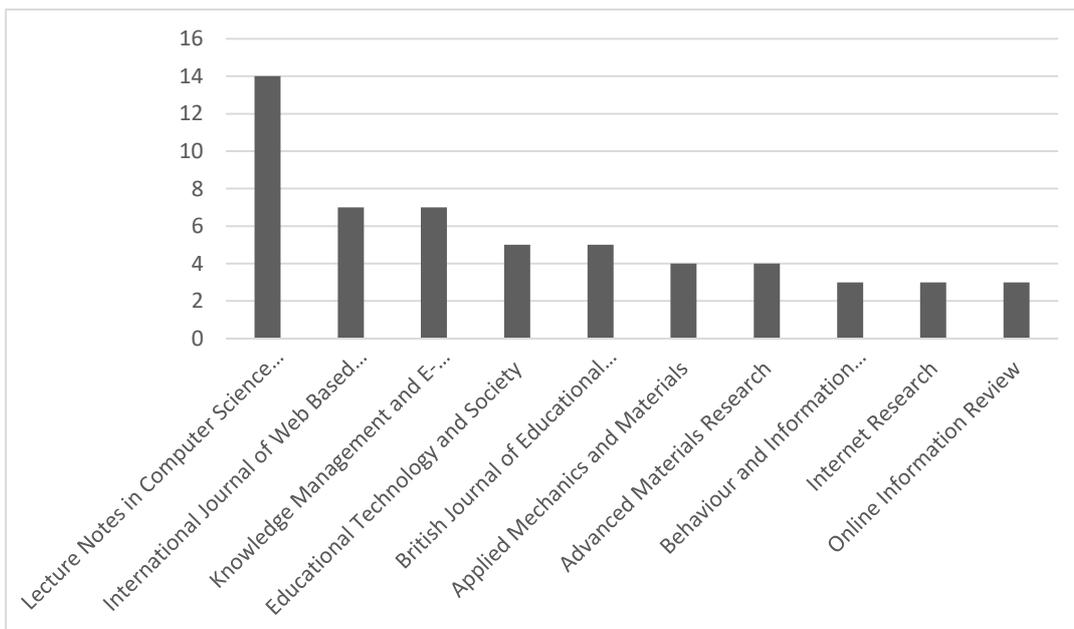


Figure 3. Number of publications magazine (Source: compiled from bibliometric analysis)

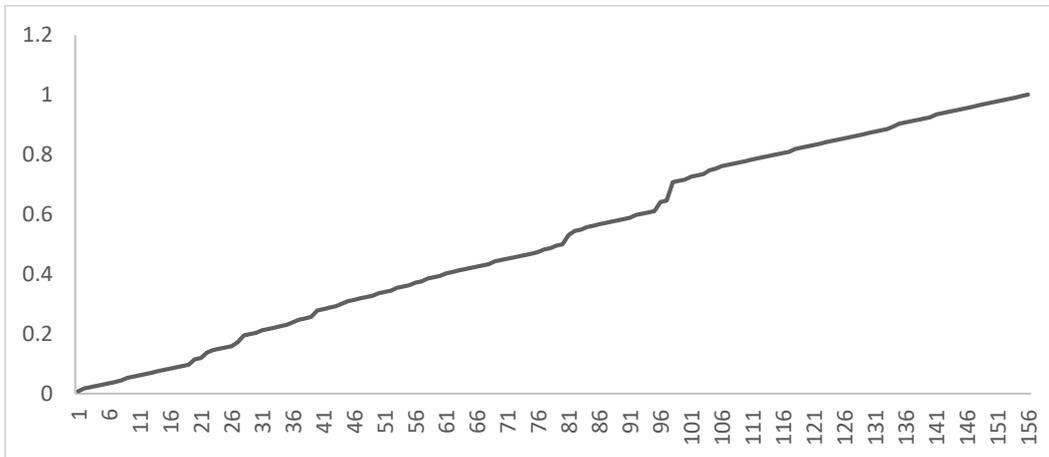


Figure 4. Cumulative percentage of publications magazine (Source: compiled from bibliometric analysis)

On the other hand, you can see the ten journals that have most publications on the subject, where the first: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) has 14 articles published (see **Figure 3**). Continuing the analysis of the cumulative percentage of publications per magazine (see **Figure 4**), it is concluded that there is no Pareto Law, since the 73.72% of the journals published 80% of the articles. In that sense, we proceeded to separate the percentage of journals by level of importance, obtaining 24.36% of the journals published 25% of the articles, and similarly, the 51.28% of the journals published 50% of the articles and finally the statistics showed that 73.72% of the journals published 75% of the articles. The information collected reveals that the distribution of articles by journal has a fair distribution, since there is no single dominating journal, for all records exported from the database.

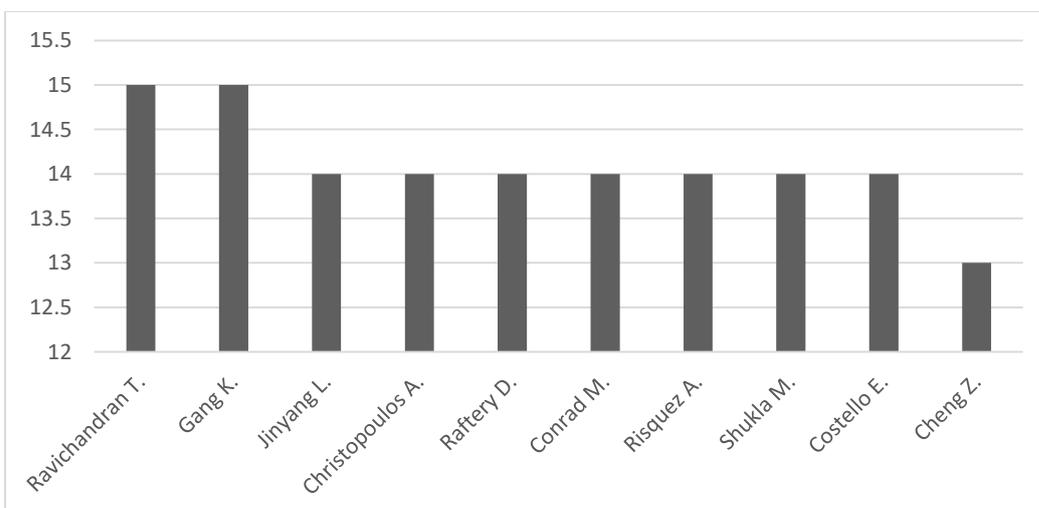


Figure 5. Number of publications in the top ten authors (Source: compiled from bibliometric analysis)

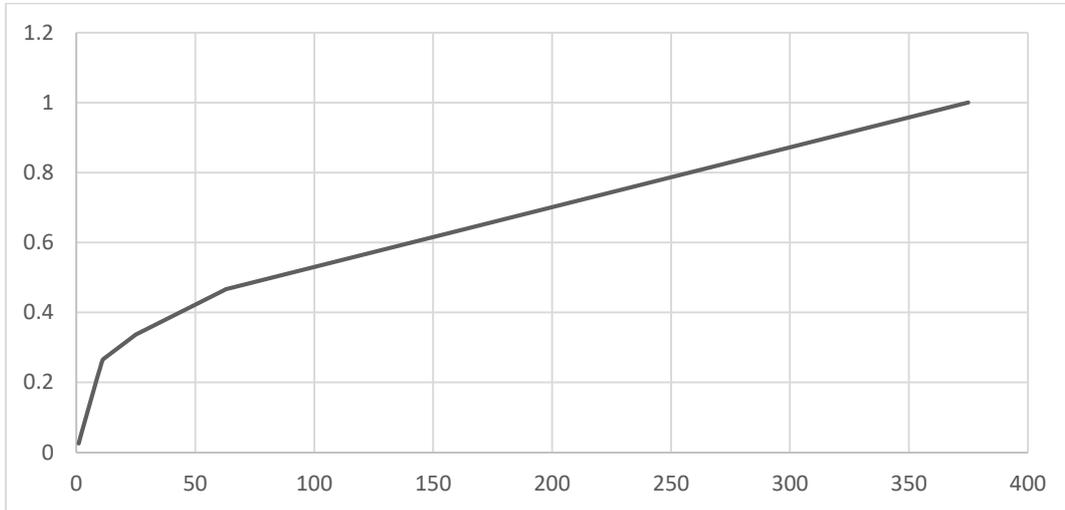


Figure 6. Cumulative percentage of publications of the top ten authors (Source: compiled from bibliometric analysis)

The ten researchers with most productions on the subject are led by Ravichandran T. and K. Gang with 15 publications each; the following seven have 14 publications respectively, this shows the great interest that exists on the subject, in addition to its timeliness and relevance in the society of the twenty-first century (see [Figure 5](#)).

In connection with the above, the cumulative amount of publications of the top ten authors (see [Figure 6](#)) shows that there is no Pareto Law, since the 40.68% of authors published 80% of the articles, given this situation, we proceeded to remove the accumulated publications for the first ten authors percentage, obtaining that: the 9.60% of authors published 25% of the items, 23.73% of authors published 50% of the articles and finally 37.85% published authors 75% of the articles. It was also obtained that 53.33% of the authors has a single publication on the subject. The information collected reveals that the distribution of articles per researcher has an equitable distribution, preventing prevailing publications of a single author in the literature.

Just as the Pareto Law and the exponential law for journals and authors are checked, the Law of Productivity is validated and thus checked for fragmented knowledge or of there is a disease of science, the latter name was introduced by 1978 pierce quoted by MV Josmel Pacheco-Mendoza and Lic.Yusnelkis Milanés Guisado 2009, and it is explained as the rapid obsolescence of scientific information.

As shown in [Figure 7](#), publications are not concentrated in a few journals. Later, it was verified whether or not the law of productivity is fulfilled; which postulates that as the number of publications increases, the number of journals decreases. The coefficient of determination is greater than 0.8 proving an appropriate adjustment of the proposed model for the case of productivity.

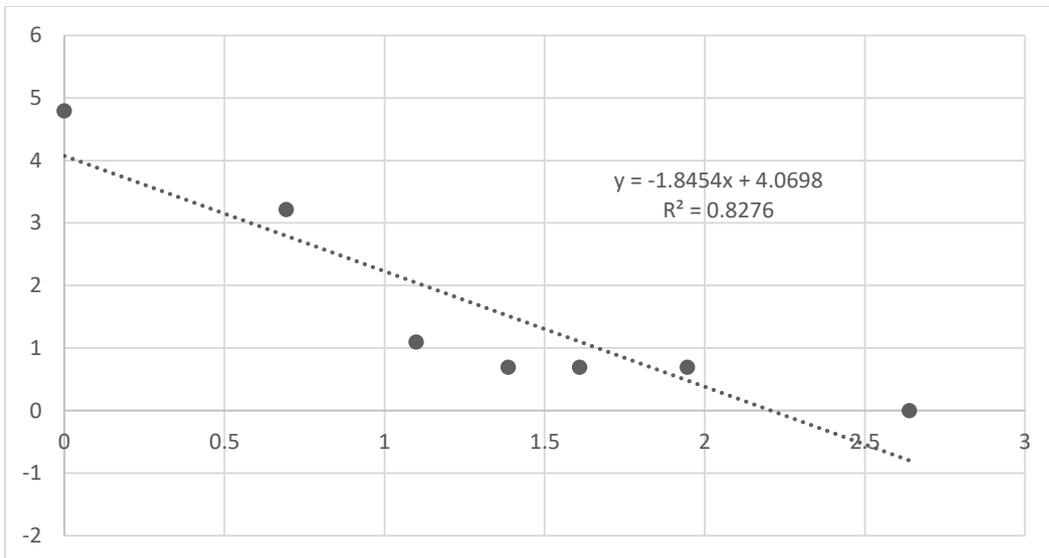


Figure 7. Law of Journal Productivity (Source: compiled from bibliometric analysis)

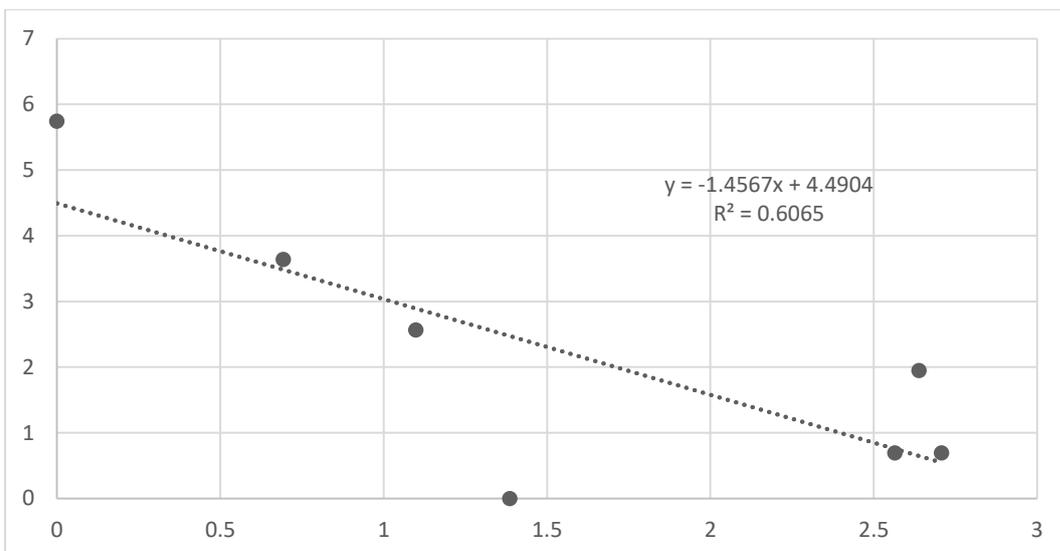


Figure 8. Law of Authors Productivity (Source: compiled from bibliometric analysis)

This same logic applies to validate the Law of Author productivity (see [Figure 8](#)) which states that the squared value of the regression coefficient of the adjustment on the accumulated number of articles against the natural logarithm of the authors is greater than 0.6, indicating that it does not completely fit the model. Finally, it is worth mentioning that 50% of the records obtained from the search equation correspond to papers presented at conferences (conference papers); and 41% to articles; the type of documents of the first two segments confirms the current interest again on the subject of ICT-based learning communities. Other types account for only 9%. This may be an indicator of current relevance of the topic and continuous diffusion in conferences and academic events.

Quality indicators

This section presents the bibliometric quality indicators calculated for the area of ICT-based learning communities according to the defined search equation.

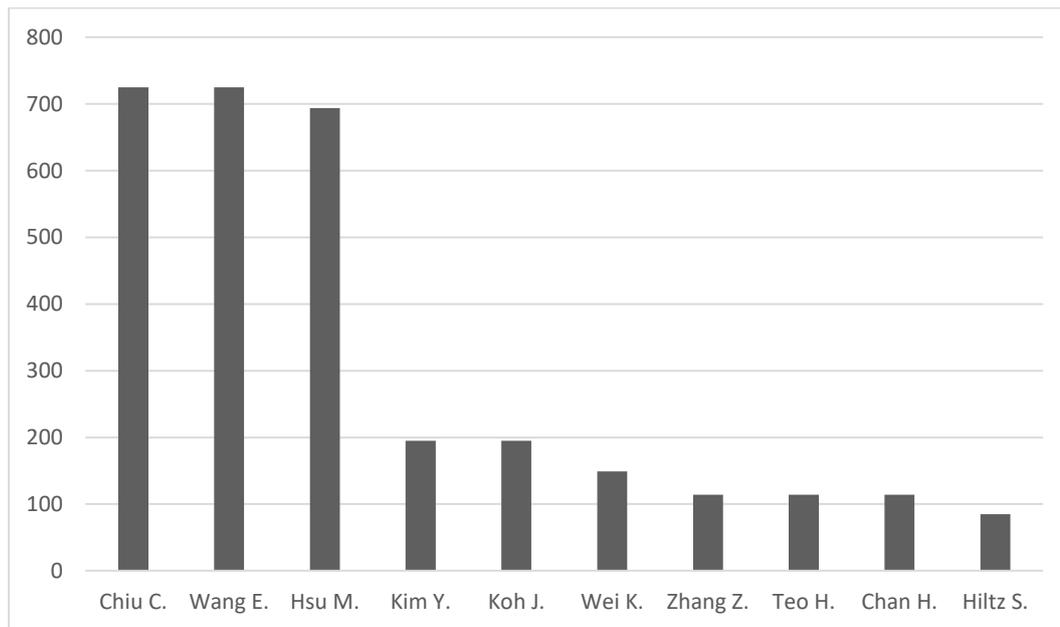


Figure 9. Number of citations by author (Source: compiled from bibliometric analysis)

With the quality indicators one can find the ten authors with most citations on the subject; in this regard, Wang Chiu C. and E. each have 725 citations; followed by researcher M. Hsu, with 694 citations; the following researcher in the group of the ten authors with the highest number of citations is Y. Kim, who has 195 citations (see **Figure 9**). None of these authors appear on the list of authors with most publications (see **Figure 5**) situation that exposes an imbalance at the level of knowledge generation and impact.

On the other hand, the indicator of quality that shows the impact of citations per journal (see **Figure 10**) has similarities versus the indicator of quantity showing the number of publications per journal (see **Figure 3**) since, three journals of the ten that make up the analysis, are in both indicators; which shows its high participation and impact on the generation and dissemination of the theme ICT-based learning communities in the following publications: *Educational Technology*; *Society, Behaviour and Information Technology*; *Online Information Review*. The journal with the biggest impact is *Decision Support Systems* with 694 citations confirming its contribution to the dissemination of the subject. The difference with other journals in number of citations is significant, because the next in importance, *Expert Systems with Applications*, has 200 citations.

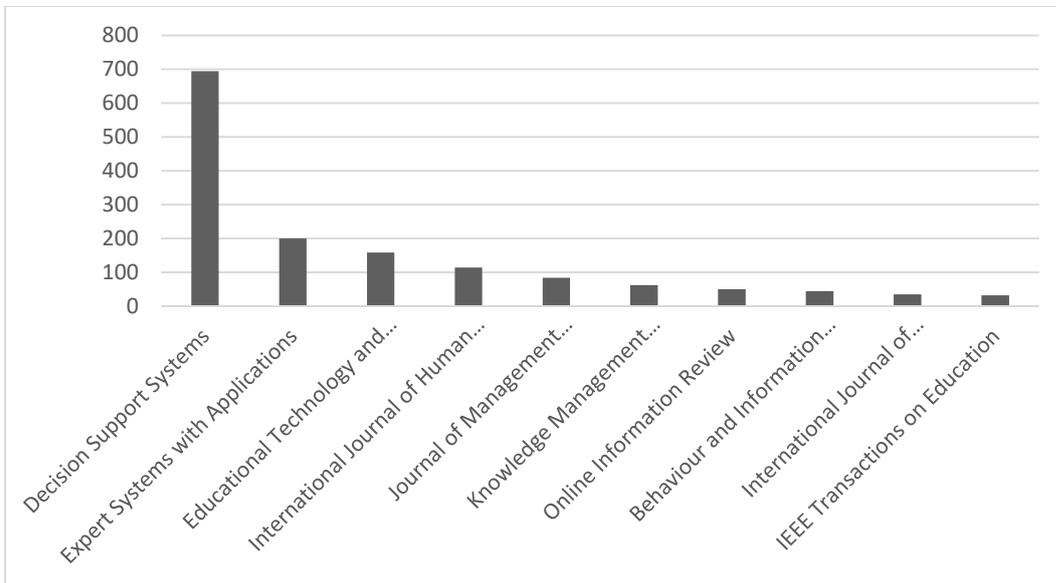


Figure 10. Number of citations for magazines (Source: compiled from bibliometric analysis)

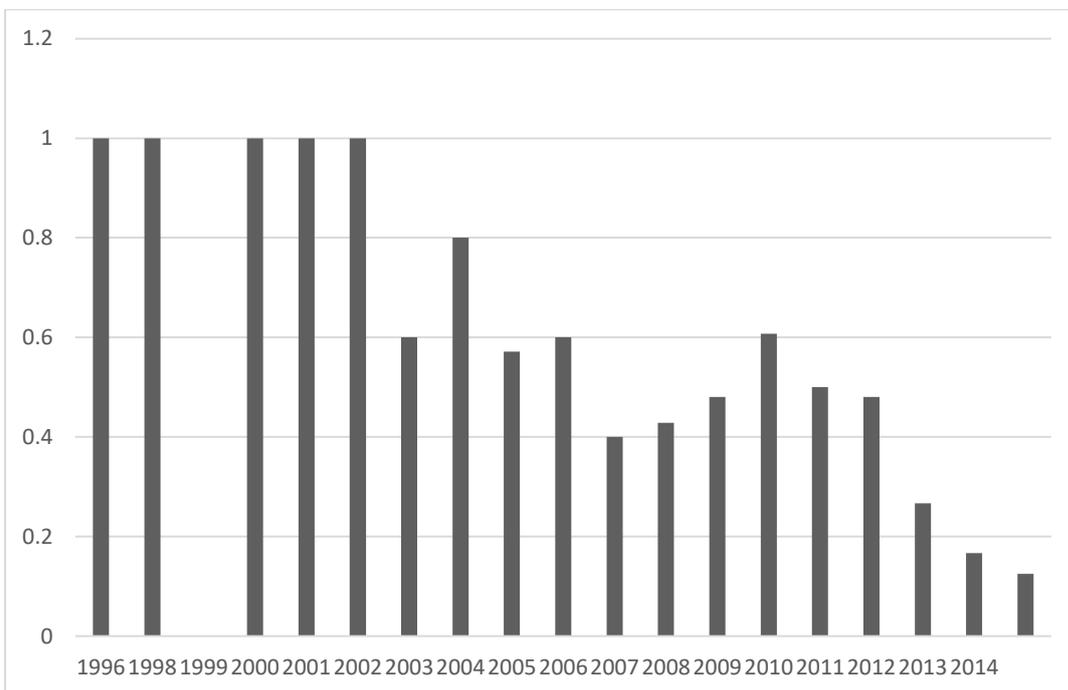


Figure 11. Number of citations per year (Source: compiled from bibliometric analysis)

Finally, the bibliometric analysis identifies that the issue was much studied in the beginning except for 1999, where no citation is recorded. In the second half of the analyzed range, between 2006 and 2014, the largest number of citations occurred in 2010, presenting a subsequent decline (see [Figure 11](#)).

INDICATORS OF STRUCTURE

Indicators of structure measure the connectivity between publications, authors and areas of knowledge, and often associated with the construction and analysis of social networks, such networks consist of nodes (vertices) and links; in the case of a bibliometric analysis, nodes are authors (people who research and publish their results) and links represent coauthorship (Rueda, Gerdtsri, & Kocaoglu, 2007). Such indicators are among the one-dimensional indicators, especially those of scientific production, dispersal of information and collaboration between authors and institutions, among others (Sanchez, 2006).

In this context, it was established that the networks of researchers through the years show certain peculiarities and relevant features, which are visible in the results of the indicators of the network of authors that are presented in Table 1; it is shown there that:

- There are 479 authors in the field, and given that the size of a network is very important because it determines the structure of relations (Fiscella & Vasquez, 2008), it can be considered that the network presented by the authors in the field, which considers the work relating to research centers, is extensive, which reveals that the researchers associated with the topic made a great effort to participate with other network experts. On the other hand, the distance can be a good indicator of network size (1,385), since it is the parameter that indicates that actors or nodes, on average, are mediated by at least one node to interact with the rest of nodes in the network, another indicator that sustain the size of the network is based on the average number of neighbors, and this shows that each author on average has published with 2 other authors (2,288), confirming the considerable extension of the network.
- Added to this, the network density is close to zero (0.005), which shows poor network connectivity and that the potential connection between the authors is not being adequately exploited. Nevertheless, this low connectivity is not uniform across the network property. There are certain areas with strong connectivity, indicating that the dispersion of production is significant, which ultimately results in a substantial centrality of some nodes, and conversely, the null connection of others, therefore, indicates a marked inequality to access or enter information and knowledge on the network.
- Additionally, subnets are formed; grouping between its nodes (authors) is significant because they have a degree of clustering of 0.595. This type of centrality defines the power that certain nodes have within a network to connect or to be a "bridge" between groups of nodes, and therefore are identified as nodes "hinges" in the management of resources that can flow in the network.
- As a result of the above, the network shows that researchers are very well connected in their neighborhood, so they can easily be influenced by other authors, and also mediate and/or control information from certain groups of nodes with the rest network in 36.32%.

Table 1. Indicators of Structure

Indicator	1996-2005	1996-2015
Number of nodes	68	479
Network Density	0,047	0,005
Network Diameter	2	4
Expected Characteristic Distance	1,009	1,385
Number of Connected Components	22	174
Average Number of Neighbors	3,176	2,288
Degree of Network Grouping (Clustering)	0,776	0,595
Network Centralization	0,090	0,014
Network Heterogeneity	0,795	0,739
Number of Isolated Nodes	3	39
Components Connected by Nodes	32,35%	36,32%
Components Isolated by Nodes	4,41%	8,14%

In **Table 1**, the indicators of structure are presented in two periods cumulatively (1996-2005 and 1996-2015), in order to perform an analysis of the evolution of the network of authors over time. There, one can see an increase in the number of authors (number of nodes) and the number of independent authors (number of isolated nodes) shown, which could indicate the existence of a research group, more or less stable, and probably consisting of an academic elite; however, the growth rate of the nodes is much larger than the isolated nodes and connected components. Therefore, there is a decrease in the dispersion of isolated and independent publications subnets (component variations indicators connected by nodes and components isolated by nodes respectively). Therefore, we can see that the subnets have been increasing in size and decreasing density, which is reflected in the evolution of the degree of clustering and network diameter. Another behavior that is evident in this network of authors, is that there is only one link of the shortest path connecting all network nodes (1,385) and in turn, the maximum distance between any pair of nodes in the network is equal to 4, which corresponds to a typology of management networks internal knowledge, used to maximize the application of individual knowledge to the objectives of the organization, these networks evolve through the thematic mapping of the experience within the organization, and conducive to sharing knowledge environments (Fiscella & Vasquez, 2008).

DISCUSSION – GROWING AND EMERGING ISSUES IN THE AREA OF REASEARCH

Figure 12 presents the main keywords that the search equation yielded, under the criterion of presenting only those which were repeated in at least five publications, it is important to note that the aim of analyzing the keywords is to locate articles related to the topic of interest, and thus encode and catalog these articles; with all the above based on the idea of displaying keywords as an essential tool when conducting a literature search. The

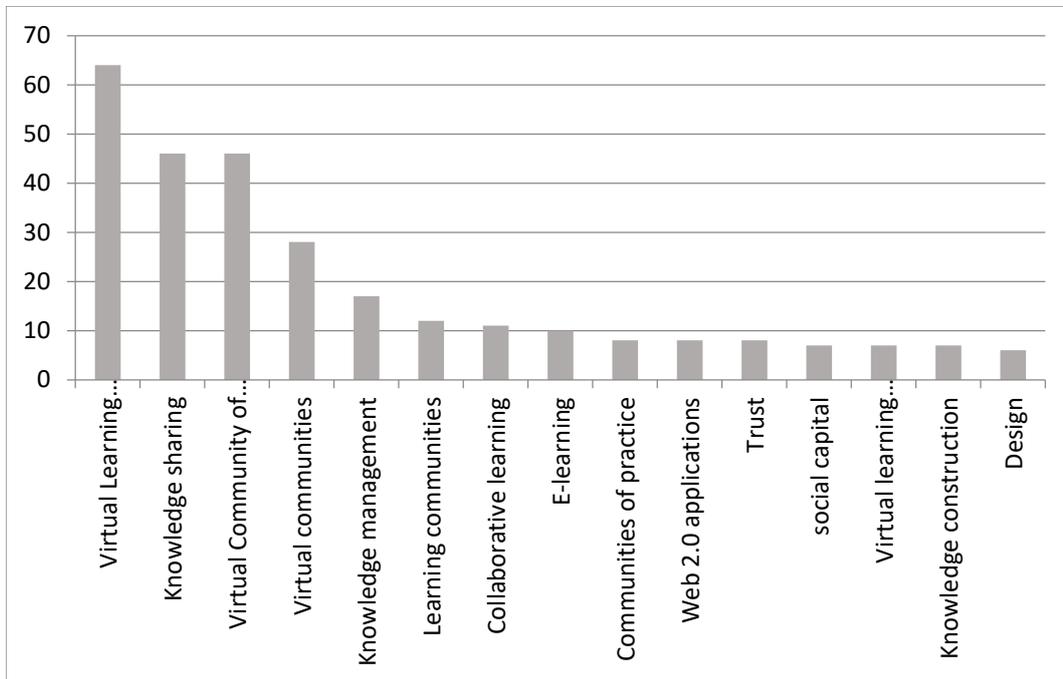


Figure 12. Behaviour of the main key words (Source: compiled from bibliometric analysis)

keyword analysis also allows revealing and representing different aspects of intellectual dynamics and the composition of scientific fields, as well as identify, over time, areas of expertise, research fronts and relationships between scientific disciplines and specialties and also changes in the various fields of interest (Miguel Moya & Herrero, 2007).

It then observed that the performance of keywords for this field reflects a significant growth in the use of the term "Virtual Learning Community (VLC)" which refers to a virtual learning environment in which a group of students with common interests and the same goal of learning get together to communicate, interact, discuss and work collaboratively in solving a problem that has arisen from active learning and permanent construction of knowledge, with the purpose of sharing each other's opinions, ideas, resources, knowledge and experience. Therefore, a VLC encourages progress in the construction of knowledge and collective knowledge, and ultimately, students achieve learning objectives and acquire the skills to a higher level (Gan & Zhu, 2007).

After this term, there is "Knowledge sharing" which is present in 46 different publications and has a special meaning within a virtual learning environment, since it has been identified as an important area of focus for knowledge management. In addition to this, its importance stems from the fact that it is based on the exchange of knowledge and experiences that effective management of knowledge is created, since the establishment of a learning network supplied with sufficient resources and services for it to function as a collaborative environment for learning (Hendriks, 1999).

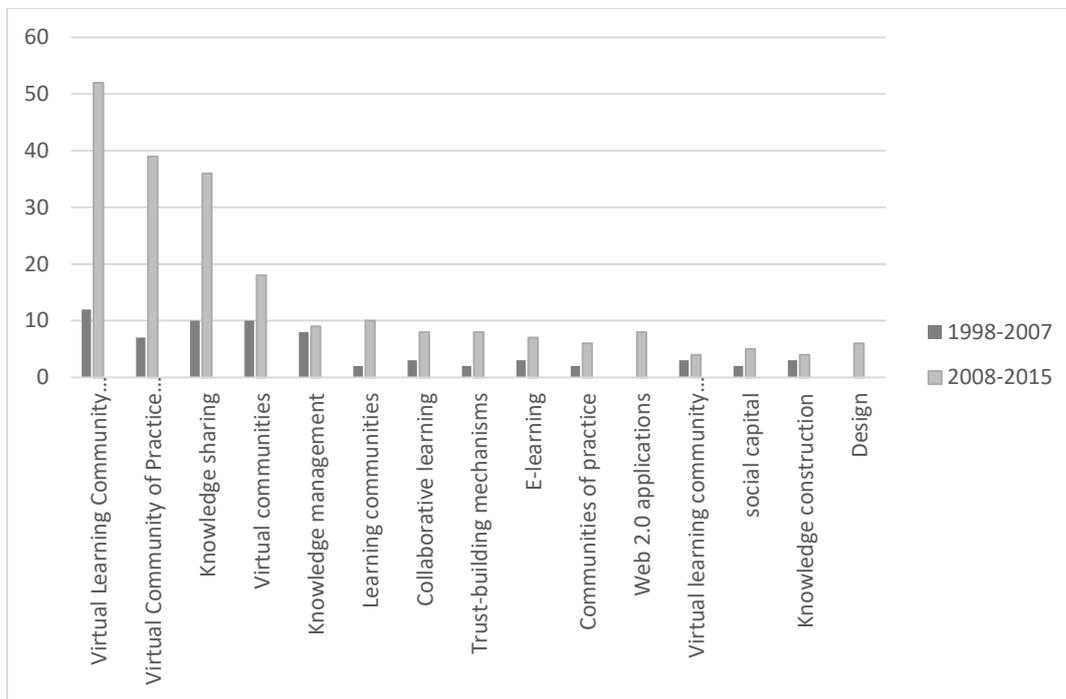


Figure 13. Emerging, increasing and decreasing topics (Source: compiled from bibliometric analysis)

Figure 13 presents the dynamics of keywords with increasing, decreasing and emerging fields of major keywords shown in **Figure 12**. The growing fields of interest are observed by researchers who write about the Virtual Learning Communities, these fields are: virtual learning communities (with a difference of 40 publications between periods), virtual communities of practice (32 publications difference between period and period), knowledge sharing, virtual communities, learning communities, collaborative learning, confidence building mechanisms, networked learning or online training.

In that vein, according to the bibliometrics analysis carried out, the following groupings of emerging issues can be highlighted, which have been selected as the affinity of keywords in order to show an overview of the research trends in the thematic discussed in this article.

Knowledge sharing

This theme addresses the elements that are related to the disposition of the members of virtual communities by providing and sharing valuable information with other members of the community. It further relates to the ability to give and contribute knowledge in order to receive similar collaboration from the other members, the above based on sustaining social interaction between people that make up the virtual community, setting as a goal to achieve the highest benefit of this (Jinyang, 2015). It can be seen then that one of the principles of this type of community is strengthened when one of the emerging themes is related to collaborative work among members. Against this, Li, Jiang, & You (2012) suggest that one of the biggest challenges posed by virtual learning communities is related to the exchange of

knowledge among members of the same, which means a greater effort by those who develop this type of scenarios to seek the strengthening of this important component. Finally, the authors argue that to promote the exchange of knowledge within these communities efforts should be focused on elements such as mutual trust, self-efficacy, reciprocity, motivation of participants and interpersonal relationships.

Virtual Community of Practice

This concept, defined as a group of people (could be informally) joined together by shared experience and passion for the same goal (Usoro, Sharratt, Tsui, & Shekhar, 2007), it is related directly with the exchange of knowledge, while its implementation requires, by default, ensuring that members of a virtual community of learning allow the exchange of knowledge held to enable the practice thereof; They must make use of different mechanisms and tools to enable it (blogs, social networks, wikis, etc.). In that sense, the virtual communities of practice are being recognized as key in the generation and assimilation of knowledge in different contexts, using different technological tools and by active and useful contribution of members (Palmisano, 2009). Thus, it has been identified that, in virtual communities of practice, confidence levels influence the exchange of knowledge among members of the same, determining that this factor reaches a high importance for receiving useful knowledge, moreover, it has been established that communities that fail to develop appropriate trust relationships, record the knowledge exchange activities (Usoro et al., 2007), leading to the third identified emerging topic called Trust Building.

Trust Building

In the context of virtual learning communities, and in the same vein of the exchange of knowledge and communities of practice, trust refers to a subjective belief of individuals in communities about the expected behavior of the other members, and they will not act opportunistically taking advantage of situations that may arise; becoming an important factor in the relationship of vulnerability and uncertainty (Chang, Yen, & Cheng, 2009). Thus, building trust in virtual learning communities translates into a very important element, and hence its emerging growth, being one of the factors that enables the generation and exchange of knowledge among members. Thus, Mangione, Cigognini, & Pettenati (2010) argue that knowledge construction is enabled by a set of factors related to trust that connect the elements influencing the results, motivation, collaboration and cognitive overload; elements to be taken into account to ensure learning processes within communities. Finally, it is important to emphasize the importance of trust while in virtual learning communities there is a reduced face to face contact between members of the same, so this factor must be present so that they can generate knowledge exchanges and allow the fulfillment of objectives (Usoro & Majewski, 2008).

With respect to declining fields, only evidence of the keyword related to knowledge management was obtained. Some authors mentioned in this paper argue that the detriment in

the use of the term has occurred because it is a complex and multifaceted concept that requires a robust theoretical basis subject to change and emerging research issues, for that reason, its study is contained in other themes that cover it, such as knowledge sharing and knowledge building.

LIMITATIONS

The analysis in this research was carried out from the SCOPUS database, which implies that can exist other different documents in other sources. It would enrich this analysis considering additional databases. Furthermore, it should consider for further researches to make an exhaustive textual analysis of texts to obtain significantly indicators on the topic, research approaches, methodological designs and findings of the articles in this topic of interest.

CONCLUSIONS

Learning communities, mediated by ICT have become an increasing trend used to contribute to the educational processes in institutions, which is reflected in the increase of publications in recent years. From the bibliometric analysis was possible to establish that the period of years with most publications corresponds to 2010-2011; presenting a particular decrease from 2012.

It is important to point out that the accumulation of publications is not present in a few journals, which allows us to infer that knowledge regarding the analyzed discipline is available to the public properly and that it presents high interest by different media.

With respect to the analysis of indicators of structure carried out in this research, it was established that although the network formed in the analyzed field has a wide dimension, indicating a strong exploration of the theme, not many structured connections between the authors are found, inferring a gap in the collaborative work of those who have written on ICT-based learning communities. In that sense, it is important to strengthen such collaboration between authors so that there can be a better use of knowledge, experiences and findings.

According to the growing and emerging issues identified in the results of the bibliometric analysis, the issues to be highlighted relate to collaborative work are, Web 2.0, trust building and networked learning. In this case, it is important that schools, especially in developing countries as in American Latin, strengthened the use of ICT to support learning processes, since as established in the review of literature, one of the main features offered by this type of community is to promote academic collaboration among members of the same, this coupled with the deficit of these countries against the use of internet and ICT in education.

In this sense, emerging fields (i.e. those who were only observed in the second period of the observation window) are "Web 2.0 applications" and "design". These keywords are related to new applications and trends that education is having in the information society, where the following are included: providing instructional materials and facilitating the optimum use of

the material in learning environments; and at the same time you must fulfill the function of serving as a connection to the outside. In this case, the proper design of learning environments based on ICT combined with the development and implementation of Web 2.0 applications represent new perspectives and ways to enrich and improve the quality of curriculum and education.

It can be inferred that virtual learning communities are primarily based on a collaborative environment for training and exchange of knowledge, for this reason, over the years, there have been more frequent implementations of Web 2.0 services (such as the. icio.us, blog, Twitter, YouTube) designing databases (educational materials, programs, links, articles, etc.) by means of certain aspects, which are accessible by all users (Sloep & Berlanga, 2011). Finally, and in addition to that mentioned by the authors, the integration of ICT in education must be based on four fundamental aspects are: access, creation, collection and connection of the contents, since the content themselves are not as important as the mechanisms by which it is accessed, created, collected or connect them knowledge (De la Torre, 2006).

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