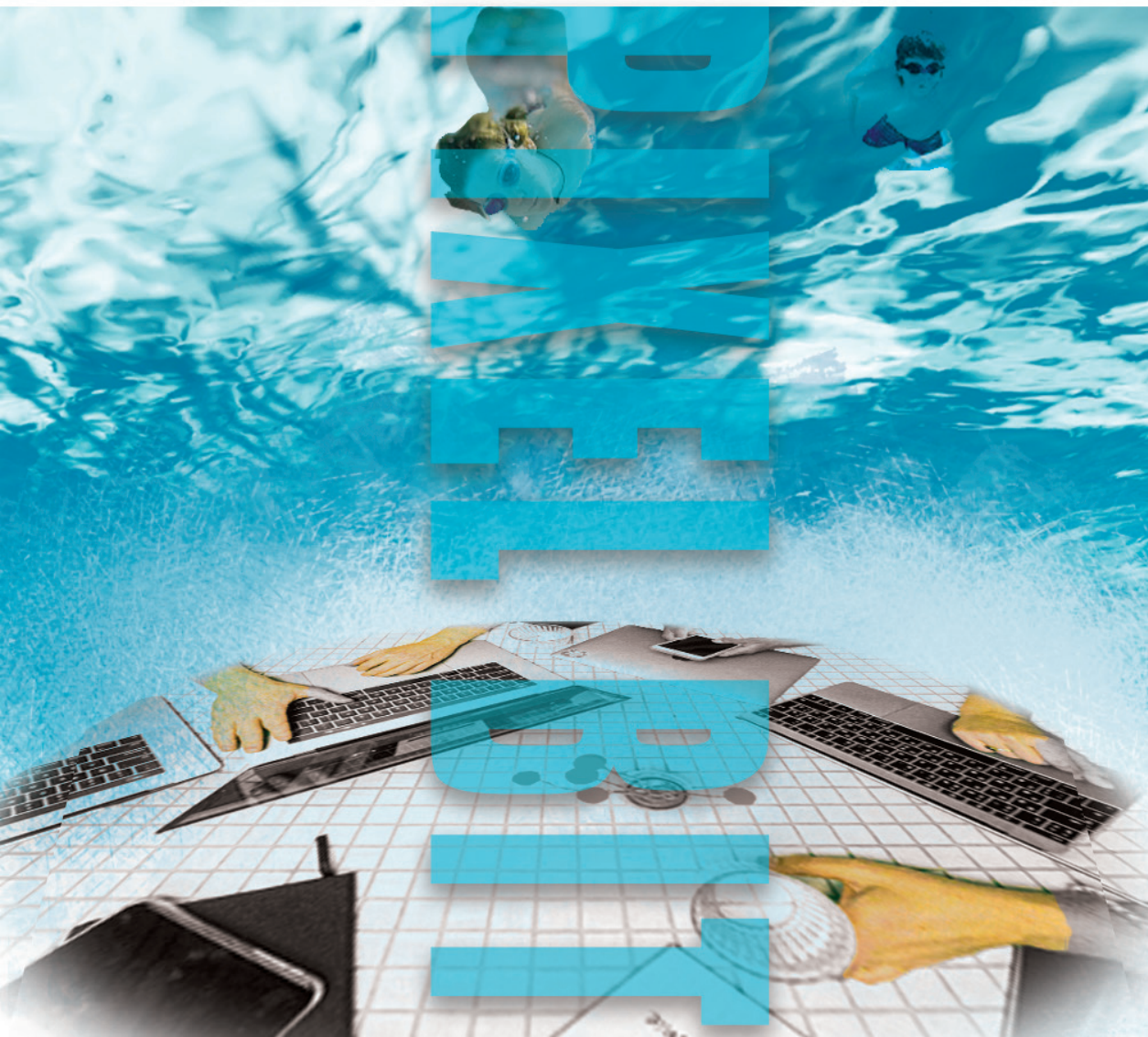


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## Rafodium: a social nets about augmented reality created in Google+

Rafodium: una red social sobre realidad aumentada creada en Google +

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### ABSTRACT

Analyzing the flow of movement that occurs in social networks is gradually acquiring greater relevance in the scientific community, which allows us in the first instance to establish the type of information “moving” within its significance and also to analyze in detail the flow of information that occurs in it. The article presents the process of creating a virtual community through the program Google+, which is found within the R&D research project “Augmented Reality to Increase Training (RAFODIUN)” granted by the Ministry of Science and Innovation of the Government of Spain (key: EDU2014\_57446P). The analysis is carried out from different perspectives ranging from nationality analysis of the participants, their gender, the volume of participations, the type of resources located, their content, and references to the educational context of the messages provided by the members. The replicas and counter-replies offered by the participants in the same message are also observed, as well as the usage of the option +1 provided by Google+ on the part of the community members. The network is analyzed under a bipartite network model with the PajecK program. One of the main conclusions that has been reached is the need to establish dynamizations so that the network is in a continuous flow of information. ■

### KEYWORDS

social networks; augmented reality; learning communities; virtual learning community

### RESUMEN

Analizar el flujo de movimiento que se produce en las redes sociales está adquiriendo de forma paulatina una mayor relevancia en la comunidad científica, lo cual nos permite en primera instancia establecer el tipo de información que se “mueve” dentro de las mismas y nos permite analizar pormenorizadamente el flujo de información que se produce en la misma. En el artículo se presenta el proceso de creación de una comunidad virtual a través del programa Google+. Esta se encuentra dentro del proyecto de investigación I+D “Realidad Aumentada para Aumentar la Formación, (RAFODIUN)” concedido por el Ministerio de Ciencia e Innovación del Gobierno de España (clave: EDU2014\_57446P). La analítica llevada a cabo se realiza desde diferentes perspectivas que van desde el análisis de la nacionalidad de los participantes, su género, el volumen de participaciones, la tipología de recursos que se ubican, su contenido, y las referencias al contexto educativo de los mensajes aportados por los miembros. También se observan, las réplicas y contrarréplicas de los participantes en un mismo mensaje, y la utilización de la opción +1 que ofrece Google+, por los miembros de la comunidad. La red es analizada bajo modelo de red bipartita con el programa PajecK. Como principal conclusión a la que se ha llegado es la necesidad de establecer dinimizaciones para que la red esté en continuo flujo de información. ■

### PALABRAS CLAVE

redes sociales, realidad aumentada, comunidades de aprendizaje; comunidad virtual de aprendizaje

## 1.- Introduction

The exponential growth of the Internet in the last decade is remarkable, its presence in the lives of individuals involves an overlap with all areas in which this takes place. The web has increasingly generated a network where Internet users can quickly develop their communication and social skills as well as the digital or technological ones, so that they can create an online identity, enabling them to be in constant socialisation with elements with which they can interact in their lives inside and outside the network.

It is important to note that social networks are today considered as a new way of establishing personal and learning relationships. As Marín, Vázquez and McMullin (2014) or Cabero-Almenara, Del Prete and Arancibia (2019) have pointed out, they will allow the creation of rich environments encouraging participation and interaction among members in support of improving organisations or institutions in which these are generated. We share with Asmawi, Suat and Zahra (2015) the conclusion that the incorporation of networks like Facebook to the teaching processes improves the learning outcomes. This is the reason why the theorists and those supporting the practical approach of higher education should be partakers of them, in regards to accomplish the request claimed to universities, that is to say, the actual existence of knowledge transference to society.

If we pay attention to the professional field linked to education, we will find that the creation of educational social networks has increased in recent years. So, we find that the vast majority of universities have been promoting their participation in them, understanding them as a showcase to raise awareness of college life. Moreover, putting an emphasis on teachers, they use the social networks primarily with the purpose of enhancing the process of teaching and learning, as it enables them to share information and exchange experiences, work collaboratively, create working groups, and answer questions or issues related to the theme (Maldonado, García, & Sampedro, 2019). Thus, the involvement of the social sphere with the academic one is enhanced, “trapping” the student’s desire to learn, as he/she observes that the tools used in his/her daily work can be linked to his/her academic life.

The incorporation of social networks like Facebook to teaching has reflected that these could be an alternative not only to traditional learning platforms, such as Blackboard (Araujo, 2019; Maldonado,



García, & Sampedro, 2019), but also a stimulus for the dynamics of the classroom, which can improve students' satisfaction with the teaching and learning process (Gaggioli, Mazzon, Mileni, & Rive, 2015). As Santamaria (2008), we consider that social networks carry more advantages than disadvantages in a general way, with some of the following advantages:

- «They create a new dimension of socialisation; allow the display of the contents from the plurality and with the right tool, they can create community.
- They provide the basis for thinking about a powerful tool for inclusive education.
- In primary and secondary schools, they are being used as a meeting place between the various actors of the process of learning/teaching. They allow people to recreate working groups and socialising activities through parents, teachers and students, although the usage is usually communicative, so in many cases we would talk more about social software rather than social networks.
- They are used as a connection with the companies offering employment. Here the professional networking (sites like Xing and LinkedIn) comes into play in order to come into contact with professionals from a particular area or field of knowledge.
- As identity and personality in a campus, they offer students a safe and convenient place to create links with other community members.
- They facilitate the work of immersion in a foreign language environment through networks or communities... Therefore, students will be required to read and write texts in that community, with the resulting learning built in practice.
- The SRS are being used as a starting point with regards to the organisation of conferences, seminars, workshops, etc., so that the audience can get to know and raise interesting issues for the organisers, speakers and lecturers. Thus, a feedback previous to the development of the event is generated, being very useful. Also, you can compile and connect links of the subject to expand the event.
- They can be used in educational organisations as a tool to reduce knowledge and technological gaps.

- We are inclined to advocate the creation of practice communities and learning networks as catalysts and builders of a digital identity».

Moving away from the negative aspects by which they have been characterised (isolation, addiction, creating false identities, sense of loss of time, ...), taking the positive aspects mentioned above and overlapping them to an educational perspective of networks, they represent a mechanism facilitating the direct training activities and the creation of virtual learning communities in which internet users share their concerns, knowledge, ignorance, needs... about a specific theme (Araujo, 2019; Marín et al, 2014; Lee & Suh, 2015; Barroso & Gallego, 2017; Borromeo, 2016; Cruz, 2016).

Virtual learning communities, although being technologically supported on a social network, usually have in common the fact of revolving around a theme. As regards the educational field, we can find examples in the Spanish-speaking country as it is the case of DIPRO 2.0 (<http://tecnologiaedu.us.es/portal/que.html>), Innovagogia (<http://innovagogia.jimdo.com/>) or in English ASCILITE (<https://ascilite.org/>), ed10x (<http://ed10x.com>), or Classroom 2.0 (<http://www.classroom20.com/>). All of them have in common regarding the learning process its flexibility, openness of the mentoring process and the enhancing of professional identity of its members (Strunga, 2015) as well as the continuity of ideas result to daily teaching experience.

In the following pages we present a virtual learning community supported by a social network (Google Plus) under the theme of augmented reality in education.

In the Horizon Reports published in recent years (Johnson, Smith, Willis, Levine, & Haywood, 2011; Durall, Gros, Maina, Johnson, & Adams, 2012; Johnson, Becker, Gago, Garcia, & Martin, 2013), it is noted that this is one of the emerging technologies of the moment, also indicating that its incorporation into the educational sphere will depend on the training and development of active methodologies by teachers (Durall et al, 2012). Its application to the field of education will be gradually done (Cabero & Barroso, 2016a, 2016b); so we find experiences as that developed by Baccaa, Baldirisa, Fabregata, Shuk and Graf (2015), in a vocational training centre in Spain, in which through the design of a mobile app called Paint-cAR, one could learn how to work cooperatively the design and how to apply colour to a

car. In this experiment it was found that 71.4% of the participating students indicated that the usage of the application improved in a satisfactory way for their learning. Following this research line, the results of the work by Chen, Lee and Lin (2016) with children with autism spectrum are also found. Their research confirmed that the combination of teaching supported in augmented reality and the traditional one improved the social and emotional behaviours of the children who had this disability. In general, we can consider that the main advantage of the application of augmented reality in education lies in the combination of three elements at the same time, as without them its usage is difficult. According to Di Serio, Ibanez and Delgado (2013), these elements are the combination of real and virtual objects in the same real environment, their aligning with each other, and the ability of running them in an interactive real-time way. In short, augmented reality will involve the use of a constructivist view of the methodology classroom (Cabero & Barroso, 2016a; Cabero & Garcia, 2016; Barroso & Gallego, 2017; Garay, Tejada, & Castaño, 2017; Sánchez, 2017), since it seeks to enhance the active learning and the learning by means of discovering on the part of the students.

As regards the social network used to support this community, we have selected Google Plus or Google+ (G+). In previous experiences (Marín, Vázquez, & McMullin, 2014), it has been noted the volatility of some free public networks, such as the case of Grouply, and the difficulties to create it. In this sense this network since its creation in 2011 has incorporated a large number of Internet users positioning itself in the second place in the social networks with more followers, behind Facebook. In networks, the privacy management and the community management are the same, the user can decide who to share the information with and it allows to organise the content in groups. Also, both incorporate the option of indicating that a content or comment is popular to the different members of the community, in the case of Facebook is «Like» and in the case of G + is a «+1». However, G + allows group video calls, whereas Facebook does not currently present this option. Therefore, this feature allows the teacher to teach a class session and that the students can follow it live or deferred. Also, it allows the opportunity to work with the documents at the same time, thus it can be created on the network as many groups as the groups formed in the classroom for teamwork. The main difference between the two networks is the ability to correct the uploaded comments that G+ offers but Facebook does not, as well as privacy on the rise of photographs if the first one does offer but not the second.

## 2.- The social network RAFODIUN

The proposal that we present here is part of the development of a research project R+D+I granted by the Ministry of Science and Innovation (key: EDU2014\_57446P) in the call in 2014, called Augmented Reality to increase Training, Design, production and Evaluation of augmented reality programs for university education

The project has been based on the following objectives:

1. Assessing the opportunities and potential offered by the different software used to create technological environments in the architecture of Augmented Reality in order to be used in university learning contexts.
2. Analysing the possibilities that the different types of Augmented Reality devices offer for its application in university education contexts.
3. Designing and producing different contents in Augmented Reality format to be applied in the university education context in different subject areas and assessing their possibilities for the students' performance.
4. Knowing the degree of motivation and satisfaction that the fact of taking part in learning experiences supported by Augmented Reality inspires among college students.
5. Creating a learning environment under the architecture of Augmented Reality, in e-book format, for the training of university teachers in the design, production and educational use of Augmented Reality.
- 6 Putting into action and validating the environment produced for the training of university teachers in the design, production and educational use of Augmented Reality.
7. Knowing the educational possibilities allowing the student to become producers of learning experiences supported by Augmented Reality.
8. Inquiring about the technical, curricular and organisational difficulties that Augmented Reality in order to be applied to university education contexts.

9. Creating a virtual community formed by university teachers concerned about the educational usage of Augmented Reality.

For the development of the first objective, it has been made a cast of the software producing augmented reality, discriminating between the owner and the free one. At present Aurasma and Junaio are being analysed, taking into account that they should cover all the research objectives, as well as the ability to have access to the entire education community (students and teachers). As regards the third objective, the unity of content called «Design, production and evaluation of ICT in education» has been created, which will be taught during the course 2015/2016 and 2016/2017 in the universities participating in the project.

Objectives 2, 4, 5, 6, 7 and 8 are in process, given the link that we can find among them. Finally, the goal 9 has been fulfilled, presenting here the initial results of its achievement. For its development the RAFODIUN community has been created under the architecture of Google+ on July 19, 2015. As of December 14, 2018, the date of completion of these analyses, the community had 654 members.

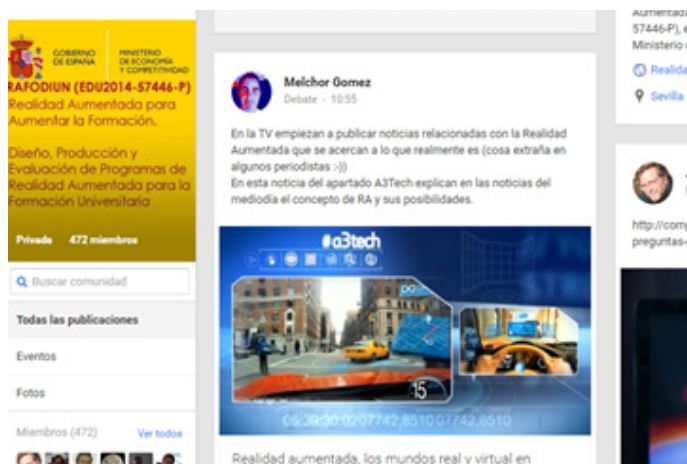


Figure 1. Inside of social nets

The analysis of social networks (ARS) is gradually acquiring some significance and it allows us to analyse in detail the flow of information produced in it (Wasserman, 2014). ARS, as Ferguson and Buckingham (2012, p. 4) suggest, «investigates links, relationships, roles and network training, and the analysis of the social learning network cares about how they are developed and maintain the support of learning. Due to the fact that it focuses on the development of relationships, and that technology is part of this process,

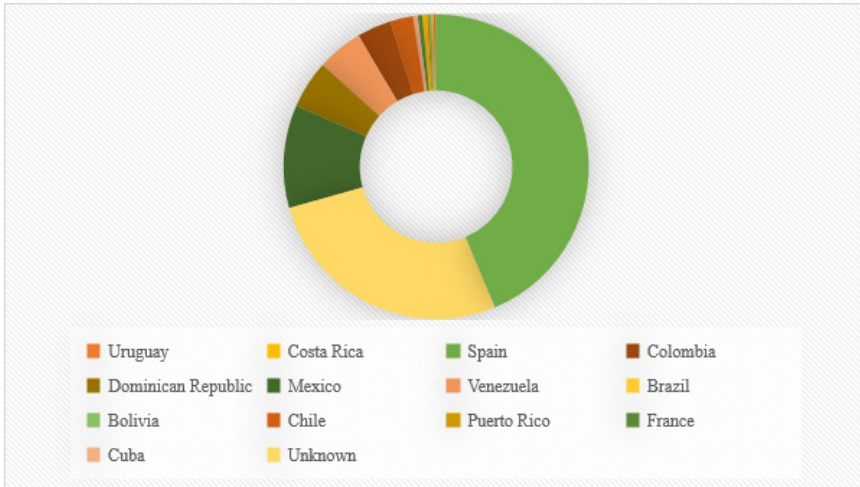
this kind of analysis provides the ability to identify interventions that can increase the potential of a network to support the learning of their actors».

This analysis is located within what has been called «Computer-Mediated Communication» (CMC), whose research is becoming increasingly important (Hrastinski & Keller, 2007), not only in the direction of seeking comparative elements between face to face communication and the communication established by means of electronic resources but also in the direction of analysing the type of interaction occurring in different tools of communication mediated both in a synchronous and asynchronous way, such as the forums and blog (Araujo, 2019; Garcia & Jocelyn, 2010) and virtual communities and social networks (Marin et al. 2014).

As Casquero, Ovelar, Romo and Benito (2014, p. 722) point «conversations obtained in a learning environment can be of two types: direct talks, in which the sender and receiver of the message are clearly identified (eg. one email) and indirect talks, which take place in a shared resource (eg. an entry of a blog, a forum thread or an entry in an adding like FriendFeed) and where the recipient of the message cannot be clearly identified». And as social networks belong to the second type, the above authors propose to use models of bipartite networks for their analysis (Casquero, Landaluce, Portillo, Benito, & Romo, 2009; Casquero et al., 2014; Wasserman, 2014).

Bipartite or bimodal networks are considered to be networks «with two sets of nodes in which connections are established only between the nodes of different sets» (Casquero et al., 2014, p. 725). In the particular case of the community in Google+, which is the one used in this case, is a kind of node constituted by the community members, whereas the other node is constituted by the messages or posts that the members write within that community, as members do not directly interact among themselves, but through the posts. The analysis period presented corresponds to the 4 years of its working, the community have 652 members (53.05% are men and 46.95% are women). The countries where people are participating can be found in Graph 1. As it can be observed these countries are Spain (54%) followed by Mexico (9.06%). It is worthy to highlight that 28.17% of the participants did not indicate the country of origin.





**Figure 1.** Members of RAFODIUN. Source: own production

If we compare the country and gender of the participants we can see that except in Venezuela and Cuba, where the presence of women is higher and in Costa Rica where it is parity, in all countries the male presence is higher (Hidalgo & Muñoz, 2017). In analysing the network by means of the model of bipartite network with the Pajeck program, we offer a graphical representation in which the red colours make reference to the members of the community and the green ones to the posts.

In this figure we can observe those members of the community who have been more active, which are located in the centre of the representation, with the members with less or no participation being on the periphery.

Using another algorithm of representation that the program offers, we can see the same network in a different way. Specifically, the two members, in the centre, that is to say, in the first circle, unite a great amount of messages (in green, first circle of post) around which other people interact; in red, the second circle of the members. These, in turn, bring together a lot of other messages, in green, the second circle of post, in which people from the periphery who are less participatory are also involved. We could therefore say that the virtual community is formed by a small group making strong participations and by a large group of members with a very significant participation, but included within the core group and the different members.

The analysis also allows us to observe clearly how a number of members located at the periphery have done a significant amount of contributions which have not been considered by the members of the

community yet. Also, we can check how four members have made any some of participation which has not been considered by any member of the community, and at the same time they have not participated nor interacted with anyone in the community. Finally, some members who have participated only once but when receiving the contribution of any member they are related to the community.

However, as Casquero et al. (2014, pp. 723-724) indicate, «while it is preferable to analyse networks in its original form, there are a few methods for analysing these networks, so they tend to be projected onto one-part networks (with one set of nodes) by a process in which two nodes are connected to a set of nodes

In addition, if we count the number of conversations that each member of the network has had with other colleagues of the same community, it can also be used to represent the «strength» of the relationship between each pair of members, which is represented by the thickness of the node and the relationship line.

If we pay attention to the days and the number of posts that the members have made, it has been found that the day of greater involvement has been in 2015 with 11 posts, followed by January 4, 2016 with 10 posts; 4 December, 2015 with 8 posts and September 15, 2015 with 6 posts, in June 6, 2017 with 10 post and finally in September 20, 2018 with 3. In total, at the end of 4 years of working they have been published 2580 posts at a rate of 1.25 posts per day.

Of the 654 members in the network, we can only consider dated today, the existence of 45 active participants, meaning participant or active subject that has participated in the community at least once. As we can appreciate only the 15.83% of subjects can be considered as active, with 46.51% of them being male and 43.49% female. In regards to the gender and participation, 68.4% of the posts have made by men whereas 31.60% were women. The highest number of posts made by a subject has been 47. It is significant to note that six subjects assemble the 52.83% of all interventions the ( $f = 112$ ): S4H (47, 22.17%), S2H (17, 8.02%), S16M (13, 6.13%), S18M (13, 6.13%), S11H (11, 5.19%), and S22H (11, 5.19%).

Out of the 212 posts in 94 there has been some involvement of a community member, what represents a 44.34% of the total; that is to say, they have produced some kind of written response to what had been submitted by the author. In 25 out of the 94 there has been some type of response by the author

of the post to the comments made by a member of the community, what means that in 26.60% of the posts in which there has been some kind of written participation, the author of the post has replied to the comments made by a member of the community. In 3 of the 94 posts the discussion has taken place between members of the community; that is, in 3.19% of the posts it has happened that after being presented by one of the members, others have discussed its contents without the participation of the author of the post.

If we focus the attention on the feedback that the contributions produce, we can say that this is very scarce, because we find that in 125 posts nobody has participated, in 40 of them only one member participated, 21 posts have been fed back by 2 participants; 12 by 3 participants; 8 posts were fed back by 4 internet users; two posts were commented by 5 and 6 members of the network, the same as 2 posts which were fed back by 7 and 8 active subjects.

In relation to their themes, the first verse about «Augmented Reality Website of SAV from the University of Seville» and the last one was called «Integrated video with notes through Augmented Reality». In general, these have mainly dealt with educational experiences in formal settings (32.5%) and in other settings (18.5%) (see graph 2).

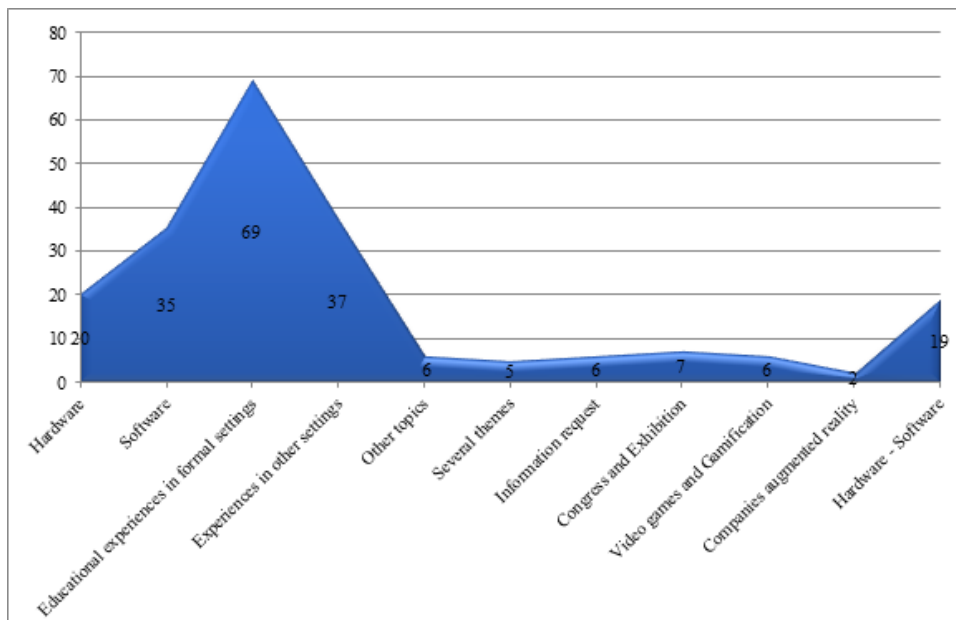


Figure 2. Themes of the posts

Paying attention to the issues raised by the posts related to the educational experiences in formal environments, we observe that 56.1% are referred to general experience, and 20.8% to various educational levels simultaneously. The other hand, putting the turning point on if any of the above experiences were related to a specific topic as the inclusive or special education, it has been shown that only the 1.4% of the posts were referred to it and 98.6% did not make mention of it. With respect to the contribution in the posts of material we see that the 62.8% brought URL Websites working or making reference to the Augmented Reality

Finally, it is worth noting that Google+ unlike other networks allows the usage of the option +1. This means that the Internet users taking part in the network can indicate which posts are the ones they like most, with which they feel more identified or with which they agree more. It has been proven that this tool is not very used, as we find that 45.3% of community members has not marked it in any of the posts made, whereas 16% have done so in one of these and 15.6 % in two, 12.7% in 3 times, the 6.1% in 4 of the post of the community, and 2.8%, 0.9% and 0.5% have made it in 5, 6 and 7 interventions.

### 3.- Conclusions and limitations

The creation of a social network focused on a theme, which makes it a learning community, as we can appreciate, gain significant relevance. However, the first handicap that we have found as Marin et al. (2014) is the limited participation of its members, so their growth and creativity will be undermined since this is made possible by the participation of all the Internet users (Maldonado, García, & Sampedro, 2019). In any case, we must not forget, as it is suggested by Wasserman and Faust (2013) that all the networks tend to centrality, marked by the prestige of some specific members. We believe that one of the reasons for the limited participation may be the subject lacking attachment to a community or group, foundation that according to Lin (2008), holds up, among others, a virtual learning community. As in other studies we see that women are more reluctant to participate actively (Fogel & Nehmand, 2009). Consequently, for the RAFODIUN network to be more participatory and dynamic, it will be necessary to generate a greater commitment on the part of its members, which in turn means that those responsible for it have to use more time in invigorating interventions. This low participation contradicts the results achieved by Eyyam, Menevis and Dogruer (2011) who pointed out that social networks had

increased by 56.6% the academic relationships among students, since as we have checked, they take the technological dynamic role of learning and in this case of guiding (Hidalgo and Muñoz, 2017). Two aspects stand out from the network. On the one hand, its strong Latin American orientation and, on the other hand, the existence of a percentage similar between men and women, although men are who have participated more in making contributions. We have found that the RAFODIUN network has incorporated materials of different typology that Google+ allows, although we have also found that some of the options that the said network allows, such as those of events or surveys, have not been used. Text options, links and videos have been mainly used.

We check that the difficulties in its creation and development are not subject to the fact that the tool in which it has been generated lets this be public or private nor subject to technical difficulties which are present. However, we believe that its privacy eliminates the intrusion of subjects which do not contribute to the growth of the network and its members. Finally, the biggest drawback from our point of view that we have faced, is the lack of educational literature (research and teaching innovation experiences) concerning the issue.

### **Limitations**

On the one hand, the main limitation or handicap that this project encounters are the disappearance of Google+ as a service. This has caused that all the project study and the development process has been affected therefore, as the visibility that the social network gave to project has been lost.

On the other hand, as it is an eminently Latin American network, the Anglo-Saxon side is left aside, what can limit the participation of other positions, visions or beliefs around the topic

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