DOI: https://doi.org/10.31686/ijier.vol10.iss5.3756

FREE SOFTWARE: A Social, Educational, Collaborative and Open to Human Inventiveness Network.

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Abstract

Technological advances are present in different segments of society and, in education, social transformations are consolidated as an important element for technical, human and political development, for that, it is necessary to dialogue with technologies that converge to the same look, in this sense. , Free Software represents an advance in this perception of collaborative movement, acting as a link to a scenario that represents the sum of all knowledge in the teaching versus learning relationship. This model used in Free Software, which prioritizes the subject in the construction of knowledge, constitutes an important ally for the consolidation of the elements present in the spaces of education, whether due to the cultural diversity resulting from the existing relations between the production communities, whether by the amount of existing technological resources in the different areas of knowledge and for the different levels of education. The graphic representation, supported by the theory of networks, about the existing relationships between the different areas of knowledge and the various levels of education on the quantity of software cataloged in the database of the Blog Software Livre na Educação (BSLE) of the Federal University of Rio Grande do Sul (UFRGS), although not exhausted by the present study, presents itself as an important analysis tool for discussions that dialogue with this theme, and which aims, in addition to bringing the reader closer to the theme, a computational model on the elements present in these relationships, contributing to the analysis of potentialities and specific needs in each area, especially in the educational context.

Keywords: Free Software; Networks; Graph Theory; Education.

1. INTRODUCTION

It is undeniable the existing technological advances due to the growth of information technology, among these advances, we can highlight communication through computing resources, a technological revolution generated from the possibility of union between communication and information technology. All this technology assumes that there is a network, not only in the epistemological sense of the word, but also of the existing relationships that effectively constitute communication between people, through the technologies that are part of it.

As we have the possibility of integrating several networks into just one, we create a scenario in which physical distances are ignored and we enter a universe called cyberspace, which is characterized as a

potentializing agent of this communication process and that, technically, is built by a series of professionals with the knowledge to make this worldwide communication possible, but which, effectively, has in its subjects, the most important element of this network, corroborating with Levy (1997, p.29), when he states that , "Cyberspace as a support for collective intelligence is one of the main conditions for its development". Sharing information favors the scientific, cultural and technological enrichment of a community, the need to use information and communication technologies is notorious, especially communication, in view of the need to share information, as a guarantee of the evolution of humanity. This scenario brings users of these computer programs closer to such an important element for the construction of knowledge, which is information, and this must be available so that this "ocean of information", to paraphrase Levy , is navigable. These computer programs, known as software, or even, in a more current scenario, with the advent of mobile devices, also known as application, or simply app, are technically framed in different categories, this detailed classification of the different categories, escapes the our scope, therefore, will not be discussed, so, throughout the text, we will simply call software, any and all logical constructions that demand a programming language with the ability to create interfaces, defined by Barbosa (2010, p.25).) as "the entire portion of the system with which the user maintains physical contact", which enables interaction between users and the existing technological means of communication.

According to Presmann (2016,p.31), the software "distributes the most important product of our era – information", and it is through it that we enhance the ability to increase the possibility of communication generated by the subjects who make use of this technological resource, consequently, we also enhance the dissemination of this information and with it, the need for new products and services that meet the infinite human needs.

In this sense, software plays a fundamental role, considering that, through its interfaces, we exempt users from the need for technical knowledge for all the existing and necessary complexity to enable its use.

Despite the relevance of this element in the training process, it is linked to the fulfillment of a set of actions imposed by a document called a license of use, which has legal validity and defines what can or cannot be performed by its user, be it an individual. or legal.

This obligation creates a technological dependency for the use of existing digital resources, insofar as the information for the construction of the software is retained in a "black box", which for computer users is known as source code. This source code can only be accessed by its creator, thus preventing new changes, updates or contributions from being made, either by its users or by professionals with the knowledge to do so.

The impossibility of accessing the source code, not only produces a technological limitation supported by the impossibility of advances and contributions in the software, but also, by the obedience in the use of existing resources, by the impossibility of auditability in the code and by the obligation to be inserted in a social representation that makes use of this software to make them feel an integral part of this network.

This submission, largely linked to a contractual value stipulated by the creative party for the appropriation of the license, leads, in some cases, to illegality, insofar as there is no express authorization from the creator and/or owner of the software to its use.

This dependency scenario, which leverages an existing process of exclusion, has made some people, small and large companies, begin to look for alternatives to allow the continuity of existing businesses and digital

resources. Victim of this scenario, a programmer named Richard Stalmann, through a non-profit organization, conceived and created by him, called the Free Software Foundation (FSF), whose objective was to promote the freedom of use of the software, idealized a license model called General Public License[1] (GPL), which has its construction based on four pillars of freedom, which are:

- Freedom 0 - The freedom to run the program as you wish, for any purpose.
- Freedom 1 - The freedom to study how the program works, and adapt it to your needs. For that, access to the source code is a prerequisite.
- Freedom 2 - The freedom to redistribute copies so you can help others.
- Freedom 3 - The freedom to distribute copies of your modified versions to others.

This model, which has as its main restriction that any software generated from free software is also free, allows users to have access to the source code of the software, and with that, the way it was built, generating a productive chain and collaborative, making this fundamental element for technological advancement, whether in the possibility of use, or in the possibility of a service provided by the people who have this knowledge, or even, in the production of new technologies, to consolidate itself as an excellent tool for social advancement.

This instrument - the software, which constitutes an important tool in the construction of knowledge, should not be imprisoned by private interests, but available for new software to be created, and for new products to be generated from them, as portrayed by Pretto (2013, p.139), when mentioning. “The appropriation of the network by music and video producers are examples of a worldwide movement around the freedom of circulation of knowledge produced by humanity.”.

2. A FREE SOCIAL NETWORK BUILT THROUGH THE SUM OF KNOWLEDGE

Talking about the social network is to articulate two fundamental concepts for the understanding of its construction, in the first, we highlight the network node, which according to Recuero (2015, p.54), “is a representation of the actors of the social network”, the author states that “an actor refers to an individual or collective of individuals”, this concept of actor, according to Freeman (2004), extends to the interactions that these authors make in the network, thus constituting a product, a group or an organization. Based on the existing relationships, we can say that each group, arising from the construction of these actors, also corresponds to a node of this collaborative network.

A second concept is that of edges, or relationships, which represent the communication links and which, according to Recuero (2015, p.54), correspond to the “connection elements”, which are interconnected to form several networks, also known as graph, made up of different groups and different actors that, in the free software environment, are present in different communities, and that deal not only with software development through programming languages, but also, in the most diverse ways, contributions, such as : translations into other languages, suggestions on the navigability of the software, identification of errors and reporting of problems, in the treatment and creation of images, among others.

The free software universe has, in its communities around the world, a productive social network capable of generating products that are currently used not only by home computer users, but also by various

1 https://www.gnu.org/philosophy/free-sw.pt-br.html

organizations and technology companies around the world. These constructions, from the various actors that contribute to the development of free software, emerged through the sum of all this knowledge, integrated into a set of collaborative environments, which corresponds to the various existing communities. By adding more users to the network, we increase the possibilities of communication through the "connection elements" and, thus, we bring a new concept portrayed by Recuero (2015), which corresponds to the "Social Capital", which produces an added value to the actor in function of the existing relationships between the various actors in the network.

These multiple relationships, so to speak, belonging to a particular actor or community, through relationships with several other communities, also defined by the author as "node degree", enable the construction of a network in which there is no direct dependence on a certain node of the network, but around the communities that contribute to the construction of the software in a decentralized way, thus guaranteeing the possibility of preserving the network in case of absence of a central node.

3. THE FREE SOFTWARE AND THE SCHOOL

Free software is not only linked to a technological context, it permeates some easily identifiable elements in its design and which support this training process.

- The legal part, allowing the software to be used without a legal commitment due to the limitations arising from the use licenses;
- The technological part, which corresponds to all the complexity existing in the construction of the software through the programming languages and the existing communication rules for the operation of computer networks;
- The philosophical part, which corresponds to the idea of sharing information, a social movement that works more on ethical issues, collective construction, freedom of expression and the union of knowledge.

This collaborative movement produces an enormous dimension in education that corresponds to a change in the configuration of the school, thinking of it, no longer as a plastered model of transmission in the student and teacher relationship, where information is transmitted from one end to the other without the freedom to explore knowledge, suffocating the student by an outdated model and yes, the union between them.

The information sharing model, allowing people to have access to the software construction process, adopted by free software, can be brought to education, allowing students to expose the result of their product, based on dialogue and research as a formative process, with the collaboration of a critical view of the teacher, exploring the best characteristics and improving the deficiencies of each one, disseminating their work as a knowledge base, thus allowing this result to be accessible, enabling the contribution and making information available, providing a process of mutual learning, corroborating the thought of Freire (1996, p.12) when he states that "Whoever teaches learns by teaching and whoever learns teaches by learning".

According to Gadotti (2007, p.93) "the school is a space of relationships and that it has contributed both to the maintenance and to the social transformation", and the educator is, without a doubt, one of the elements

that support education, transforming the being from the construction of thinking and the ability to contribute and to regenerate, to produce and recreate, to appropriate information, knowledge and culture, defined by Benkler (2009) as "public goods".

In the conception of public, and in the possibility of network access, we have a scenario in which, according to Levy (1999), teacher and student appropriate information at the same time, making use of a constant update through the internet, which characterizes, still according to the author, as a change in the teacher's role as a diffuser of information.

The world has changed and the information is now available, to the student, just the direction is enough for him to walk. Exploring more and more their potential is the objective of any teacher, this process carried out in a classroom, with different realities and knowledge, does not produce uniform results, but students who have gone through a momentary evaluation process that does not represent true individual potential.

It is possible to break the barriers imposed by an outdated model of mandatory physical presence in a place that could be used as a space for reflection, contribution, freedom of expression, opinion, behavior and change; for exchanging ideas, information, thoughts and knowledge, as well as free software.

These cultural manifestations form the essence and existence of the subject, exploring what is best, from the appropriation of the various elements for its completeness, the various existing contributions and existing relationships.

The model adopted by free software is a way to be used as a teaching and research reference, making the responsibility not only of the creator in the construction of the software, but of the community in producing its own knowledge, therefore, exploring the free software in a school environment, transcends only the use of technological resources in the classroom.

Using free software is to support the production of knowledge, it is to produce citizens who are aware of their role in society, it is to reveal their existence to others, it is to bring to the classroom an element that is not limited in time due to its possibility of renewal and constant learning, thus constituting an important relationship in the construction of society, not only in terms of their cognitive training, but also in their formation as a citizen.

4. MATERIALS AND METHODS

The amount of software that uses the GPL license model is very large and difficult to catalog, given that there is no single repository of software that uses this licensing model. This statement extends to a scenario focused on education where, normally, these discoveries are given as a result of indications from third parties or collaborative projects that support databases through volunteers and researchers, such as the Blog Software Livre na Educação[2] (BSLE) from the Federal University of Rio Grande do Sul (UFRGS).

From the database available in BSLE[3], it was possible to explore graphic elements that help in understanding the relationships between the various areas of knowledge, while respecting the cataloging carried out in the construction of the mentioned database, considering only the areas of knowledge related in the research.

2 https://www.ufrgs.br/soft-livre-edu/
3 https://www.ufrgs.br/soft-livre-edu/relacao-de-software-livres-educativos/

This compilation of the areas present in the BSLE database was carried out considering a grouping on the main areas of the research itself, Table 1, given that, there is not a direct relationship with the areas of the Coordination for the Improvement of Higher Education Personnel (CAPES), in addition to the amount of software researched by area.

Table 1. List of Areas Cataloged by BSLE

AREA	QUANTITY
Literacy	5
Authorship	4
Biology	8
Typing	2
Artistic Education	1
Child Education	2
Physics	35
Geography	23
Languages	18
Game	27
Math	71
Medicine	1
Music	23
Systems Development	5
Chemistry	35
Utility	2
Others areas	14
Chess	4

Source: Adapted from https://www.ufrgs.br/soft-livre-edu/wiki/Tabela_DinC3%A2mica_Software_Educacional_livre.

The set of software cataloged until the date of collection was 279 (two hundred and seventy-nine), distributed in 18 (eighteen) areas as mentioned. This set of software was represented by 5 (five) levels of education, as highlighted by the BSLE, Table 2, which relates each software cataloged to its respective level of education, acting in at least one of these levels defined in the range represented from kindergarten to higher education.

Table 2. Teaching Framework Represented by BSLE.

LEVEL OF EDUCATION	ACRONYM
Child Education	EI
Initial Years of Elementary School	AIEF
Final Years of Elementary School	AFEF
High School	EM
University Education	ES

Source: https://www.ufrgs.br/soft-livre-edu/wiki/Tabela_Din%C3%A2mica_Software_Educacional_livre

When considering the sum of the elements that support the graph, it can be seen that the number of nodes, Figure 1, differs from the total represented (302), when adding the total of software that works with a GPL license represented in Table 1 (280) , with the total of areas identified in the compilation of the database (18) and the total of the education levels represented by the BSLE (5), totaling 303 nodes in the network, or graph.

Figure 1. Graph Nodes and Edges Quantitative Metric.
Source: The Author (Generated through Gephi software).

This divergence is due to the “Genius” software, Figure 2(a), represented by the color orange, since it is used in two areas (math and languages). The highlight on this representation of the areas can be better identified through Figure 2(b), when highlighting only the existing links on the specific software, thus allowing a better visualization of its participation in the two mentioned areas.

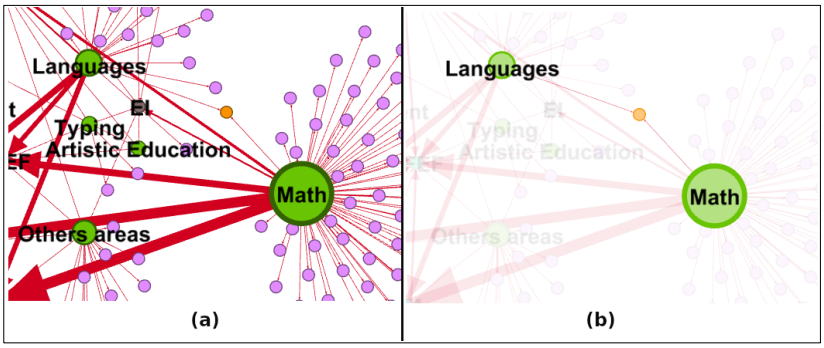

Figure 2: Highlighting Genius Software over Graph
Source: The Author (Generated through Gephi software)

The result of this divergence in the totals represented by the number of nodes and the sum of the elements constituted in the graph, which represents a difference of 1 (one) over the total, corresponds to the sum of the software, area and level of education in relation to the number of nodes in the graph, characterizes a

multidisciplinary performance model that can be extended to other software.

The graphic analysis of the relationships between the software cataloged by the BSLE and the levels of education on the areas also cataloged by the BSLE, Figure 3, produced a computational model that directs us to a look at the potential that these different contributions can offer, in all the educational levels, for that, considering that the objective is not to explore the software individually, but the production potential in each area, the name of the software in each node, identified by the color lilac, were omitted for a better visualization but , from the database available at BSLE, it is possible to identify each existing software in the database used through its respective area of activity.

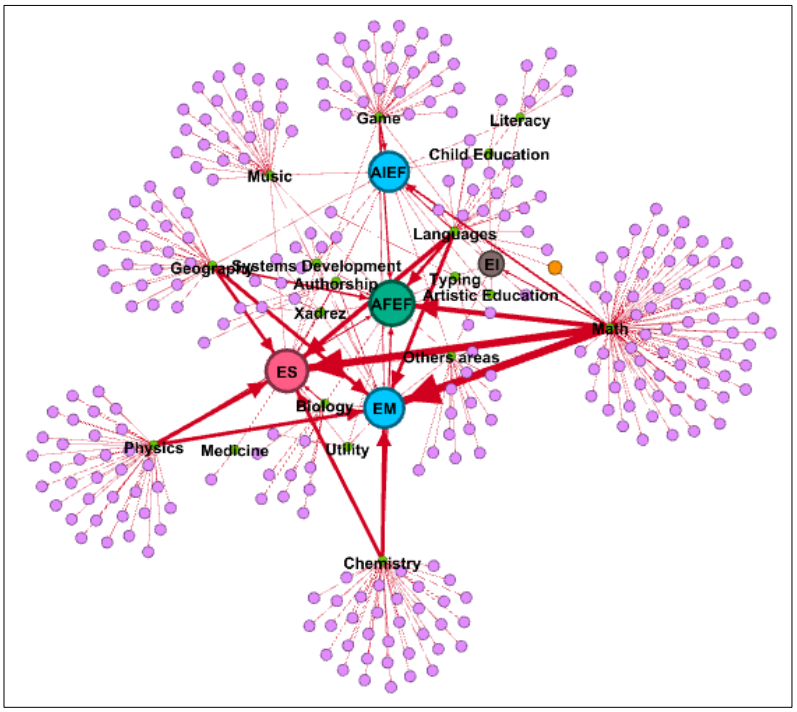

Figure 3: Graph of the Relationships between the Cataloged Software by Level of Education
Source: The Author (Generated through Gephi software)

In addition to the existing relationships that affect the level of education, it is possible to establish a model with emphasis on the areas of knowledge, Figure 4, represented by the green color, allowing the reader to graphically visualize the maximum and minimum production potential of each specific area acting on the database used.

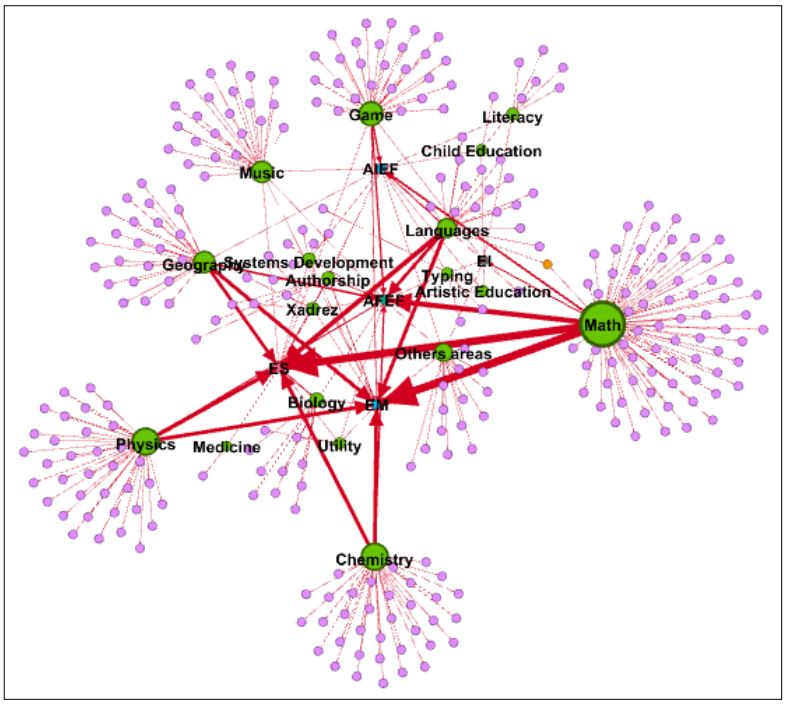

Figure 4. Graph of the Relationships between the Software Cataloged by Area
Source: The Author (Generated through Gephi software)

The total of elements identified in the graph, represented through the nodes of the network and corresponding to the cataloged software, the compiled areas mapped in the database and the levels of education highlighted by the BSLE, has, in its relations, a direction between the elements " Software" and "Level of Education" represented by a targeting model, as follows:

- From SOFTWARE to AREA: Example: Kcalc → Math
- From AREA to LEVEL OF EDUCATION: Example: Math → ES

This implementation, which characterizes a directed graph, already highlighted in Figure 1, allows the manipulation of metrics that aim to represent the models used in the construction of the study, considering the scope of the work carried out, as well as the possibility of future work. that dialogue with these graphic representations.

5. RESULTS AND DISCUSSIONS

The elements worked in the study bring some indications about the productive scenario of free software in education, as is the case of math, Figure 5, where the emphasis on the existing relationships in this area in relation to the other areas highlighted in the study is evident. On the other hand, we have a smaller scenario when we look at these other areas, such as biology, which represents a lesser emphasis on this production.

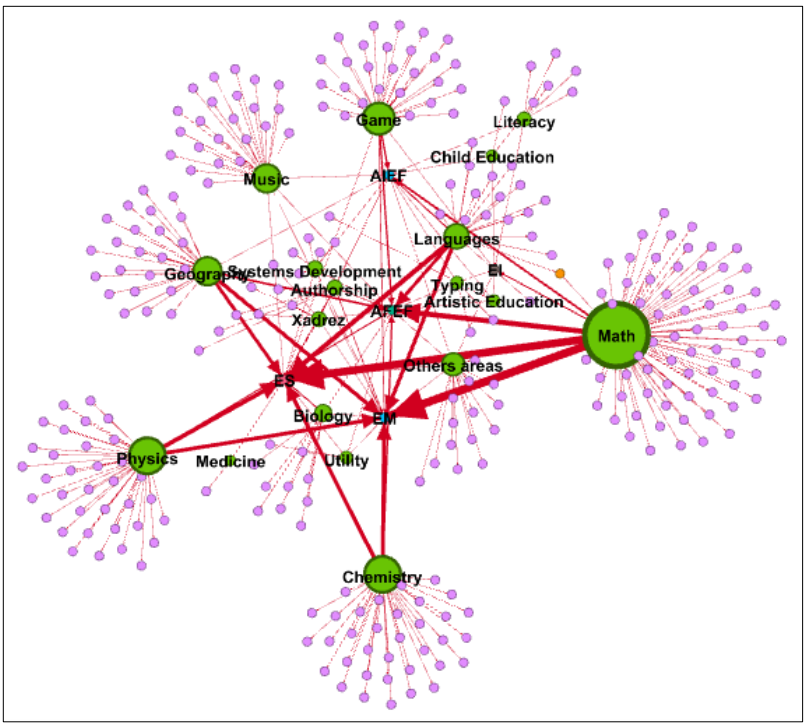

Figure 5: Highlight of Mathematics over the other areas represented in the graph.
Source: The Author (Generated through Gephi software)

It is also possible to observe that there is no single identification about the level of education in relation to the areas of activity highlighted in the BSLE database, it is observed that it is possible to establish levels of complexity on the same software, considering the various levels of education defined in the search. This reading can be observed by relating a specific area, Figures 6 and 7, for all levels of education.

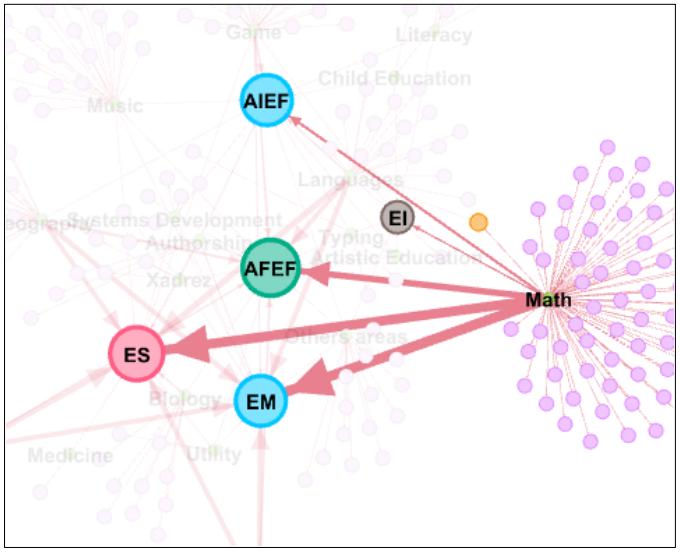

Figure 6: Relation of the Mathematics area with all Education Levels
Source: The Author (Generated through Gephi software)

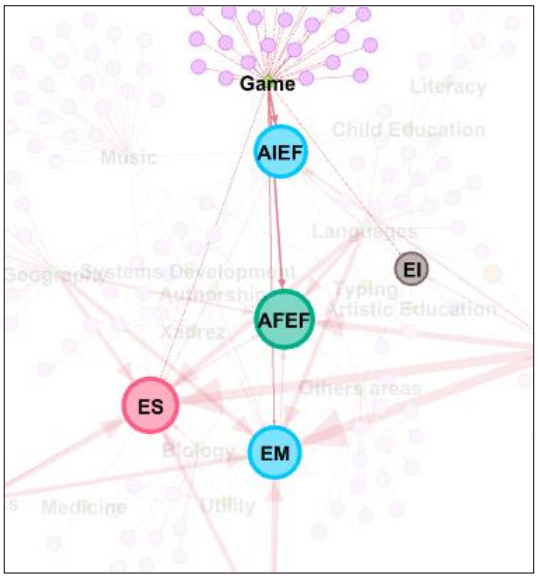

Figure 7: Relation of the Game area with all Education Levels
Source: The Author (Generated through Gephi software)

The role of games in the education scenario, identified in Figure 6, constitutes a vast field of research, bringing gamification as an integral part of the production process and, as presented, at all educational levels presented in the BSLE database.

6. CONCLUSION

It is a fact that the amount of software that works with licenses that dialogue with this free culture of production, execution, learning and collaboration is not limited to the list of software used in this study. It was used as an important basis for analysis on a reality not yet fully explored.

It is also possible to bring software that does not have a direct relationship with some school content but that are, indirectly, inserted in the instruments used at school, such as: text editors and electronic spreadsheets; video, audio and image editors; browsers, calculators, as well as a vast set of functionalities that, combined with the ability to create the actors inserted in this educational universe, can be potentiated in this learning relationship.

This learning relationship mediated by technological instruments, supported by elements that dialogue not only within a technicist view, requires the expansion of this debate to license models that dialogue with a training process that goes beyond the limits of technique and that are also supported by issues human and political. This debate is necessary inside and outside of formal education environments, but education is the biggest ally on the need to expand discussions involving license models and software that support this philosophy.

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