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12-31-2019

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Recommended Citation

Wang, Marco Alberto; Grotta, Alexandre; and Vasques Prado, Edmir Parada, "UNDERGRADUATE BRAZILIAN FRESHMEN: COMPUTER LITERACY FACTORS, DIMENSIONS AND VISIONS" (2019). *Proceedings of the 2019 AIS SIGED International Conference on Information Systems Education and Research*. 12.
https://aisel.aisnet.org/siged2019/12

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UNDERGRADUATE BRAZILIAN FRESHMEN: COMPUTER LITERACY FACTORS, DIMENSIONS AND VISIONS

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Abstract:

Brazilian society has experienced an increase of computing devices used by the population in general. Anyhow, individuals might be technologically unprepared to deal with them, particularly at in-developing countries. At the Information System education, this technological gap might affect undergraduate freshmen students' performance. Thus, the goal of this study was to identify the most relevant computer literacy dimensions and factors required from freshmen. The research method was a combination of two techniques, Systematic Literature Review followed by a Delphi technique. We found 24 factors that are most relevant to the Brazilian context regarding freshmen students learning goals. They were classified according to: i) seven different dimensions and ii) four different visions: teachers, industry managers, researchers, and a blend of these three visions.

Keywords: computer literacy, under-graduation, freshmen students, Brazil.

I. INTRODUCTION

People, companies, and government agencies from different countries are increasing their dependence on Information and Communications Technology (ICT) systems. ICT devices such as smartphones are changing several aspects of contemporary society, such as the way people and companies pay their bills, do their work, communicate for instance [Dednam, 2009]. ICT widely influences the learning process as well. The traditional method has been based for decades on paper, pencils, and books. But in addition to that, the internet provided to the society new was of teaching and learning in several different knowledge areas [Gupta, 2006].

Given this context, ICT knowledge might be considered more important than algebra knowledge in some cases given its impact on people and on society at all [Liao and Pope, 2008]. This digital evolution is prone to bring more benefits to a certain portion of society. For instance, there is a large portion of people that are living in in-developing countries that has no or few accesses to the digital evolution. People that have very few or no access to these digital benefits are named as digital divide persons [Cilan, 2012]. Given Brazil is an in-developing country, it has a larger portion of its population digital divided due to constraints such as lack of financial access [CGI, 2018]. All these lacks of computing abilities reduce opportunities to digital divide persons in general, such as job opportunities or learning capabilities [Dednam, 2009].

Therefore, in regards to computer literacy, it can be said that there is a minimum set of ICT knowledge and abilities that allow individuals to efficiently perform a certain task. For instance, tasks such as paying a bill online or apply to a job opportunity online. Even further, there is a myth that the younger generations naturally incorporate basic ICT knowledge and abilities. It is particularly observed at most privileged social classes, as their children grow-up exposed to more ICT devices [Hoar, 2014], given this learning is restricted to an insufficient level usually focused on communication tools [Hoffman and Vance, 2005].

Regarding formal education, undergraduate students from different programs and knowledge are required to acquire computing abilities since the 1980 decade [Hartman, 1983]. There is a

misconception that there is no need for ICT training for undergraduate first-year students (freshmen/freshwomen, from now on referred to as freshmen). No ICT training to freshmen may result in students' insecurity, embarrassment, and poor academic performance [Hoar, 2014].

The goal of this study is to identify the most relevant computer literacy factors in order to provide the proper needs of freshmen undergraduate students in Brazil. This study started with a systematic literature review (SLR) based on a computer literacy theoretical framework to obtain a general list of computer literacy factors. Then, a group of experts evaluated the results via the Delphi technique in order to ensure that these SLR factors were applied to the Brazilian context. We then identify and prioritized those factors considered more relevant when considering the preparation of freshmen undergraduate students. The outcome of this article is part of a project aimed to develop an instrument for computer literacy assessment in Brazil applied to freshmen.

In addition to this section, the theoretical bases section defines the two most important concepts regarding computer literacy. The following section presents the research methodology. The fourth section presents the results and discusses its results and limitations. The last section presents the research conclusions.

II. THEORETICAL BASES

Computer Literacy

The computer literacy term by the 1970 decade was associated with the formal education offered by schools associated with reading abilities: those who had no access to that knowledge were nominated as computing illiterates [Lankshear and Knobel, 2006]. In the next decade, there was no consensus about the terms and ranges adopted to classify computer learning at the earlier stages of computer education [Mason and Morrow, 2006]. Anyhow, given the evolution of ICT and changes at the ICT learning process, especially regarding the concept of "computer literacy", this term started to represent a large amount of knowledge types and abilities, name as essential for a person to be introduced to ICT tools, such as communication tools [Goodman, 1981; Leu et al., 2004] or to become a part of the "computer society" [Hartman, 1983].

Computer literacy, in minimum terms, meant to give the society access to the knowledge [Bartholomew, 2004] and a continuous sequence of learning and empowerment of the individual [Bartholomew, 2004] and that were depend on software versions when released by the manufacturers, such as new version for certain text editors [Goldweber, Barr and Leska 1994]. Thus, computer literacy becomes to be bonded to certain manufacturers. It became an issue given the learning results were restricted to certain manufacturers [Hoar, 2014].

By the new millennium, the internet era changed the concept of computer literacy due to the communication media type and tools [Hoffman and Vance, 2005]. The huge increase of connectivity among people changed the concept of computer literacy, given it incorporated the ability to search, read, evaluate and publish information on the internet. The internet also brought emphasis on issues such as: risks, ethics, and privacy. The most important awareness items were: self-protection against risks; limits on the use of ICT tools; potential applicability of ICT; and develop innovation and creativity. However, for a person to have a proper level of computer literacy, all these three skills, identifying issues, and self-awareness and technical skills, should be considered [Mason and Morrow, 2006].

In summary, at the internet era, digitally excluded people are those ones that are most exposed to issues, risks, such as being a victim of cybercrime, or losses, such as losing job opportunities. As seem, computer literacy is highly important to population life-quality, knowledge, and abilities [Liao and Pope, 2008].

Computer Literacy Factors

As reviewed by the previous subsection, the concept of computer literacy evolved over time side-by-side to the ICT progress. At different points in time, there were different computer literacy factors. In 1980, the advent of microcomputers made it possible for the individuals to interact directly with the personal computers (PCs): the computer literacy was related to operating PCs and its software packages such as word processors, spreadsheets, graphic presentations, and basic file management. The computer literacy was considered a balance on two elements: (1) knowledge, which corresponds to the awareness and expansion of cognitive ability of instructive character, such as ethics and risks and (2) abilities, which correspondent to development of practical use capacities, for example text editors and internet search tools [Mason and Morrow, 2006].

Another definition by [Myers et al., 2007] defines knowledge and abilities relates to computer literacy as the critical ICT thinking related to various types of devices, their specific software, and related resources. Given the speed that the technology changes, these factors related to ways of learning solving problems using ICT resources. Beyond technological tools, people need to develop a set skill that enables their independence to "learn how to learn".

This research adopted two different sets of computer literacy factors. First set, based on two decades of experience in teaching this subject in University of San Diego different education programs, there are seven factors that represent computer literacy [Liao and Pope, 2008]: (1) understanding and abilities related to the internet, (2) software tools usage, (3) programming language, (4) applicability, (5) social networks (impacts and culture), (6) hardware components (basic understanding), and (7) database concept. In addition to this, there are five other factors to represent computer literacy at 2000 decade [Hsin and Ganzen, 2008]: (1) basic knowledge of computers, (2) text editor, (3) email, (4) internet, and (5) spreadsheet.

III. RESEARCH METHODOLOGY

This is a exploratory research. It utilized an SLR, the Delphi and survey techniques [Selltiz et al., 1981] to identify the most relevant criteria towards evaluating students' computer literacy, from the point both the SLR and from the subject matter experts' point of view. The outcomes were divided into two results: (1) concept: the conceptual meaning of computer literacy, and (2) factors: the list of knowledge and abilities attributed to computer literacy.

We divided this research into four phases as follows. Phases 1 to 3 are detailed within this section.

a) Phase 1: SLR. Via SLR we identified the key knowledge and abilities expected from high school students, which are expected to enter at the university;

b) Phase 2: draft instrument. We developed an instrument based on the knowledge and abilities related to computer literacy, collected in the literature.

c) Phase 3: specialists' review. A group of specialists analyzed the instruments via two rounds of Delphi Panel in order to adapt the results of the SLR to Brazilian local context;

d) Phase 4: results. This phase is reported in section IV.

Phase 1 - SLR

We used two research databases to conduct the SLR: Association for Computing Machinery Digital Library (ACM Digital Library) and Education Resource Information Center (ERIC). We searched for papers whose title had the keyword "computer literacy" and that have been published from 2004 to 2014 (which means the previous ten years, considering the date when the search was carried out). As a first result, this SLR returned 84 papers, on which we applied the following inclusion and exclusion criteria:

• Inclusion criterion: we have included only publications in journals and conferences with peer review.

• Exclusion criterion: we excluded papers that address computer literacy but applied specifically to: children's education; elderly education; teacher training; distance education; or programming language. This criterion was used because our study relies only on general undergraduate first-year students.

As a final result, after applying these inclusion and exclusion criteria, we selected 28 papers as primary studies. These papers constituted the theoretical basis used to conceptualize and define the scope of computer literacy as presented in the two following subsections. The SLR revealed that “computer literacy” as a term to describe this first stage of computer literacy, which is related to ICT knowledge and abilities. These results were used to create the draft instrument, as follows.

Phase 2 - Draft Instrument

Based on the SLR results, we created the initial instrument based on the knowledge and abilities related to computer literacy collected in the literature to identify the more relevant computer literacy factors in daily life in a digital society, particularly for individuals within the age group of high school students. Figure 1 shows twenty-two factors grouped into seven dimensions of knowledge of computer literacy evaluated in the instrument.

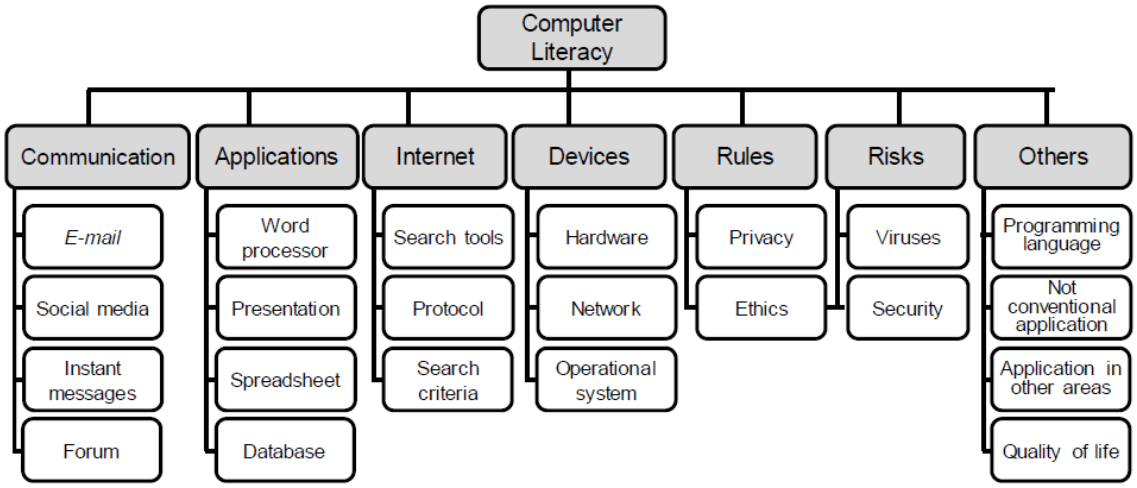

Figure 1: Dimensions of Computer Literacy according to the SLR

a) Communication. It corresponds to the media operationalized through computing devices connected to the internet. For communication between two people or between a small group, e-mails and instant messages are widely used, depending on the respectively large or small amount of information you desire to transmit. Forums and social media networks are useful tools for public disclosure of content. Anyhow, certain restrictions apply to this kind of tool.

b) Applications. Tools widely used both in academia and in everyday work. The text editors replaced the old typewriters in terms production of documents. Presentation tools are very useful for concisely organizing information with the intention of passing it to others. Spreadsheet skills are helpful in performing calculations, graphing, among others. And, also, the databases are fundamental to organize a huge set of data.

c) Internet. The internet provides access to a huge amount of information, some of them very accurate, some of them, untrue. Search engines are essential for the localization of the desired information, although it is also fundamental to consider criteria for an estimate of the truthfulness of each data found. The internet operationalizes many protocols, and the recognition of the more important ones, such as HTTPs is fundamental to ensure the transmission of confidential information.

d) Devices. All applications and computing tools run on a platform based on electronic components (hardware) and operating systems. The basic understanding of the hardware is useful in the

process of the acquisition of devices, or even for identified problems. The knowledge about the operating systems application includes turn on the equipment, turn off the equipment, manipulating files and folders, run programs, among others. And the understanding of the network devices that allow the interconnection among other computing devices and the internet.

e) Rules. Factors related to computing limits correspond to the awareness of legal factors and good relations in the digital society. Misuse of information about a violation of ethics or privacy, may bring on serious adverse consequences, punishable under the law. This awareness also extends knowledge to self-preservation of their own individual privacy in the digital context.

f) Risks. The risks involve awareness of the potential loss of data due to viruses, stealing sensitive information, and abilities to apply good security practices, such as use and update of antivirus, password policy, among others.

g) Other. Other computer literacy factors include: basic knowledge of programming language for the creation of applications, understanding about the computer incorporating potential in the several devices of daily life (clothes, glasses, refrigerator, etc.), understanding of the potential of integrated application in different areas (medicine, agriculture, etc.) and the awareness of the importance of quality of life in the use of computers (ergonomics, recycling, etc.).

The initial instrument consists in 22 questions that are related to each of the factors of the seven dimensions of computer literacy (Figure 1), as shown in Appendix A. We collected the data in the second half of 2014, through questionnaires given to 30 experts selected according to the criteria defined in this research. For each question, we asked an opinion on the level of importance based on a Likert scale (0-5).

Phase 3 – Specialists' Review

To compose the group of specialists we required 15 specialists, distributed evenly amongst the different types of specialists, which we called visions, due to their different visions or expectation from a student. The description below shows the requisites for the choice of each group of specialists, each one that represents one unique vision:

a) Private Company Manager. We chose this profile motivated by being team leaders with young members and cope with the shortcomings of computer literacy in their daily life by their employees. We defined three requirements: (1) being responsible for the selection and coordination of newly trained young workers or apprentices; (2) coordinating team activity that requires the intensive use of IT devices; and (3) performing core activity not related to IT professional career.

b) Researcher on subjects related to digital inclusion. The choice of this profile was motivated by conducting research on the theme of computer literacy, identified in the production of articles or academic papers. We defined two requirements: (1) having a master's degree or a higher degree in IT or education and (2) having published researches or articles related to Digital Inclusion or similar subjects.

c) Undergraduate teacher, with classes for the first year. We chose this profile because of the freshmen teachers demand computer literacy activities. We defined two requirements: (1) teaching students from non-ICT programs and (2) having experience superior to five years in teaching for freshmen undergraduate programs, which requires activities based on IT resources.

These three profiles of specialists were used to select the panel members in subsequent stages of application of the Delphi technique.

First Round

We had the participation of 30 panel members, with the following characteristics: eight of them were from private companies, and worked in leadership teams that relied on young people newly entering the labor-marketing; 10 of the panel members were active as researchers in academia, and relied on historical research related to the topic of digital inclusion; and 12 of them had teaching experience in the first year of undergraduate programs not related to IS. The first round occurred in February 2015.

Table 1: Convergence of Delphi Panel Rounds

Characteristics of rounds	First Round	Second Round
Factors of CL (N)	22	24
Panel Members (k)	30	22
Convergence (W)	0.537	0.638
Significance (χ^2)	338.097	323.003

The analysis of the results obtained in the first round, as indicated in Table 1, shows a high convergence rate (W = 0.537) of opinion among panel members participating.

W values higher than 0.500 are considered high Schmidt (1997). Likewise, the result can be considered significant (338.097) since, according to Siegel (1981), chi-square values (χ^2) above 59.70 are considered remark-ably significant. Under the first round, panel members proposed the inclusion of two new computer literacy factors:

a) Audio conversations via apps: The ability to use apps properly, either on desktop computers, whether on mobile devices, to establish audio conversations. Examples of Apps: Viber ™, Skype ™, etc.

b) Portable Document Format: Abilities to identify and convert documents into standard formats. Standardized document formats allow accessing their content without the need for specific apps. For example, conversion of documents, worksheets, presentations in PDF (Portable Document Format).

The addition of these two new factors has required the implementation of a second-round to evaluate and rank the relative importance of the updated set of 24 computer literacy factors.

Second Round

For the preparation of the instrument of the second round, we consolidated the answers given by all panel members of the first round and we highlighted the opinion chosen by each panel member. So, we created specific questionnaires for each of the 30-panel members of the first round. We sent those questionnaires for the second round to the 30-panel members participating in the first round. We asked each panel member to review their opinion. It was possible to maintain the same previous opinion, giving the panel member the freedom to express his opinion. We had 22 answers from the panel members, which were received in April 2015: five from private companies, eight researchers, and nine teachers.

Analyzing the results from the second round, as indicated in Table 1, we find a high convergence rate of opinion among panel members (W = 0.638). This W value is considered remarkably significant because the value of χ^2 was 323.003. Thus, we found at the end of the second round that there was a relevant convergence of opinions, which made it possible to end the application of the Delphi technique.

IV. RESULTS

The analysis of results is based on the score and categorization corresponding to the total amount of opinions on each computer literacy factor, adopting as reference the Likert scale. The Likert scale was proportionally adapted to the number of panel members in each group according to Table 2.

First, we analyzed the opinions of each group of experts. Then, we did a comparative analysis of the opinions of all the experts and, finally, an overall analysis. The details of each group, as well as the overall consolidated analysis, are described in Table 2.

Table 2: Final Dimensions of Computer Literacy

	Manager			Researcher			Teacher			Consolidated		
		Factor	Score		Factor	Score		Factor	Score		Factor	Score
A1- Word processor	A	L2	25	A	L2	40	A	L2	45	A	L2	110
A2- Presentation		I1	25		I1	40		I1	44		I1	109
A3- Spreadsheet		L1	25		L1	39		L1	43		L1	107
A4- Database		R2	25		R2	38		R2	43		R2	106
A5- Portable Document Format		R1	25		R1	38		I3	43		R1	104
C1- E-mail		A1	25		C1	38		R1	41		I3	103
C2- Social media		I3	24		I3	36		C3	41		C1	102
C3- Instant message		C1	24		C3	35		C1	40		A1	97
C4- Forum		O4	24		A1	33		A1	39		C3	96
C5- Audio conversations via apps		I2	22	H	A3	30	H	C5	35	H	A3	85
D1- Hardware		A3	21		C5	30		A3	34		C5	84
D2- Network		D3	21		A5	30		D3	34		D3	84
D3- Operational System	H	C3	20		D3	29		O4	30		O4	81
I1- Search tools		A2	20		I2	28		A5	29		A5	77
I2- Protocol		O3	20		O4	27		C2	29		I2	77
I3- Search criteria		C5	19		A2	26	M	I2	27		C2	69
L1- Privacy		A5	18		C2	26		D1	24		A2	69
L2- Ethics		O2	16	M	D2	24		A2	23	M	O3	66
O1- Programming language	M	D1	15		O3	23		O3	23		D1	62
O2- Not conventional application		C4	15		D1	23		C4	23		C4	60
O3- Application in other areas		C2	14		C4	22		D2	21		D2	59
O4- Quality of life		D2	14		O2	19		O2	19		O2	54
R1- Viruses		O1	13	L	O1	16	L	A4	16	L	A4	42
R2- Security		A4	11		A4	15		O1	8		O1	37

Caption	Company Score	Researcher Score	Teacher Score	Consolidated Score
Importante	(5 painelist)	(8 painelist)	(9 painelist)	(22 painelist)
A- Absoluty	5x5 = 25	5x8 = 40	5x9 = 45	5x22 = 110
H- High	4x5 = 20	4x8 = 32	4x9 = 36	4x22 = 88
M- Moderate	3x5 = 15	3x8 = 24	3x9 = 27	3x22 = 66
L- Low	2x5 = 10	2x8 = 16	2x9 = 18	2x22 = 44
V- Very low	1x5 = 5	1x8 = 8	1x9 = 9	1x22 = 22
W- Without	0x5 = 0	0x8 = 0	0x9 = 0	0x22 = 0

Group 1 – Managers

Private-sector managers considered that all 22 computer literacy factors have importance above the average. They rated all factors according to a Likert scale regarding the importance: absolutely [important], high [important], moderate [importance], low [importance], very low [importance], without [no importance] as shown in Table 2. All factors categorized as absolute importance refer to the following three dimensions: risks, rules, and the internet. We also noted that these three dimensions are strongly interconnected because risk, ethics and privacy issues are strongly related to the internet.

Two applications were considered very useful for personal life: the text editor and the spreadsheet used to draw letters or even control the household budget. Managers also

highlighted the operational system factor. Although basic operating system knowledge is intuitive for many users, those who do not use computers often do not have this knowledge. Finally, the quality of life factor was also classified as of absolute importance. It is a factor that includes conscious discarding, addiction due to overuse, among other issues.

Group 2 – Researchers

The computer literacy opinions of the group of researchers were rated into the four top levels of the six available in the collection instrument. All the factors that belong to the dimensions of rules and risks were classified as absolutely important. In addition, the following factors were also classified as of absolute importance: (1) Search Tools and Search Criteria, which belong to the internet dimension, and which are undeniably important factors for the citizen in a digital society; and (2) E-mail, instant-messaging and Word Processor, which are widespread tools used in daily life.

Programming Language and Database factors appear with low importance, confirming the need for simplicity in the characterization of computer literacy (Bartholomew, 2004; Dyck, 1987).

Group 3 – Teachers

The opinions of teachers to rank computer literacy also focused on the four levels most important. All factors of the risk and rules dimensions were classified as absolutely important. The internet dimension also had high importance to the Search Tools and Search Criteria factors. The communication dimension had two factors: e-mail and instant messaging. The results of this group were very similar to the group of researchers because the factors classified with absolute importance were the same for both groups.

Group 4 – Consolidated

We did an overall analysis of the results based only on computer literacy factors rated as of absolute importance. Some findings could be extracted from the categorization of computer literacy factors considering all groups on a consolidated basis:

a) We observe that most of the categorized factors (90%) as of absolute importance refers to connectivity. This result of [Goldweber et al., 1994] and [Lynch, 1998], which emphasizes the importance of individuals in society develop the learning about internet use, which is aligned with the concept of the network society.

b) Regarding the nine factors categorized as of absolute importance, there is a good balance between factors related to knowledge (ethics, privacy, security, virus and search criteria) and abilities (search tools, email, word processor and instant messages). The first ones represent 56% of all the factors and the others 44%. The highest percentage of factors related to knowledge [Mason and Morrow, 2006]: effective computer literacy should include both components, especially with a stronger focus on knowledge.

c) Factors more related to the computer science field, such as database and programming received the lowest rates. In other words, they have minor importance in computer literacy. This reinforces the claim of many authors about the low relevance of these factors in the daily lives of individuals [Dyck et al., 1987; Clarke and Adkins, 1988; Goldweber et al., 1994; Bartholomew, 2004].

d) The factors related to risk dimension (security and virus) and rule dimension (ethics and privacy) are fully present in the absolute importance category for the three groups. This reinforces the survival concept and responsible interrelationship in Web 2.0 [Turk, 2011], emphasizing the potential risks of cybercrimes on the internet.

e) The moderate importance attributed relates to more conceptual factors. It points to a rudimental level of computer literacy in Brazilian society. This result shows that, currently, it is more important to incorporate basic computer literacy factors into Brazilian citizens. Despite this, conceptual factors must be considered by Brazilian society, because these factors are related to more relevant learning to be explored, that values innovation and cognitive ability [Cohen, 1987].

Discussions and Future Work

Some findings emerged from the comparative evaluation among the groups of specialists about the importance of computer literacy factors:

a) All three groups of specialists categorized all factors of rules dimension (privacy and ethics) and risk dimension (security and virus) as of absolute importance. Added to these, the three groups categorized the factors Email, Search Tools, Search Criteria and Word Processor as of absolute importance. Except for the Word Processor factor, these remaining eight factors are related to the concept of connectivity. It is plausible to say there is a consensus among specialists' opinion, regarding that connectivity, corresponds to a relevant concept to computer literacy.

b) Unlike members of the managers' group, the others considered the factors Operating Systems, Spread-sheet, and Protocol as being of minor importance. Teachers and researchers possibly have a more pragmatic interpretation of computer literacy, since Operating Systems and Protocols are a means to an end rather than an end in itself. Spreadsheets, despite its undeniable usefulness, require a prior knowledge based on algebra.

c) Researchers and teachers ranked computer literacy factors in a very similar way. The factors categorized as of absolute importance and low importance are the same for both groups of specialists. The difference of opinion between these two groups refers to only two factors: Protocol and Presentation. These factors were categorized as most important by researchers compared to teachers.

d) By analyzing the answers, it is observed that there is a consensus among the three groups of specialists about the lesser importance of Programming Language, Database, Hardware, and Network factors. This result confirms the [Dyck et al., 1987]: complex concepts, such as Programming and Hardware would not correspond itself to the entire concept of computer literacy.

e) It is observed that the panel members who work in companies considered most important the quality of life aspect (conscious disposal of computers, addiction for excessive use, etc.) regarding the opinion of panel members of academic areas (Researcher and Teachers groups). The panel members who work in private companies tend to experience more frequently issues related to costs and depreciation of computers than panel members from the other groups.

f) It is also interesting to observe that panel members of the academic area gave less importance to the factors considered more abstract, such as a non-conventional application and applications in other areas, in relation to the managers' group. From the set of computer literacy factors approached by experts, these two are the least pragmatic

factors, because they correspond to the development of new hypotheses and cognitive models, related to innovation [Cohen, 1987]. This result contradicts the common sense that academic teachers usually highlight the need for cognitive development of students.

For future work, we plan to update the context of this research to the state-of-art as of 2020 by including reports from other in-developing countries such as those made in South Africa [Breytenbach, de Villiers and Hearn, 2013].

Limitation

Despite a careful approach to the methodological procedures, the research has limitations regarding the validity of the results obtained. We highlight the main limitations below:

a) Research Framework. It is based on a theoretical framework regarding two research bases (ACM Digital Library and ERIC). Despite the relevance of these databases, these essays depict the reality of developed countries, which present a different digital inclusion reality faced by Brazil.

b) Regarding the opinion of specialists, although the Delphi technique used in this research is widely used and recognized in the scientific literature, it is worth noting that this technique is based on expert opinion and, therefore, carries with its certain subjectivity.

c) Exploratory Method. This type of method is suitable for the study of phenomena little studied as computer literacy. However, it is noteworthy that it does not allow the results to be generalized, mainly when considering other contexts and different geographic regions, with social, economic and cultural conditions varied.

V. CONCLUSION

The goal of this study was to identify the most relevant computer literacy factors that should be part of the set of knowledge and abilities required for undergraduate first-year students to carry out their activities at university. We applied a questionnaire to 22 experts based on the Delphi technique to identify the relevant computer literacy factors in this context. The obtained results are based only on the opinion of these experts and are limited by the exploratory method adopted. We classified the finds according to four dimensions (managers, researchers, professors, and consolidated dimensions).

We found that factors are related to knowledge and abilities in a balanced way. Most factors identified as primordial are associated with the connectivity. Given this result, this is plausible to conclude that the use of internet and information technologies to promote connectivity between individuals have highly important for Brazilian under-graduate freshmen students.

The more technical factors, such as knowledge related to database and programming language have low relevance according to the experts who participated in the Delphi panel. Given this result, this is plausible to conclude knowledge technical factors do not present relevant factors compared with the others since they do not constitute basic knowledge and long-term abilities that enable an individual to develop computer literacy skills.

The most relevant computer literacy factors found in this research can be used to develop tools that can measure undergraduate first-year students' skills in computer literacy. The results can also be applied in the formulation of Brazilian educational policies that can allow a broader inclusion of the individual in the digital society.

Finally, it is noteworthy that the computer literacy factors related to the dimensions of risk (security and viruses) and rules (ethics and privacy) were also classified as of absolute importance. Although the results of this research are not generalizable, this is reasonable to state that in in-developing countries, such as Brazil, digital literacy issues related to risk and privacy regarding the use of new technologies are those ones of greater importance. This is due to the lack of knowledge of the population about the implications of using new technologies is also greater.

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