Knowledge in social networks with digital media promoted by open education towards the habitat of collective intelligences

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ABSTRACT

This study explores knowledge in social network with digital media promoted by open education for colearning - collaborative open learning (Okada, Meister, Mikroyannidis & Little 2013). Underpinned by the Cynefin framework (Snowden, 2015) and the state of relevance (Meister, 2012) key components are integrated to examine the COLEARN network constituted with more than 800 people. Its members are educators, students, researchers, and professionals interested in Open Education, Open Schooling and Responsible Research and Innovation. COLEARN uses multiple platforms including a variety of digital media supported by different groups and projects in network in FaceBook, such as CONNECT. This Europe-Brazil project CONNECT focuses on open schooling to promote partnerships between universities, schools, and society for co-learners to discuss socio-scientific issues and solutions. Based on qualitative research using virtual ethnographic, findings suggest a method to explore knowledge in social networks with digital media towards a collective intelligence habitat and provide some recommendations for networks of groups and project teams.

Keywords: Social networks. Open schooling. Informal Learning. Collective intelligence. Responsible Research and Innovation. Colearning.

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Conhecimento em redes sociais com mídias digitais promovido pela educação aberta na direção do habitat de inteligências coletivas

RESUMO

Este estudo explora o conhecimento em rede social com mídias digitais promovido pela educação aberta para a coaprendizagem - aprendizagem aberta colaborativa (Okada, Meister, Mikroyannidis & Little 2013). Com base na estrutura Cynefin (Snowden, 2015) e o estado de relevância (Meister, 2012), os componentes chave são integrados para examinar a rede COLEARN constituída com mais de 800 pessoas. Seus membros são educadores, estudantes, pesquisadores e profissionais interessados em Educação Aberta, Escolarização Aberta e Pesquisa e Inovação Responsáveis. COLEARN usa várias plataformas incluindo uma variedade de mídias digitais apoiadas por diferentes grupos e projetos em rede no FaceBook, tais como CONNECT. Esse projeto Europeu e Brasileiro CONNECT foca na escolarização aberta para promover parcerias entre universidades, escolas e sociedade para os coaprendizes discutirem questões e soluções sociocientíficas. Com base na pesquisa qualitativa usando etnográfica virtual, os resultados sugerem um método para explorar o conhecimento em redes sociais com mídias digitais na direção de um habitat de inteligências coletivas e fornece algumas recomendações para as redes de grupos e equipes de projeto.

Palavras-chave: *Redes sociais. Escolarização aberta. Aprendizagem Informal. Inteligência coletiva. Pesquisa e Inovação Responsáveis. Coaprendizagem.*

1   INTRODUCTION

The COVID-19 pandemic had a profound impact on the world increasing social inequalities, educational challenges, and unemployment in a more competitive job market. Governments, organizations, and individuals had to adapt quickly, supported by an accelerated digital transformation that was already underway (UN, 2020). Social isolation, remote work, and distance education require individuals to improve their way of learning collaboratively enhanced by digital technologies.

This study explores knowledge in social networks with digital media, supported by networked thinking for lifelong learners to acquire, appropriate, and build knowledge by creating connections that have meaning in real-life contexts. Network thinking enables students to acquire just-in-time information needed for decision-making and to develop knowledge in a collaborative and interactive way (Okada et al., 2020). This study considers that knowledge can be experienced, adapted, recreated, and communicated with social networks, as part of the act and/or effect of knowing (Souza & Gligio, 2015) and colearning (Okada et al., 2013). This study argues that knowledge shared on the networks can result in a habitat of collective intelligence when exploited by a participatory architecture that can activate it. In other words, the knowledge discussed, reflected, questioned, and expanded enables a better process of decision-making and improvement of practices with this collective intelligence habitat.

In this study, the network is a key concept but that has various meanings based on different disciplines such as mathematics, metaphysic, biology, sociology, and computer science. A contribution from mathematics was provided by Leonard Euler (Newman et al., 2004), who introduced the Graph Theory. The network has nodes (points) and edges (lines) that can be interacted with and transformed by vectors, layers, and connections. Another contribution from metaphysic was provided by Capra (1966) who introduced the systems theory, neural network, and interconnected patterns and processes. In Biology, Maturana and Varela (1995) presented the autopoietic feedback loop. In Sociology, Castells (2006) highlighted the network society. In computer science, Paul Baran (1964) research demonstrated some important principles: the network can be centralized, non-centralized or distributed. His contribution is amplified by the network science focused on the network as a structure in complex development as well as the carrier of a dynamic system. The network science includes also various researchers, for example, Barabási (2002); Newman et al. (2004); Watts (2004), and Strogatz (1994). The network has density related to clustering; organizational capacity related to swarming; connectivity related to the degree of communication. Communication can be established by different levels, for example, strong and weak ties that converge a small world phenomenon, a place for the growth of innovation.

A potential gap is the lack of more multidisciplinary approaches to examine the meaning of networks connected to knowledge in 'social networks' supported by digital media in education.

Therefore, this study investigates the following research question: 'What are the key elements for exploring knowledge in social networks with digital media?' Our aim is to design a

method and provide recommendations for groups and project teams interested in fostering a habitat of collective intelligence.


2   THEORETICAL PRINCIPLES

The Cynefin framework (Snowden, 2015) and the state of relevance (Meister, 2012) provide useful principles for collaborative learning in networks. The first focuses on decision-making supported by sensemaking. The second centres on collective knowledge with digital media. The novelty of this study is to interconnect both theoretical principles to identify key components to explore knowledge in social networks with digital media.

2.1   The Cynefin Framework

The Cynefin framework was introduced by Dave Snowden in 1999. It was developed in knowledge management for decision making and aggregates understanding of 'contextual domains' (Figure 1) and 'sensemaking processes' (Figure 2). Snowden's framework denominated Cynefin draws on research that includes systems theory, complexity theory, network theory and learning theories.
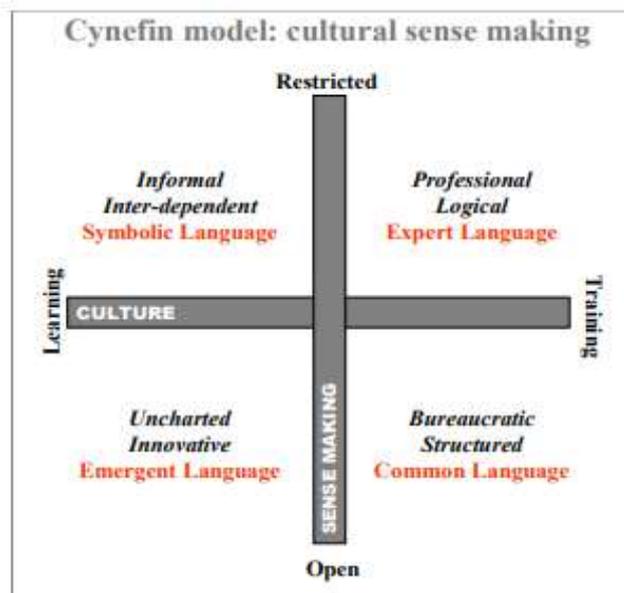
"Each quadrant represents a particular union in time and space of a form of community with varying degrees of temporal continuity." (Snowden, 1999, p. 4) It has different degrees of abstraction. The dark domain in the centre is disorder.

Figure 1 - Domains of the Cynefin framework
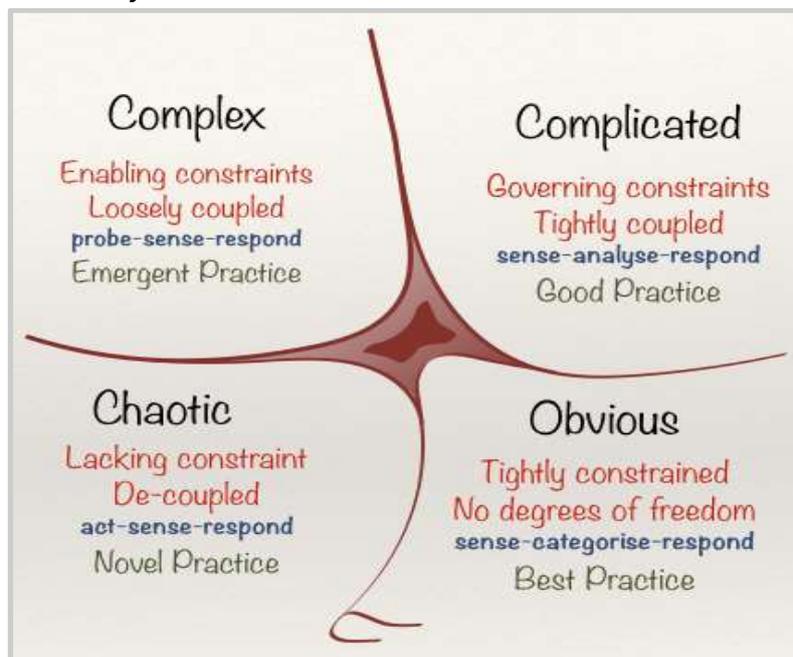
Note. Snowden (2014).

Figure 2 - Cultural sensemaking

The first category is Chaotic (unclear) — this domain refers to a context that is unstable, confusing, and uncertain. It requires participants to act in order to make sense of the context and to be able to respond to it. As there is not a right way, nor constraints; that means no limitations nor restrictions; therefore, it creates opportunities for new insights, brainstorm, novel ideas, and potential innovation. This domain propitiates novel practices.

The second category is Complex (unknown) — this domain represents unpredictable contexts, competing ideas, a variety of information, which requires methods and tactics to problems make sense to be able to respond to them. As there is not a straightforward way to react to the situation, it requires to check/probe if any approach will lead to the correct direction. Although more time will be necessary for decision making, this domain will conduct to emergent practices.

The third category Complicated (knowable) — this domain refers to more detailed scenarios, with lots of information, facts and data that will require sense, analyses, and response. Participants will need to analyse the situation and conclude what must be done. Although specialists can be contacted, and professionals can provide answers; participants will need to reflect on a process for addressing resolution. This domain will promote good practices.

The fourth category is Simple/Obvious/Clear (Known) refers to a familiar domain. Participants can make sense, categorize, and respond promptly according to established best practices. This context is structured and is presented with a common language.

These four domains are key components to explore knowledge in social networks enriched by digital media. In the scope of chaotic, complex, complicated, and simple domains, it will be possible to examine inter 'actions' and 'reactions' which will propitiate novel, emergent, good, and best practices.

This reminds us of the impact of the pandemic on traditional education and the need to quickly understand other virtual systems to enhance knowledge supported by formal and non-

formal learning through the relationship between these complex, chaotic, complicated, and necessary simple conditions to better respond with possible practices.

2.2   Theory of Relevance

The theory of relevance was introduced by Sperber and Wilson (1995) in cognitive linguistic and pragmatics to better understanding the process of real time interpretation to enhance communication. It was developed to help the process of decision making based on whether a situation is relevant enough to be worth the effort of responding to it. It guides communicators to present situations/utterances in a way that require less processing effort and/or achieve more positive cognitive effects/ responses.

The 'state of relevance' in social networks is a term defined by Meister (2012) as the condition that indicates higher or less visibility of a knowledge shared with digital media through a post. State of relevance is described as a set of four components: relevance, usefulness, timeliness and meaning. The relevance is determined by the number of people engaged with the knowledge and their response in terms of likes, views and comments. The more people and reactions occur in a particular post higher will be its visibility in the social network. Visibility is a key issue in social media due to its ephemeral structure whose content is always on transformation.

State of relevance is a key component for the convergence and expansion of the ephemeral and unstable knowledge developed and shared by social networks. It is related to a non-linear process that depends on people reached, number of interactions, contributions and connections. It is an important indicator to support and be supported by collective intelligences. Thus, knowledge in social networks with digital media is in movement, it can be incomplete and transitory with minimum visibility defined by its pertinence and its obsolescence. It is organised by a triangulation between convergence, expansion and relevance as stated above.

This triangulation requires the breaking of network boundaries. To maximise the rupture, it is necessary open circulation of messages outside the network, prompt use of codes (emoticons, images, texts) by external members. This will enable more connections between knowledge and practices with other networks with different actors who will demonstrate different realities in the construction of habitat of collective intelligences.

Figure 3 presents this process. For example, the FaceBook group page of a social network is recognized as a space of various posts which are nodes of the network. When actors respond to the posts they can connect to other actors and follow them as well as to the actors' responses. The connected nodes of a social network can be actors and their posts and responses denominated actants for Latour (2005). The relationship between space and network occurs through interaction. This interaction takes place in a collective interface, which is a space of connection, which to some extend are confused and always in transformation with new members, posts, interactions, and connections. The posts can be multi-hypermedia with textual, visual, sound, and iconic languages, enabling actant (humans and non-humans) to move to new spaces. This movement establishes actions of convergence, for example, action in the node itself or with

interconnected nodes that can represent a strong link or expansion to other nodes through weak links.

Figure 3 - State of relevance model
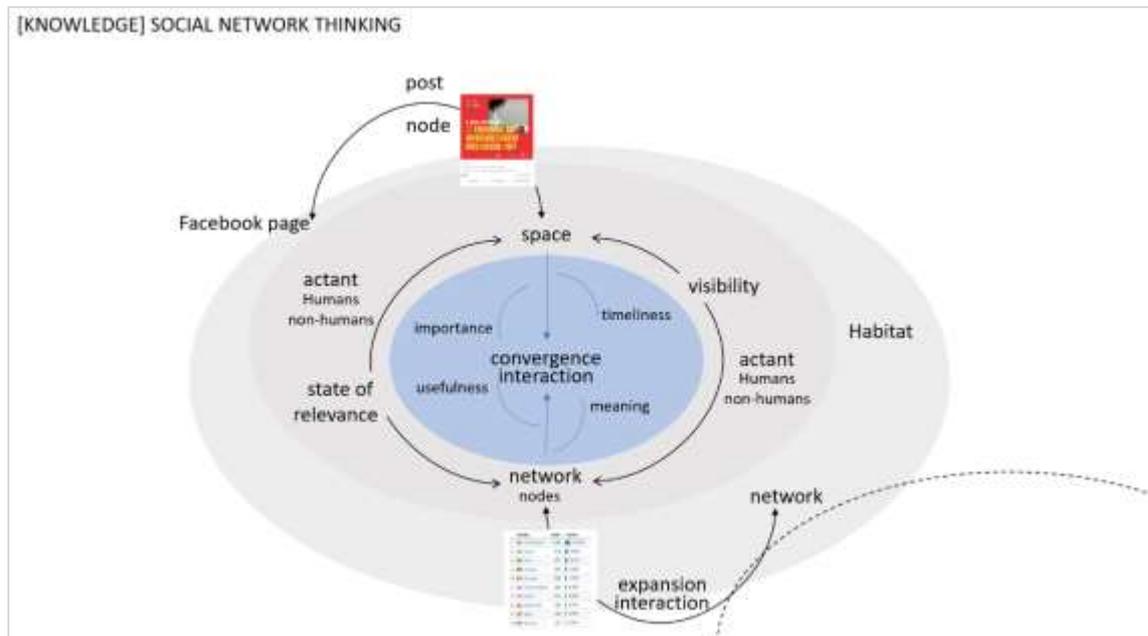
This process results and produces the 'state of relevance' based on its four attributes: importance, usefulness, timeliness and meaning. This triangulation between convergence, expansion and relevance determines the visibility time of the posts that circulate in the network. The visibility of the network and their nodes is important for the construction of its own knowledge and the existence of the network itself. This sustainable habitat that expresses the network thinking in its functioning integrating theory and practices, actions and reflections forms the habitat of collective intelligence. Looking from Lévy's perspective to collective intelligence (Lévy, 1999; 2009; 2011), State of Relevance is a tool to social support ties to enhance learning and knowledge, diversity, and autonomy. At the same time, it is an architecture to exploit data, skills, and symbolic potency. Based on Latour's ANT (actor-network theory) the habitat is a hybrid composition that represents a socio-technical collective of humans (subject) and non-human (media) entities connected by digital artifacts (network space and its components). This hybrid world populated by hybrids actants and their hybrid interactions is mediated through each other, human and nonhuman (Latour, 2005; Angeluci & Cacavallo, 2016).

3   METHODOLOGICAL APPROACH

This study focuses on the COLEARN community at Facebook under the lenses of Cynefin framework and the state of relevance model:

a) to observe knowledge, complexity and collective intelligences at open and collaborative social network supported by the State of Relevance;

b) to understand how knowledge is created and shared in the context of resilience and adversity, such as the COVID-19 pandemic, taking the quadrants of the Cynefin framework as categories of analysis.

3.1   Participants

This study focuses on the COLEARN community created in the OpenLearn virtual learning environment in 2008 with various members from Brazil interested in Open Education enhanced by Technologies. This community became an open network, including educators, students, researchers and professionals, using FaceBook in 2012 and including WhatsApp in 2013. Currently one of the themes of interest of this network is open schooling (Okada & Sherborne, 2018; Okada & Rodrigues, 2018) supported by the multi-network platform of the CONNECT project in Brazil and Europe (connect-science.net) which integrates also FaceBook (https://www.facebook.com/connecth2020).

> Open schooling refers to schools, in cooperation with other stakeholders, become agents of community well-being; families are encouraged to become real partners in school life and activities; professionals from enterprise, civil and wider society are actively involved in bringing real-life projects into the classroom (EC, 2021).

3.2   Research method synthesis

Table 1 provides a description of the qualitative approach adopted by this exploratory research study. It presents the components of ethnography, Research fields, Delimitations, Data generation approach, research object, categories of analysis, principles from state of relevance.

Table 1 - Qualitative research

Research Design	Description
Qualitative approach	Virtual ethnography supported by visual ethnography and net ethnography.
Networks participating in this study	Facebook COLEARN public group 883 members engaged in collaborative open learning
	Facebook CONNECT Project public page

Research Design	Description
	1.105 followers interested in increasing science aspirations by connecting students, scientists & family towards solving real-world challenges through colearning and coinquiry in science.
Characteristics of the networks selected	Social networks in public spaces using digital media Informal education environment Open education and open schooling enhanced by technology Languages diversity Communication and connectivity Members are educators and colearners from universities, schools, enterprises and civil society
Criteria to select and analyse data	Time: date Relevance: like (engagement) Convergence: comments Expansion: shares and post reach Meaning: content
Categories to group and interpret data	Chaotic/innovate Complex/informal Complicated/professional Obvious/structural
Limitations (gaps)	It focused only on content added and shared during covid-19 The quantity of messages was lower than expected This study does not examine participants' views

Note. Source: Authors (2021).

3.3 Qualitative approach

This study is underpinned by ethnography, which is part of anthropological studies with long immersion in the research field. Virtual Ethnography is derived from it and demonstrates appropriation of cyberspace, social networks and internet fields mediated by technologies (Hine, 2004) and data visualisation based on visual ethnography.

Immersion supported by visualisation in a transitory space is useful for taking strategic relevance as a principle. Net Ethnography Online is a field of research including interactive data analysis and insights, as a communication code and a hermeneutic interpretation (Kozinets, 2011).

Visual and Net ethnography are establishing new approaches to time of immersion, data analysis and subjects of observation, all mediated by technologies as well. The qualitative approach considers the main investigative principles and practices to describe and analyse data generated in FaceBook during the period of 2020 to 2021.

4 FINDINGS

Our findings are presented in four categories underpinned by Snowden (1999; 2014) that were described in our introduction: chaotic/innovative; complex/informal; complicated/professional and obvious/structural. Each category group contains data that were selected and interpreted using the concept of state of relevance by Meister (2012) whose components are time (action e.g. fast), interaction (reaction: view, likes, share, comments, following), relevance (high reach, high visibility), convergence (centralisation/ integration on the action whose reaction is located in the same space, high visit) /expansion (decentralisation/dissemination of the action, high number of 'share'; reaction may occur in other space).

4.1 Chaotic/innovative

Data selected in this category indicated a variety of contributions shared by members who were participating in different networks during COVID-19 pandemic. Various messages were about online live events, which increased during the pandemic. Most of these messages contained a banner with photo or images and a brief text summarised about the event. For example, Figure 4 presents the invitation to an open live webinar event "What could we expect of teaching and learning post COVID-19?" organised by PUC-PR Brazil supported also by Coimbra University in Portugal. This event was promptly shared by 3 members with 3 positive reactions.

Figure 4 - Live webinar event

Note. Source: The Facebook COLEARN public group.

Time:3/June 2020; Relevance: 3 likes, Convergence: 0 comments; Expansion: 3 shares.

Figure 5 shows a message, posted by a CONNECT member in Europe and shared in COLEARN network. This example illustrates two sets of comments in different languages (English and Portuguese). The parallel conversations can be chaotic in various groups as it is not possible to visualise it as a whole; for example, who, when and what was commented about the post. The chaos can enable some level of innovation when the knowledge shared is rich with text, icons, and images in the comments, which potentially can generate more ideas, reflections and contributions.

Figure 5 - Live web meeting from CONNECT project page shared in COLEARN generating two different sets of comments

Note. Time: April 2021.

CONNECT post (left); Relevance: 10 likes, Convergence: 2 comments in English.

COLEARN (right) Relevance: 1 Like; Expansion: 3comments in Portuguese

4.2 Complex/informal

Data selected in this category presented a variety of interactions by members who were participating in the discussion in comments. The content of these posts was based on the needs of participants and engaged other members with common interests. The interaction was high in terms of integrated conversation around a particular topic. Participants read not only the main post but also the previous comments and add more ideas and reflection. Therefore, they supported a dialogue around a specific thematic space, which potentially enabled informal learning. This set of data did not included images, instead was based on text added both on posts and comments. So that, the complexity centres on the content, interpretation and prompt responses to the dialogue as shown in figure 6 and 7.

Figure 6 is an invitation to members participate in an interview as part of a PhD study about "strategies of colearning in online education". The message was promptly shared by 4 members to attract more participants The dialogue was not generated in comments but through the interviews developed about the topic.

Figure 6 - Invitation to participate in a web interview of a PhD student

Note. Time: Feb 2020. Relevance: 2 likes, 4 shares.

Figure 7 presents a critical web discussion in the COLEARN group whose topic is about avoiding unappropriated posts about policy advertising in April 2020. The conversation generated prompt fast reaction, by including 6 interactive comments and 9 likes but no share. The message also generated other 3 posts in the network with more reactions about the same topic including a variety of likes and comments; enabling further discussions and reflections about what should be or not be discussed in the COLEARN network.

Figure 7 - Web discussion about unappropriated messages shared in the network

Note. Time: Apr 2020. Relevance: 9 likes, 6 comments and no share.

4.3 Complicated/professional

This category presented included data with high visibility based on 'post reach' (number of views by different members), which was extracted from the new FaceBook option – 'view insights. The set of data illustrated messages that reached more than 20% of the network (approximately 150 to 250 members). The content of this messages were courses (Figure 8) and large conferences (Figure 9) developed by professional staff from universities and very connected to the network' research interests. This means familiar topics to the COLEARN members but maybe complicated to other FaceBook users.

Figure 8 introduces an invitation to an open online course (Digital content production video lessons). The message reached 123 with 4 post engagement, 4 likes(engagement), 4 comments, 1 share and 1 click to the link.

Figure 8 - Online course prepared by a University
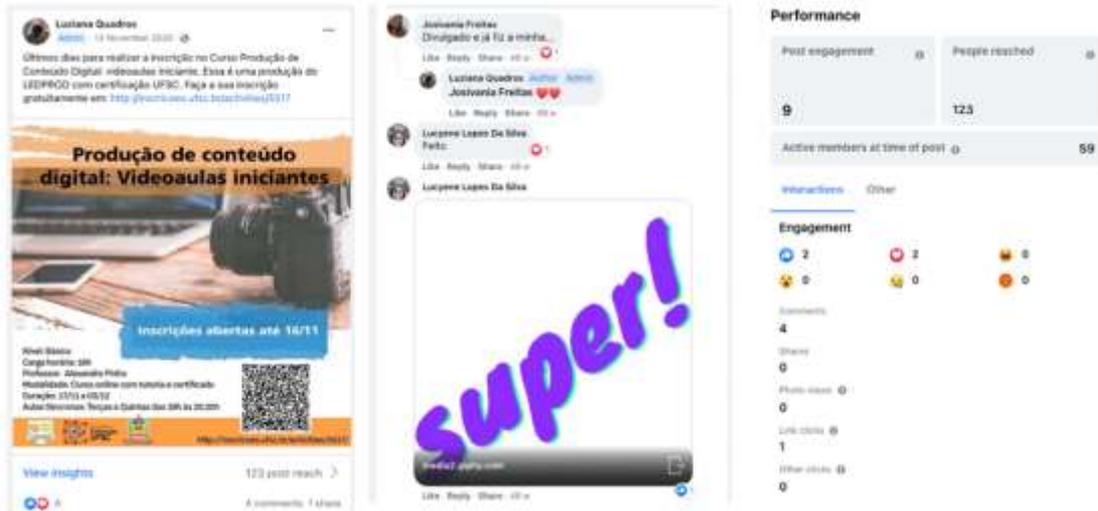
Note. Time: Nov 2020. People reached 123. Relevance: 4 likes, 4 comments, 1 share, 1 click.

Figure 9 highlights an invitation to an open international conference (Education outside box during the pandemic with speakers from UK, Portugal and Brazil. The message reached 213 members with 23 post engagement, 8 likes(engagement), 3 comments with video clips about two sessions of the conference, 7 photo views, 3 shares and 3 link clicks.

Figure 9 - Large open conference with speakers from Portugal, the UK and Brazil

Note. Time: June 2021. People reached 213. Relevance: 8 likes, 3 comments, 3 shares, 7 photo views, 3 clicks.

4.4 Obvious/structural

This category includes messages shared from international project pages which were designed to be structured with clear content that can be easily understood by the network members. Their content commonly contains images, links and information about interesting

topics related to the projects. These posts have often high visibility based on the usefulness for the networks who received the shared content and frequently no or very little comments.

For example, figure 10 shows a page about a project part of GOOGLE Innovator whose aim is to offer educational resources for institutions with low technological infra-structure. This post reached 268 people from COLEARN, 4 post engagement, 3 likes, 1 share.

Figure 10 - Online resources of the Project page Google Innovator
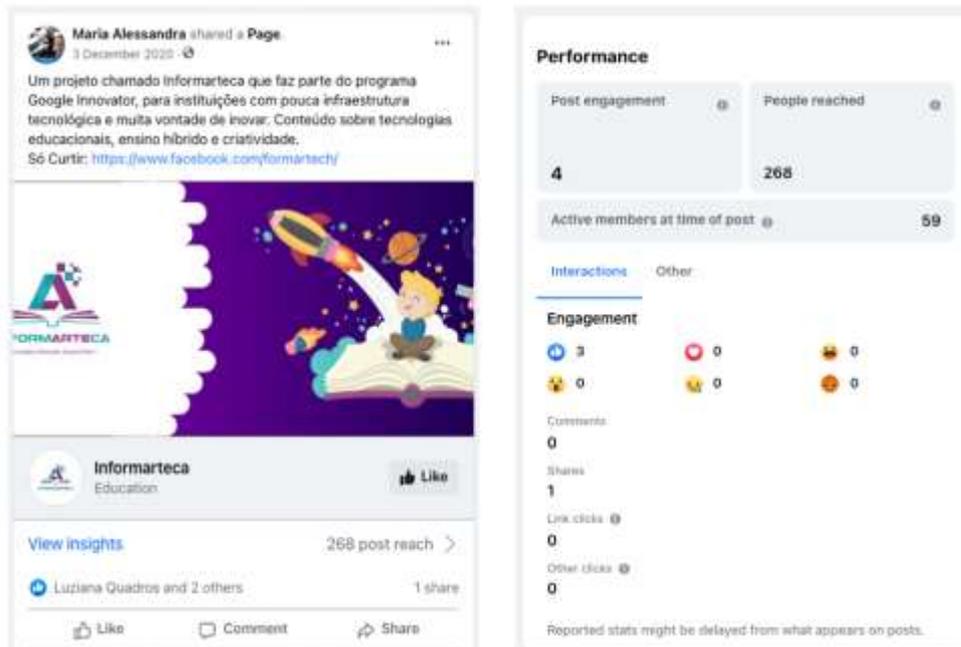
Note. Time: Dec 2020. People reached 268. Relevance: 9 likes, no comment, no share, no clicks.

Figure 11 includes a post of CONNECT project page with information including various links to posts with similar topics #STEM and #OpenSchooling and also more details about the CONNECT open schooling approach https://bit.ly/Connect-about.

The message was shared in COLEARN network and there reached promptly more than 100 members, 59 were online, 3 engagements with 3 likes and 1 share. In the CONNECT project page, this post presents 256 likes, 1 comment and 7 shares. This post contained two comments. The first comment included more information about the CONNECT network added by the project coordinator "*In October, CONNECT reached 1109 educators in United States, 574 in Greece, 477 in Brazil, 351 in Portugal, 325 in Romania, 266 in the United Kingdom, 210 in France, 193 in Netherlands, 180 in Spain and 157 in Germany. Congratulations to all teachers*". The second comment announced this study and provided more details about the open access to the paper and data for both COLEARN's and CONNECT's members; by following the ethical protocol consistent with open science and RRI.

Figure 11 - Open schooling news of the Project page CONNECT shared in COLEARN group

Connect Project
15 October at 08:00 ·

We all want + young people to aspire to a career in science, and job demand in #STEM fields is growing.
Still, students lack 'science capital' & schools STEM curricula need updates.
 Know how CONNECT is transforming the classroom through #OpenSchooling:
https://bit.ly/Connect-about

CON■NECT

CONNECT

Transforming the classroom through Open Schooling

www.connect-science.net

 Cíntia Rabello and 255 others   2 comments 7 shares

CONGRATULATIONS TO ALL TEACHERS !!!!! More than 100 countries celebrate the International Teachers' Day in October. CONNECT has just reached 5822 educators across the globe! HAPPY WORLD TEACHERS' DAY!

	Country	Users	% Users
1.	United States	1,109	19.01%
2.	Greece	574	9.84%
3.	Brazil	477	8.18%
4.	Portugal	351	6.02%
5.	Romania	325	5.57%
6.	United Kingdom	266	4.56%
7.	France	210	3.60%
8.	Netherlands	193	3.31%
9.	Spain	180	3.09%
10.	Germany	157	2.69%

Alexandra Okada
Hi all, Dr Meister and I developed a study of COLEARN group and CONNECT project page during the current time of the pandemic (analysing messages from 2020 to 2021). The article is about "KNOWLEDGE IN SOCIAL NETWORKS WITH DIGITAL MEDIA PROMOTED BY OPEN EDUCATION TOWARDS THE COLLECTIVE INTELLIGENCE HABITAT". This text celebrates 10 years of https://www.facebook.com/groups/colearn21, an open and public network focused on Open Education which was analysed as part of the Meister's Ph.D. study (2012) under my supervision.
http://kmi.open.ac.uk/news/article/18480. Text and data follow open access based on open science and RRI. The URL of the published paper will be added here soon.

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A educação em rede e a inovação responsáveis em tempos de pandemia

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Note. Time: Oct 2021. Relevance: 255 likes, 7 share, 2 comments.

5   DISCUSSION AND FINAL REMARKS

Findings of this exploratory research provide some insights about how knowledge is created in social networks with digital media in the context of resilience and adversity, such as the COVID-19 pandemic.

The originality of this exploratory study is based on the connections established by domains and levels of sensemaking that are relevant for knowledge production within social networks supported by digital media (Table 2). The relevance of this study is to provide a method to support ethnography studies on social media, which is an emerging area with a few studies (Rüller, Aal, Mouratidis, Randall, Wulf, Boulus-Rødje & Semaan, 2020; Wang & Liu, 2021). This empirical study suggests that knowledge can be developed in four domains: chaotic, complex complicated and structured. Each one can facilitate a type of sensemaking respectively: innovative, informal, professional and structural as the result of individual and collective fruition of the "artefact-actor-network" spectrum. The same network is capable of being transversal reaching different quadrants of the Cynefin framework. Although, one of them might be more prevalent.

This study shows that a network can work with a diversity of content (created, inserted and/or feedback), as much as with a diversity of languages. Weak ties are as important as strong ties are. The first expands the net and the second maintains its performance. Each action, connection, interactivity, transforms the collective memory and guides other participants in complex dynamics of collective collaboration and thinking that transcend their own creation and are realized through knowledge (collective intelligences). On the other hand, collective intelligent habitats can probably empower individuals with innovative insights in the cyberspace (Lévy, 2011).

The process of weaving knowledge on social networks is sophisticated and dependent on the interactions and connections activated by relevance, conversion and expansion. However, it

will be necessary more in-depth analysis with a larger dataset and a variety of digital media. Future studies will be developed focused on the CONNECT multimedia platform that integrates WordPress, FaceBook, Twitter, YouTube, LinkedIn and Instagram.

Table 2 summarises the key components and features of knowledge in social networks with digital media.

Table 2 - Knowledge in social networks with digital media

Domains for *sensemaking*	Interaction (Comments)	Relevance (Reach)	Convergence Reaction	Expansion Share	Dataset (Examples)
Chaotic domain for *innovative* sensemaking	high interaction of disconnected ideas	low	fast	varies	Colearning informal events: Fig.4 webinar Fig.5 webmeeting
Complex domain for *informal* sensemaking	high interaction of connected ideas	low	fast	varies	Colearning non-formal activities: Fig.6 webinterview Fig.7 webdiscussion
Complicated domain for *professional* supported sensemaking	low	High People Reached >100	varies	fast	Coinquiry informal references: Fig.8 online course Fig.9 large conference
Obvious domain for *structural* sensemaking	low	High People Reached >100	varies	fast	non-formal project communication Fig.10 online resource Fig.11 open schooling news

Note. Source: Authors (2021).

This study provides two recommendations for networks led by communities such as COLEARN and by project teams such as CONNECT based on our findings:

First, knowledge which occurs through the rupture of order with high interaction, is facilitated by the chaotic or complexity domains. However, it can be perceived as incomplete or disperse in its time of visibility. Conversely, the information shared by social networks may carry minimal knowledge that enables a significant articulation revealed by the connections, expansions and new circumstances of weaving established by individual members or groups in a very short time between its relevance and obsolescence. Our findings suggests that information from chaotic and complex domains can be transformed in innovative insights and informal learning opportunities. This process can enhance the convergence of the network; with more knowledge shared in the network habitat.

Our recommendation underpinned by the Cynefin framework (Snowden, 2014; 2015) and Actor-Network Theory (Latour, 2005) is therefore to observe the network context in both domains and their actants (human and non-human). Identifying the conditions of non-linearity, unpredictable and complex processes, emerging experiences and fast response time will potentially enhance visibility, controversy, creativity and innovation.

Second, the state of relevance can be useful for the expansion of the network with knowledge to be shared to and from other networks. It determines visibility time based on the

collective intelligences created and members reached internally and externally. Our findings shows that the importance, utility, timeliness and meaning of knowledge produced by expert or project teams can facilitate the expansion of the network and its knowledge, facilitating the sustainability of the network and its habitat.

Our recommendation underpinned by the Cynefin framework and the state of relevance is then to provide network movement supported by expert members and project teams to create a relation between controversy and black boxes (stabilization and resolution of disputes), interaction by convergence and expansion movements to promote time of visibility and network sustainability.

6   CONCLUSION

This research study explored the concept of state of relevance, the actor-network theory and the Cynefin framework to face the relationship between social network interactions within FaceBook during COVID-19 pandemic. It provided a methodology to explore social networks enriched by digital media. Recommendations were designed to support and develop this field of knowledge in social networks enriched by social media to enable the habitat of collective intelligence. This study indicated that fragments of knowledge -the minimal persistent knowledge - are building in layers of complex and chaotic scenarios or quadrants as placed in the Cynefin framework. These layers are weaved into the convergence and expansion movement in its time of visibility. They are established in connections and digital media language format (tags, comments, likes-emotions, video, images, hyperlinks). We can say that convergence emerges in the chaotic and complex context and expansion in the complicated and obvious domains.

Thinking about formal, non-formal and informal education we highlight a common ground: collaborative and open principles; collective intelligences; unpredictable processes; emerging experiences based on interaction, relevance, convergence and expansion. It's a co-creation and habitat for colearning and coinquiry. In fact, "Cynefin" means habitat in ancient welsh.

This study highlights digital media as artefacts to enhance social actors-networks, that enables their colearning and co-inquiry by engaging members, followers and new users in producing, adapting, sharing and disseminating knowledge collaboratively. Social Networks with Digital Media – "SNDM" is a relevant approach for establishing the cooperation for acquisition, adaptation and transformation levels of the network itself, once supporting local and global teams with prompt interactions to enhance open education and potentially open schooling.

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Note

A Portuguese version of this article will be available at https://www.rridata.com/forum/phd-studies-1/cocreation-of-knowledge-in-social-networks.