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## The Problems of Contemporary Education

### Reflections about Complex Thought and Complex Thinking: Why These Theoretical Constructs Matters on Higher Education?

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#### Abstract

This article is based on the knowledge that complex thinking as a construct is nowadays shaping a system of meta-competencies which depends entirely on synergy at all its levels. In higher education contexts, it is well known that the development of transversal competencies allows fostering a better recognition and adaptation to the environment. However, the indistinct use of some concepts that allude to competencies generates confusion regarding what they imply, both theoretically and practically. Consequently, the present article analyzes the differences between *complex thought* and *complex thinking*, as relevant concepts, and competencies in higher education. We analyzed to what extent the concept of complex thought is a possible starting point for the adoption of the term and development of the competence of complex thinking, and how this is permeating all branches of knowledge. A qualitative research methodology was used to support the present theoretical reflection, through a critical reflection of the literature. Both concepts, their uses, and implications were analyzed through a compilation of scientific papers, which allowed an entire observation, and document analysis to ensure objective study. The present work presents practical implications in higher education contexts: 1) complex thought has become a relevant matter for explaining the multidisciplinary from theory of knowledge in epistemology, and 2) complex thinking has become a mean for ensuring new academic skills and strengths for problem solving among students in higher education.

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### **1. Introduction**

Complex thought as a concept, often used in science and epistemology, has been undergoing a process of construction and refinement since the French philosopher and sociologist Edgar Morin coined it in the mid-twentieth century. Strikingly, this notion seems to be profoundly hard to understand not precisely because of the level of difficulty involved in its meaning among the words themselves that contain the concept; but essentially because of its level of multidisciplinary and transdisciplinary that involves a prominent intervention of various aspects and field of knowledge within this whole construct (Montouri, 2004; Textor, 2010).

It can be said that complex thought as a construct within epistemology (that branch of philosophy that studies knowledge in general and its properties) alludes to the nature of association and the relationship between a series of elements that necessarily share an essential complementarity. Although such elements may be heterogeneous, in any case, there may be a relationship of synergy between all of them, which represents a paradox of the individual and the group from the logic of systems (Morin, 1992; Morin 2005; Moraes, Petraglia, 2021). Likewise, complex thought must, in ontological terms, fulfill very numerous conditions to be considered as such. For example, it must link the object to the subject and in turn both with the environment; all these as elements of a system that raises complex problems within the organization and order. Likewise, it must respect the multidimensionality of beings and things. It must deal and dialogue with uncertainty, with the rationalizable. Similarly, it must not disintegrate the world of phenomena, but try to account for it by mutilating it as little as possible (Morin, 1984; Kaspar, 2014; Preiser et al., 2013).

Thus, complex thought can be defined, among one of its various meanings, as the ability to integrate different ideas, which a priori may seem unconnected, but which over time, in the network of knowledge that is built within science, end up being connected. A situation that involves providing explanations and solutions to the problems, which at the phenomenal level, are present in the very evolution of life and human reality. However, Morin's whole proposal took a new direction not only because of the possible translation into English of a term originally written in French and deeply convoluted, but also because over time complex thought has gone from being a less philosophical idea, proper to the field of epistemology, to a more practical idea that has reached a more practical meaning related to learning. All of the above, as is the case with complex thinking, which is currently associated with the development of competencies in higher education (Castañeda-Bustamante, 2018; Solana-Ruiz, 2019; Baena-Rojas et al., 2022).

Regarding complex thinking, the concept is also in a current process of construction and refinement since the American philosopher and pedagogy theorist Matthew Lipman started to deal with this in the last twentieth century. Then, this notion conjures different strategies to enhance educational resources, besides expand the range and nature of the concepts taught and promoting self-correction, critical aptitudes, modification of the methods and content that is taught from cognitive processes (Kennedy, 2012).

In this manner, on the one hand, complex thought is from Edgar Morin's contributions a strategy or way of thinking that has the purpose of encompassing phenomena holistically but, at the same time, recognizes the specificity of the parts or elements that make up the whole as an ensemble. Thus, everything related to complex thought is linked to epistemology that then seeks the production and validation of scientific knowledge through the analysis of different criteria (Salazar, 2020). On the other hand, complex thinking is from Matthew Lipman's contributions defined as different ideas based on coherence that besides are shaped by profound and dynamical terms which enhance the need to investigate and explore different topics and matters from academia (Gratton, 2004; Silva-Pacheco, Iturra-Herrera, 2021).

The current paper recognizes the relevance of complex thought as a remarkable input for the current dynamic of sciences in general for understanding different disciplines of knowledge in a wider manner and without ignore the particularities that comprise it. Similarly, this article also indicates the role of complex thinking as an evolved component and relevant output from the previous construct, in this case focused to learning, for instilling this type of thinking in students to

stimulate their intellect, their critical sense and their creativity for solving problems. All of this in a changing environment subordinated to education systems and educational trends.

### **Research problem**

Among higher education literature, the vague use of the concepts *complex thought* and *complex thinking*, has caused confusion regarding what they imply, both theoretically and practically, generating in turn, uncertainty, and lack of specificity regarding academic activities. Consequently, in order to clarify the origins, definitions and implications of the use of both concepts, the present article analyzes the differences between them, as relevant conceptions in higher education. We analyzed to what extent the concept of complex thought is a possible starting point for the adoption of the term and development of the competence of complex thinking, and how this is permeating all branches of knowledge. Discursive, as well as interactive relationships were considered between the concepts, contemplating the following query for the present reflection:

Are there substantial relations and variations, on the one hand, between complex thought and, on the other hand, with complex thinking; addressing both notions as constructs within field of knowledge where different scientific disciplines join on higher education?

Being clear about the relationships, variations, uses and implications of both concepts, educational practice at the higher level will benefit from establishing well-defined areas of competence for both terms. Likewise, it will give clarity to the teaching education community regarding the theoretical baseline and practice under which the training of students will be focused.

## **2. Literature Review**

### **Considerations about complex thought and complex thinking**

Complex thought as a term, still in construction, entails a kind of method or practice, where empirical research and philosophical reflections on complex systems and complexity science require to be analyzed holistically in order to understand better the reality of daily. In this way, it is clear current literature on complex thought is quite extensive but paradoxically, in many cases, it also seems to be somewhat confusing and convoluted. Especially considering an apparent lack of technical and conceptual precisions which allow to understand better some essential relations with other particular and specialized fields such as education. Then, even though complex thought is not a new matter this construct is still moving forward and adapting to new circumstances of human reality; merely feeding various scientific disciplines within epistemology itself (Massip-Bonet et al., 2019; Rezaei, 2021).

It is possible to affirm that complex thinking has tried, since its origins in the middle of the 20th century, to focus on the study of problems that attempt to explain the development of the human subject. This is precisely how the French philosopher Edgar Morin developed a whole idea supported by various disciplines and fields of study, at that time, such as biotechnology, systems theory, cybernetics, and information theory. All these which end up being an important input for the whole epistemological proposal of complexity (Chaves, 2010).

With other new technological advances and even diverse scientific revolutions, all of the contributions from Morin have revealed an astounding, varied and rich body of work during more than 50 years. In this manner, Morin is usually recognized as one of the most important French and European thinkers to emerge in the 20th century. Although is remarkably curious to misread his work on Method and Complex Thought as being focused exclusively on the cognitive domain. The term complex thought might be misleading here because it is relevant to point out that Morin's work is far broader, as his first literary production indicates. Therefore, Morin's proposal offers a wide vision of complexity and of thought explicitly connects reason and emotion, wisdom and compassion, idealism and realism, besides other interesting human features (Montuori, 2004).

In any case, while the academic community in general recognizes the relevance and validity of Morin's work, there is also some criticism of the way in which some of his work is approached. This is part of the reason why there may be ambiguities in the interpretation of his ideas, which for some may be somewhat vague and difficult to assimilate. All this in addition given its pomposity in the dialectic of his ideas that makes it not only philosophically robust, but also lends itself to various interpretations. This apart from the fact that it can also be excessively qualitative, which some of his own critics interpret as weak at the logical and mathematical level (Reynoso, 2006; Solana-Ruiz, 2011).

Even though the complex thought shows then approaches, in general, very qualitative, there are some new works that have also tried to further strengthen the theories of this construct with certain mathematical contributions that pretend increase the rigor of this concept. All this, precisely because the ideas addressed within this notion involve or consider the susceptibility to change as well as the adaptation itself to the circumstances. Nevertheless, complex systems and the elements that interact with each other within them show non-linear behaviors, difficult to measure, and with constant feedback from the environment (Tsoukas, 2005; Chevallier, 2016).

In any case, the real systems of thought, as a deductive and discursive manner for analyzing reality supports philosophy, theology, science, etc. and this is why complex thought is also associated with common sense, popular culture, popular knowledge, everyday knowledge, social representations, among other names. Obviously, this is because this construct permeates any single area of cognition aiming at a non-divided, non-reduced knowledge, as well as the constant search for the limits of all that is unfinished or incomplete within all knowledge in general (Viana, 2015; Juárez, Comboni, 2012).

Thus, it is quite clear that complex thought is related to the educational sciences not only because of its remarkable field of influence on all sciences in general, but also because of the very condition of multidisciplinary of this notion that holistically integrates knowledge. In fact, this influence is increasingly recognized by specialized international organizations because education is currently developing diverse pedagogical projects that involve different educational approaches more and more integral and therefore more in line with complex thought. In addition, the migration to the new educational paradigm continues to require a new structural model, whose components are not analyzed in isolation but in a complementary manner. This is a clear characteristic of complex thinking as well as the fact that education focuses on social, human, and technological aspects (De Oliveira, De Souza, 2006).

In any case, it is necessary to recognize that although Morin's contribution, given its transdisciplinary and multidisciplinary essence, influences contemporary educational theories, his postulates are only one element that generates what is called "complex thinking", which as a concept, in recent decades, has proliferated an enormous number of new studies on educational sciences. Thus, this other construct is usually recognized more in the field of educational systems and despite generating a robust literature on the subject, with points in common with complex thought, it is necessary to make it clear that both terms do not allude to the same idea and therefore should not be used as synonyms (See Figure 1).

Term	Definition	Approach	Referent authors	Points in common
Complex thought	The concept refers the capacity to interconnect different dimensions of reality, constructed by the sciences and their different disciplines, without generating reductionisms and fractioning the parts that integrate the whole object of study.	Transdisciplinary	Morin (1992)	<ul style="list-style-type: none"> <li>• Problem solving</li> <li>• Disciplines</li> <li>• Information</li> <li>• Education</li> <li>• Competencies</li> <li>• Knowledge</li> <li>• Cognition</li> <li>• Reality</li> <li>• Understanding</li> </ul>
Complex thinking	The concept refers the capacity to develop different meta-competencies, in any discipline of knowledge, in order to improve problem solving all this adopting innovative strategies in educational system.	Academic	Lipman (1995)	

**Fig. 1.** Parallel between complex thought and complex thinking

Source: own elaboration based on Viana, 2015 and Cruz-Picón, Hernández-Correa, 2021

Precisely, the American philosopher Mathew Lipman goes deeper regarding this other construct derived from complex thought; all this emphasizing in the learning processes that

compose it. Then, based on action and interaction with the environment (full of uncertainty and vulnerability) in addition to cognitive and metacognitive processes, it is valid to postulate complex thinking as a notion especially challenging for education with meta-competencies such as critical, systemic, scientific, and innovative thinking (Silva-Pacheco, 2020; Ramírez-Montoya et al., 2022; Nur et al., 2022).

It can be said that complex thought subordinated to Lipman's contributions is of enormous conceptual richness because of the way it explores a socio-pedagogical, psychological, and logical educational context that must be in constant change considering the conditions of human learning. That is why this construct is nourished by a constant and broad analysis based on diverse epistemological and pedagogical meanings that, with a critical narrative, depends in turn on the notion of "complex thought" for the generation of different and heterogeneous theoretical lines that can improve learning techniques and cognitive processes (Cruz-Picón, Hernández-Correa, 2021).

### **Justification**

There is a need to address certain challenges related to an operational conceptualization that allows the development of instruments, tasks or evaluation systems for observation or measurement, from the conceptual perspectives derived from "complex thought" and "complex thinking", both considered as some of the most relevant and referenced notions in the educational field today (Silva-Pacheco, Iturra-Herrera, 2021).

Therefore, complex thinking has recently become an important topic for higher education. All this, not only because it considers, epistemologically speaking, the foundations of "complex thought" to approach the sciences and their various fields in a multidisciplinary and systemic way; but also, because it has been concerned to show within the educational sciences that students must develop new capabilities, regardless of their training, to better meet the technological, environmental, social, political, and social challenges of the present (García, 2020; Vázquez-Parra, et al., 2022). Specifically, complex thinking understood as a mega competence, is a useful training tool for students and the educational community in general, to propose solutions to complex problems in an innovative way and with scientific bases (Suárez-Brito et al., 2022). As mentioned above, it is made up of the subcompetencies of critical, scientific, innovative, and systemic thinking (González-Pérez, Ramírez-Montoya, 2022; Ramírez-Montoya et al., 2022), each of which presents its own characteristics, and are also conceived as part of the 21st Century Skills proposed by UNESCO (Fadel, 2008; UNESCO, 2017; UNESCO, 2022). Thus, by integrating competency-based training in higher education that includes complex thinking development, each of the abilities in turn detonates other skills, promoting a comprehensive and holistic training of individuals that prepares them to face today's complex problems. Likewise, all the above characterizations and conceptions are aligned with the Sustainable Development Goals (UN, 2022), in order to contribute to a better education in the global context.

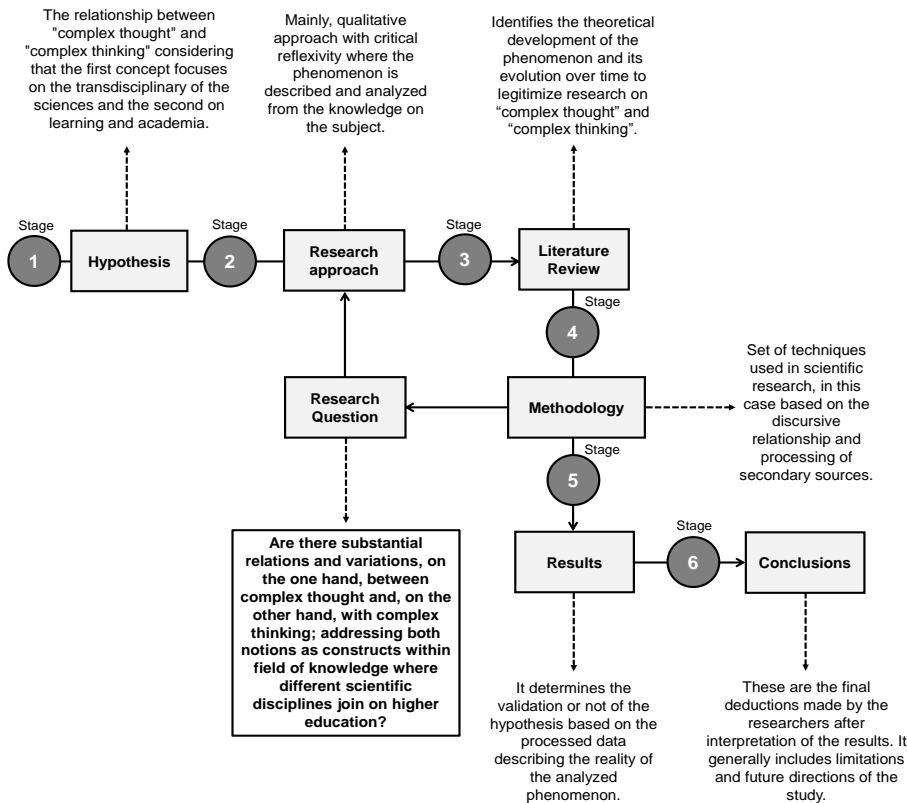
### **3. Methodology**

A qualitative methodology was used with descriptive critical reflection of the literature, through an informetric analysis of 814 indexed articles, as well as conceptual analysis of the terms of interest. Figure 2 shows graphically the methodological procedure from the establishment of hypotheses to the conclusions. Likewise, this article carries out an exercise of critical reflexivity with a qualitative approach within the Social Sciences. In this way, according to De la Cuesta-Benjumea (2011) this reflexivity exposes the researcher's awareness of the subject under study, also showing its connection with the circumstances of the research. It is a theoretical and detailed process in which researchers analytically and critically examine the content of an idea or even a specific phenomenon over time. These ideas or phenomena are usually present in the research question. The latter is answered from the researcher's reasoning, either through a propositional exercise where he/she reflects on possible relationships and explanations, both discursive and interactive, according to the available literature and knowledge of the subject.

It should be noted that the research question can also be answered using available databases (Scopus and Google Scholar in this case) whose information can be processed to construct figures and their respective explanations that open the debate on a given topic within the academy.

It is relevant to indicate that this paper aims to not only to answer the research question of this proposal through a discursive and conceptual approximation but also document with evidence,

using the Scopus data base, some relevant ideas which finally validate the hypothesis suggested on this entire study.



**Fig. 2.** Methodological steps and stages to complete this study  
Source: Own elaboration

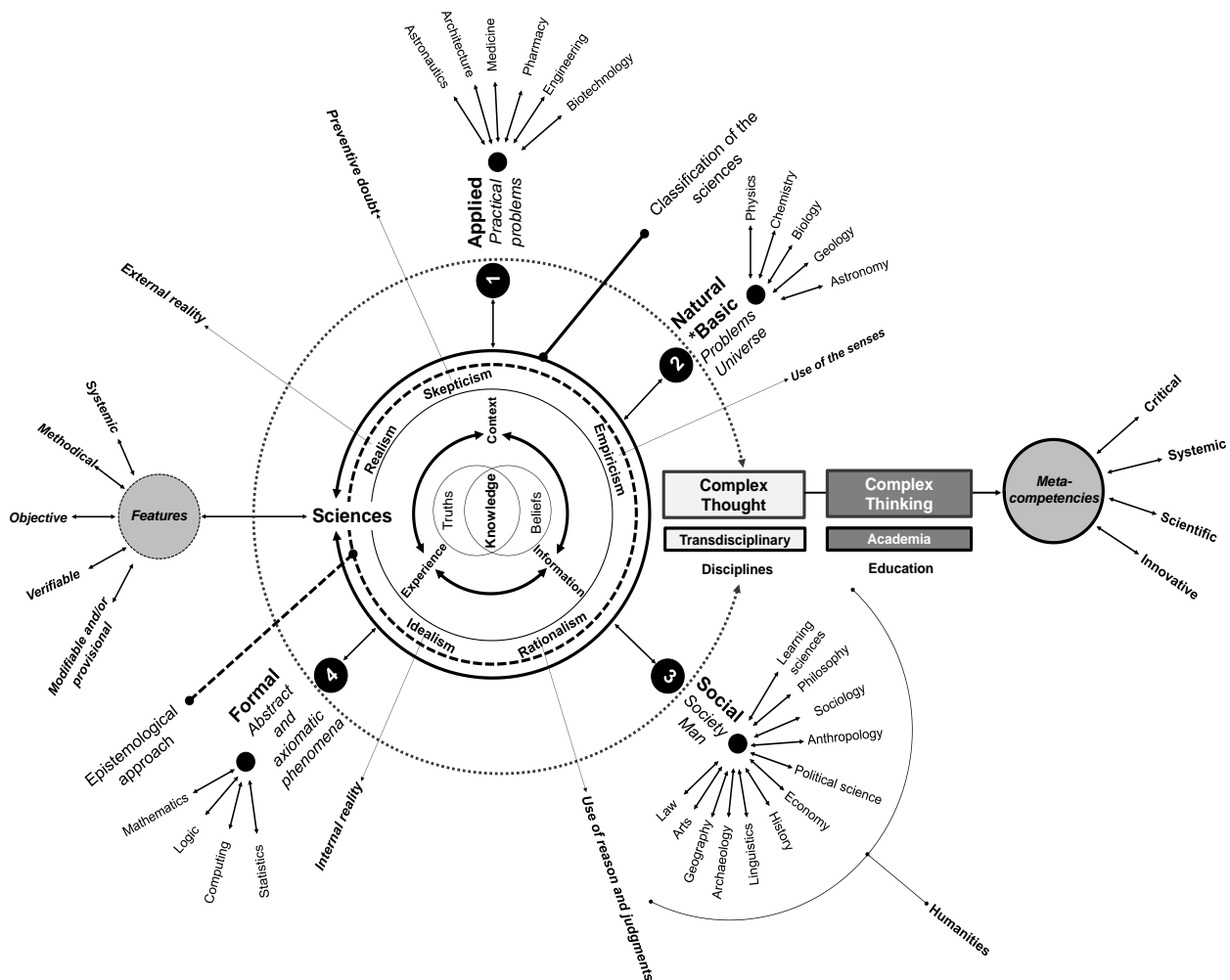
Therefore, the process of collecting, verifying, and analyzing about the content written on complex thought and complex thinking allow to transform historical and recent papers, as well as statistics data from Scopus, into new knowledge or at least open new debates regarding all this matter.

In this way, with the current analysis the authors seek to highlight and understand how two relevant concepts such complex thought and complex thinking are related besides where exactly these terms take distance from each other. All of this, despite some theoretical approaches surprisingly associate both terms or constructs as the same, without establishing the conceptual boundaries or limits among them. In fact, the Spanish translation of these two constructs is literally the same denoting a lack of deepening into the addressed topic of this article. Then, this current proposal pretends to point out the essential topics, issues and elements which usually are linked as those who are not mostly related between these two constructs framed within sciences in general and higher education.

#### 4. Results

In this section, it is essential to highlight, epistemologically, the relationship between the central concepts of this article, such as "complex thought" and "complex thinking". In this way, these constructs are represented in a remarkable and intricate network that represents knowledge, where these interact with various disciplines and fields of science at a general level, as several theoretical works suggest. Subsequently, the incidence of the central concepts of this work is analyzed; all this, on the different disciplines according to their classification within the sciences. Likewise, co-occurrences are identified for each concept based on the most recurrent themes that are related. Then, this part of the article closes by pointing out those themes that are common (and that generate intersection) among all the most important literary production at present that contains the terms "complex thought" and "complex thinking".

Therefore, in the first part of the results, a comprehensive review of different theoretical sources was carried out to recognize, at the epistemological level, where "complex thought" and "complex thinking" are located, considering that both constructs are not only different, but in each case their fields of study are different. However, it should be noted that although it can be said that there is a discursive causality that derives from the way the second construct has been nourished by the first. All of this, to achieve the understanding of various aspects within its *raison d'être*, as the literature shows according to Figure 3; this does not mean that both do not have points in common because theoretically in deductive terms both complement each other.



**Fig. 3.** Representation of complex thought and complex thinking in epistemology  
 Source: own elaboration based on Tsoukas, 2005; Henry, 2013; Hyytinen et al., 2014; Ramírez-Montoya et al., 2022

In the second part of the results, after considering various disciplines and fields within the classification of sciences, it is possible to indicate possible perceptions and relationships between "complex thought" and "complex thinking". Thus, according to Table 1, there are sciences with a greater affinity with respect to "complex thinking", as is the case with the applied sciences due to the enforceability of their disciplines. This is also the case of the social sciences because of their focus on epistemology in addition to the object of study itself, in this case man. On the other hand, there are also sciences with a greater affinity to complex thinking because of their focus on education and teaching, as is the case with the social sciences and the formal sciences. Similarly, the current analysis points out how some of these sciences also have a significant affinity with the meta-competences of complex thinking, as is the case here with the applied sciences and the formal sciences, where there seems to be an enormous potential for the enrichment of complex thinking as a construct.

**Table 1.** Perception and relationship between complex thought and complex thinking in science

No	Classification of sciences	Complex Thought	Complex Thinking	Influence of meta-competencies			
		Relation	Relation	Critical	Systemic	Scientific	Innovative
1	<b>Applied</b>	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>High</b>	<b>High</b>	<b>High</b>
	Astronautics	Low	Low	Low	High	High	High
	Architecture	Medium	Medium	Low	High	High	High
	Medicine	High	High	Low	High	High	Medium
	Pharmacy	High	High	Low	High	High	High
	Engineering	High	High	Low	High	High	High
	Biotechnology	High	High	Low	High	High	High
2	<b>Natural</b>	<b>Medium</b>	<b>Medium</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>High</b>
	Physics	Medium	Medium	Low	Medium	High	High
	Chemistry	Low	Low	Low	Medium	High	High
	Biology	Medium	Medium	Low	Medium	High	Medium
	Geology	Low	Low	Low	Low	High	Low
	Astronomy	Low	Low	Low	Medium	High	Medium
3	<b>Social</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>Medium</b>	<b>Low</b>
	Learning sciences	High	High	High	High	High	High
	Philosophy	High	High	High	High	Medium	Low
	Sociology	High	Medium	High	High	Medium	Low
	Anthropology	High	Low	High	High	Medium	Low
	Political science	High	Medium	High	High	Medium	Low
	Economy	High	High	High	High	High	Medium
	History	Medium	Medium	High	High	Medium	Low
	Linguistics	High	High	High	High	Medium	Medium
	Archaeology	Medium	Medium	Medium	High	Medium	Low
Geography	Medium	Medium	Low	High	Medium	Medium	
4	Arts	Medium	Medium	Medium	Low	Low	High
	<b>Formal</b>	<b>Medium</b>	<b>High</b>	<b>Medium</b>	<b>High</b>	<b>High</b>	<b>High</b>
	Mathematics	High	High	Medium	High	High	Medium
	Logic	Medium	Medium	Low	High	Medium	Low
	Computing	High	High	High	High	High	High
Statistics	High	High	High	High	High	High	

Source: own elaboration based on [Montuori, 2013](#); [Ramírez-Montoya et al., 2022](#)

Then, in the third part of the results, an additional analysis of co-occurrence is performed. In this case, after considering the papers resulting from the Scopus search (total = 814 papers) and using as a filter the two central constructs of this study, it is possible to identify the words, which in turn act as sub-themes, most recurrent in the literature analyzed. Thus, it is possible, according to [Table 2](#), to recognize for the case of "complex thought" that there are a series of key clusters from which different themes are derived. In this case, nonhuman, male and human stand out regarding other terms; all of them, that suggest the connection of this first construct of the current study with



living organism’s cognition. In this case, the co-occurrence percentages of related topics and recurrent words within the concepts of interest are presented. Given the descriptive perspective of this work, in this study we were not interested in showing statistical comparisons between the links and the co-occurrences of the clusters.

**Table 2.** Co-occurrence of related topics and recurrent words within complex thought

Nº	Cluster	Nº	Items	Links	%	Total link strength	%	Co-occurrence	%
1	Nonhuman	1	Nonhuman	22	9,65	157	15,56	35	17,50
		2	Controlled study	26	11,40	164	16,25	30	15,00
		3	Unclassified drug	19	8,33	125	12,39	23	11,50
		4	Animals	19	8,33	117	11,60	22	11,00
		5	Animal cell	17	7,46	77	7,63	14	7,00
		6	Animal	17	7,46	60	5,95	13	6,50
		7	Metabolism	19	8,33	53	5,25	11	5,50
		8	Gene expression	18	7,89	48	4,76	10	5,00
		9	Animalia	16	7,02	42	4,16	9	4,50
		10	Protein binding	14	6,14	47	4,66	9	4,50
		11	Genetics	11	4,82	33	3,27	8	4,00
		12	Protein function	14	6,14	40	3,96	8	4,00
		13	Protein localization	16	7,02	46	4,56	8	4,00
		<b>Total</b>				<b>228</b>	<b>100</b>	<b>1009</b>	<b>100</b>
2	Male	1	Male	28	12,02	206	17,87	37	17,29
		2	Female	28	12,02	182	15,78	32	14,95
		3	Adult	19	8,15	162	14,05	28	13,08
		4	Thinking	20	8,58	75	6,50	18	8,41
		5	Cognition	20	8,58	80	6,94	17	7,94
		6	Brain	20	8,58	77	6,68	16	7,48
		7	Human experiment	17	7,30	92	7,98	15	7,01
		8	Physiology	23	9,87	89	7,72	14	6,54
		9	Review	21	9,01	66	5,72	13	6,07
		10	Aged	12	5,15	39	3,38	8	3,74
		11	Normal human	13	5,58	53	4,60	8	3,74
		12	Problem solving	12	5,15	32	2,78	8	3,74
		<b>Total</b>				<b>233</b>	<b>100</b>	<b>1153</b>	<b>100</b>
3	Human	1	Human	33	24,44	353	46,94	87	37,83
		2	Humans	32	23,70	243	32,31	53	23,04
		3	Complex Thought	8	5,93	13	1,73	29	12,61
		4	Complexity	5	3,70	7	0,93	17	7,39

	5	Nursing	9	6,67	24	3,19	10	4,35
	6	Child	16	11,85	47	6,25	9	3,91
	7	Phycology	9	6,67	29	3,86	9	3,91
	8	Philosophy	10	7,41	15	1,99	8	3,48
	9	Theoretical study	13	9,63	21	2,79	8	3,48
	<b>Total</b>		<b>135</b>	<b>100</b>	<b>752</b>	<b>100</b>	<b>230</b>	<b>100</b>

Source: own elaboration based on [Scopus, 2022](#).

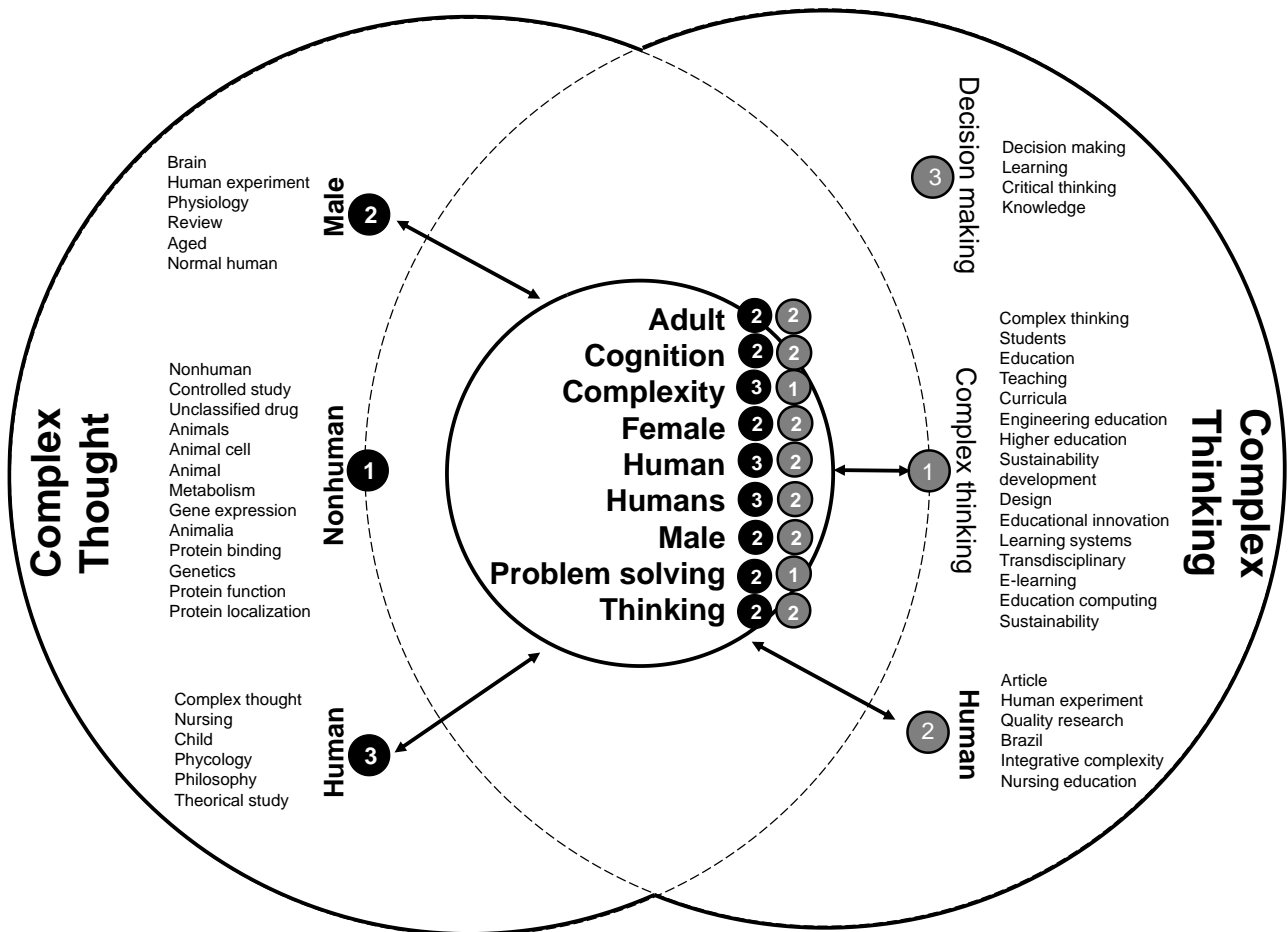
Similarly, it is possible, according to [Table 3](#), to recognize for the case of "complex thinking" that there are also a series of key clusters from which different themes are derived. In this case, students, complexity, and educations stand out regarding other words and terms that suggest the connection of this second construct of this study with learning sciences.

**Table 3.** Co-occurrence of related topics and recurrent words within complex thinking

N <sup>a</sup>	Cluster	N <sup>o</sup>	Items	Links	%	Total link strength	%	Co-occurrence	%
1	Complex thinking	1	Complex thinking	30	10,00	156	16,79	97	25,13
		2	Students	29	9,67	143	15,39	48	12,44
		3	Complexity	16	5,33	33	3,55	36	9,33
		4	Education	28	9,33	86	9,26	29	7,51
		5	Teaching	28	9,33	96	10,33	25	6,48
		6	Curricula	14	4,67	62	6,67	20	5,18
		7	Engineering education	16	5,33	51	5,49	19	4,92
		8	Higher education	19	6,33	49	5,27	15	3,89
		9	Problem solving	26	8,67	59	6,35	15	3,89
		10	Sustainability development	12	4,00	29	3,12	13	3,37
		11	Design	13	4,33	27	2,91	11	2,85
		12	Educational innovation	13	4,33	31	3,34	11	2,85
		13	Learning systems	12	4,00	22	2,37	10	2,59
		14	Transdisciplina ry	7	2,33	13	1,40	10	2,59
		15	E-learning	16	5,33	23	2,48	9	2,33
		16	Education computing	13	4,33	34	3,66	9	2,33
		17	Sustainability	8	2,67	15	1,61	9	2,33
		<b>Total</b>		<b>300</b>	<b>100</b>	<b>929</b>	<b>100</b>	<b>386</b>	<b>100</b>
2	Human	1	Human	28	10,85	303	19,04	68	21,45
		2	Humans	27	10,47	235	14,77	49	15,46
		3	Article	24	9,30	209	13,14	41	12,93
		4	Thinking	23	8,91	168	10,56	32	10,09
		5	Female	22	8,53	158	9,93	25	7,89
		6	Male	22	8,53	151	9,49	23	7,26
		7	Adult	21	8,14	124	7,79	18	5,68
		8	Human experiment	18	6,98	75	4,71	15	4,73

		9	Quality research	12	4,65	29	1,82	10	3,15
		10	Brazil	16	6,20	33	2,07	9	2,84
		11	Cognition	16	6,20	39	2,45	9	2,84
		12	Integrative complexity	12	4,65	22	1,38	9	2,84
		13	Nursing education	17	6,59	45	2,83	9	2,84
		<b>Total</b>		<b>258</b>	<b>100</b>	<b>1591</b>	<b>100</b>	<b>317</b>	<b>100</b>
		3	Decision making	1	Decision making	25	31,25	96	44,24
2	Learning			22	27,50	58	26,73	15	25,86
3	Critical thinking			21	26,25	42	19,35	13	22,41
4	Knowledge			12	15,00	21	9,68	9	15,52
<b>Total</b>				<b>80</b>	<b>100</b>	<b>217</b>	<b>100</b>	<b>58</b>	<b>100</b>

Source: own elaboration based on [Scopus, 2022](#).



**Fig. 4.** Relations between complex thought and complex thinking according to the most important literary production

Source: own elaboration based on [Scopus, 2022](#).

Finally, in the fourth and last part of the results it is possible to identify the terms or words, from the previous co-occurrence exercise, that are repeated within some of these clusters. This is the case for clusters 2 and 3 of "complex thought" and likewise for clusters 1 and 2 of "complex thinking". According to the above, this means that among the different terms with co-occurrence only adult, cognition, complexity, female, human, humans, male, problem solving, and thinking are repeated among some of the clusters of the two central constructs of this research.

## **5. Discussion**

All the documents and research papers obtained from the Internet, as well as from the scientific database used for the search of specialized literature, allow us to deduce that there is, at least in the literature in Spanish, a deeply striking and relevant situation. It is a lack of conceptual and theoretical precision between the constructs precisely addressed in this article, such as "complex thought" and "complex thinking". As has been pointed out, although both concepts are complementary, in fact possibly one is derived from the other (complex thinking derived from complex thought), their purposes and objectives of study tend to differ from each other; then, these cannot be understood as synonyms. In the first case, the construct of complex thought focuses mainly on achieving an epistemological interconnection of the different transdisciplinary dimensions of the real in an integral and holistic way without generating reductionism and disintegration between the different fields of knowledge. Also, within this construct it is also intended to analyze, at a biological level, the associative functioning not only of the animal mind and specifically the human mind for a better understanding of problem solving. In the second case, the complex thinking construct focuses more on the development within the academy of strategies that, from the complex thought itself, allow students, or people susceptible to learn, to achieve certain skills to further qualify their individual and professional profiles. From the perspective of this notion, it is also essential to maximize the use of any technological tool that allows the achievement of critical, systemic, scientific, and innovative meta-competences.

From this perspective, scientific research on the study of complex thought and complex thinking has been oriented to a greater extent to its use and implications in the context of higher education, both at the theoretical and practical levels. In the analyses presented in this paper, it can be identified how each of the concepts is oriented towards problem solving and the cognitive process of thinking from its practical application. However, each of them presented certain thematic clusters that differentiate it from each other. In this context, higher education institutions play a relevant role in determining from which perspective (epistemological or practical) they will want to approach the enhancement of processes and/or competencies for the benefit of their students. Likewise, it has been seen that interdisciplinary research on this topic, favors problem solving as necessary skills in the 21st Century in the same students (Fadel, 2008; UNESCO, 2017; UNESCO, 2022).

The results shown here, also show practical implications for the development of educational policies, as well as in the attention to the promotion of transversal competences in higher education students (García-González et al., 2019), specially, the mega competence of complex thinking (Ramírez-Montoya, 2022; Suárez-Brito et al., 2022).

## **6. Conclusion and recommendations**

It is possible that a large part of these conceptual and theoretical inconsistencies are the result of the fact that both concepts arose more or less at the same time during the last 20th century, that both notions are still under construction considering the abundant literature that continues to emerge and that also continues to enrich and refine the subject; but above all that both concepts, regardless of the fact that each one focuses on specific topics, can permeate all branches of knowledge and disciplines of science; the latter, given the versatility of both concepts with respect to the epistemological essence of complex thought and the educational essence of complex thinking.

Precisely in relation to this previous aspect, the analysis of co-occurrence reveals that each notion or construct ends up favoring certain specific lines of study. Therefore, in the first case with complex thought, the incidence of topics alluding to epistemology is appreciated, where causes closely related to sciences in general stand out, as well as the biological causes that have an impact on the generation of knowledge. Then, in the second case with complex thinking, the incidence of topics allusive to education can also be seen, where, in this case, causes related to the learning sciences and causes related to the teaching sciences stand out.

Last but not least, at the conceptual level, the database analyzed in this research article also shows that there is a very interesting situation. This is precisely because, although each of the two constructs analyzed in this article focuses on very specific issues. In any case, there are also common themes where intersectionality is present, which shows that both constructs are complementary with points in common and possible causal relationships.

Likewise, as future lines of work, it would be ideal to carry out surveys among some prominent authors in the present topic under study, through their publications and citations, to contrast at a practical level possible similarities and differences between complex thought and complex thinking; all this, in order to further clarify at a conceptual level these two constructs that continue to generate new scientific literature after the contributions of Morin and Lipman.

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