

Modalities to Collaborate in the Social Construction of Conceptual Maps: A Comparison between Individual and Collective Productions

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Abstract The main aim of this research is to recognize and differentiate several kinds or modalities of elaboration of a cognitive product in pairs, in this case, the elaboration of conceptual maps. These modalities come from a comparative analysis between individual and collective productions. This comparison is not concerned only with the quality of the productions, but also with qualitative differences that could show processes of social influence. In this case, it is interesting to analyze the different modalities of social interaction and of reaching consensus. After a master lecture of a professor, 24 university students were requested to individually produce a conceptual map of the topic. The students were able to consult their notes. Finally, in pairs, they were asked to collaboratively develop a single conceptual map, consulting their respective individual conceptual maps, but not their notes, which were taken away. The analysis is based on a comparison, inside each pair, between the individual and the collective conceptual maps. This analysis includes both cognitive (content) and formal (graph) aspects. Two dimensions were considered: homogeneity-heterogeneity and symmetry-asymmetry of individual contributions. The crossing between these dimensions allowed to differentiate the modalities of the collective construction. Finally, the article analyses the relation between cognitive and formal aspects, which are not always in accordance. The most general conclusion is that, concerning the social construction of conceptual maps, the cognitive contribution of each subject/student to the collective production must be differentiated from the instrumental operation of drawing the map.

Keywords: *collaborative learning, shared cognition, sociocognitive construction, Peer interaction, group learning*

Cite This Article: Néstor Daniel Roselli, "Modalities to Collaborate in the Social Construction of Conceptual Maps: A Comparison between Individual and Collective Productions." *American Journal of Educational Research*, vol. 5, no. 10 (2017): 1058-1064. doi: 10.12691/education-5-10-7.

1. Introduction

What is exactly a collaborative construction of a cognitive product? What is the added value of elaborating a cognitive product collaboratively? What is the relation between individual and collective productions? Which are the modalities of socio-cognitive interaction that can be recognized in this collaborative process? These are recurring research topics regarding collaborative learning. This paper aims at explaining these topics focusing on the collaborative production of conceptual maps.

The theory of collaborative learning [1,10] argues that collective cognitive work has better results than individual cognitive work or, in any case, that it adds value to the work, maximizing the achieved learning. There are implicit theoretical aspects which underlie these generic arguments. These theoretical aspects are not always explicated which leads to conceptual confusion.

In the first place, learning as a process and learning as a product are not always differentiated. The way in which we learn (which can be individually or in company) is not the same as the achieved learning in terms of the knowledge that is acquired. The latter is usually regarded

as something internal and individual: it is the mind or the brain that acquires knowledge in the end.

In the second place, from a genetic perspective a relation between social cognitive processes (socio-cognitive interaction) and individual cognitive processes can be stated. According to Vygotsky (and the cultural-historical approach as a whole) in ontogenetical development, the social interactions precede individual self development. Whereas Piaget, and cognitive psychology in general, suggest that the genesis of thought lies on the individual. Interactions with others are only part of the context. There are even some approaches that consider the existence of double-conscience: a kind of non-binding parallelism between collective conscience and individual conscience, between the individual-self and the social-self, between socialization and individualization.

In the third place, it is pertinent to differentiate, the issue of superiority or non- superiority of collective cognitive performance over individual performance, from the issue concerning the enhancing effect that socio-cognitive interactions have on individual cognitive development. These are the two main issues that Doise and Mugny (1981) [1] studied in the research which was the basis of the theory on socio-cognitive conflict.

This research does not aim at finding specific answers to the questions enumerated (even though certain enlightening thoughts can come up), it merely intends to descriptively compare individual cognitive productions to collective ones (in pairs). This comparison is not concerned with the quality of the productions (supposedly collaborative production should benefit from the enriching contribution of both members of the couple), but with qualitative differences that could show processes of social influence. In this case, it is interesting to analyze the different modalities of social interaction and of reaching consensus. Yet, no attention is paid to the possible effects that social participation has regarding the improvement of individual cognition, i.e., over the learning of each subject/student.

Many authors have discussed the different modalities of socio-cognitive collaboration [2,3,4], and various classifications have been proposed. The most widespread one is the distinction between cooperation and collaboration [5], whether the task is divided and shared between the members or taken as a unit. There has also been much promotion about the distinction of three basic modalities: egocentric, asymmetrical or dependent, and symmetrical or independent [1,4,21], which recalls Piaget's stages of social development, which connects cognitive development to three basic ways of relations: egocentrism, dependence on adults, and the symmetrical relation among peers. In social psychology, Sherif's classical experiments on perceptual standardization [6] allowed to distinguish different modalities of social influence: average normative convergence, preponderant influence of a subject, and construction of an original norm. It is necessary to bear in mind that working collaboratively, no matter how cognitive the task is, is a social action between subjects, and not only between minds. In other terms, the social influence process can be symmetrical or asymmetrical, depending on the subject's dependent or independent personality trait. Inspired in this idea, Roselli [7] compared the individual performance in a logical task (logical classification of blocks) with a collective performance in pairs. This comparison was made differentiating three basic modalities: symmetrical-inclusive, matching-unilateral, and incoherent-irregular.

For Granot (1993) [8], when speaking about cognitive tasks, in both logical tasks or acquiring of knowledge tasks, the social influence is explained by the level of cognitive capacity of the subjects, which interacts with the degree of collaboration that takes place in a certain social situation. It could be concluded that the symmetrical-asymmetrical relational pattern of a certain socio-cognitive exchange depends not only on the participant's personality traits (personal willingness to exert-accept social influence), but also on the cognitive equality-inequality between them.

Baker (2008) [9] suggests a three-dimensional model of the cooperative activity: the dimension of role symmetry, the dimension of alignment (between an individualist distinctive mark and an actual collaborative intersubjectivity), and the dimension of agreement (between an automatic agreement and an argumentative one).

Geneva school of social psychology has always insisted in differentiating an authentic cognitive relation of interaction and socio-cognitive conflict from a mere

relational regulation, where social control and preponderance prevail over the conviction and the search of consensus. The key of such differentiation seems to be in resorting or not to argumentation [10-15]. In fact, the use of argumentation aims at convincing the other part. Hence, to achieve an authentic cognitive effect. In socio-cognitive tasks, resorting to argumentation is what differentiates actual collaboration from a mere non-cognitive social regulation.

At this point, it is important to refer to another great distinction: interindividual negotiation and intersubjective construction [2,4,16]. Negotiation involves discussion (supposedly cognitive) between subjects, based on reciprocal arguments and counterarguments tending to bring positions closer and create consensus. Thus, the socio-cognitive conflict is solved by assuming that plurality of actors means plurality of criteria and points of view. On the other hand, intersubjective construction suggests that the community has a collective identity (collective subject), forming a unity of thought and of action ("mutuality" according to Phelps and Damon, op. cit.). To make this possible, it is necessary that the community is not a mere occasional group, but that it has identity as a real group.

The following diagram provides an integrated model of the modalities abovementioned, which will be used as reference in the analysis of the cognitive-collaborative interaction of the surveys carried out. It is pertinent to clarify that the basis of this classification is the relation between individual productions previously obtained and the collective productions made afterwards.

HOMOGENEITY: symmetrical intersubjective unity or mutuality, which can be reductive or non-reductive, whether there exists selective filtering of the cognitive content or not.

SYMMETRICAL HETEROGENEITY: symmetrical negotiation and egalitarian integration of the contributions, which can be reductive or non-reductive.

ASYMMETRICAL HETEROGENEITY: asymmetrical control, which can be reductive or non-reductive.

In short, the main aim of this investigation is to recognize and differentiate the different kinds or modalities of elaboration of a cognitive product in pairs, in this case, elaboration of conceptual maps.

Why choose the elaboration of conceptual maps? The conceptual map is a didactic resource of widespread use in educational institutions, even though students also use it spontaneously [17,18,19].

Opposite to note-taking or summaries, which are preponderantly linguistic and sequential, concept maps are structural representations (non-sequential) of knowledge, essentially geometrical, where physical space is a metaphor of the cognitive-conceptual field. Consequently, geometrical figures are used (rectangles, triangles, circles), as well as lines and arrows, underlining, different sizes of fonts, and key words. So, the conceptual map allows a drawing illustration of the central topics of the theme, blended with linguistic references. That produces a conceptual representation of the basic structure of a given knowledge, easy to elaborate and easy to understand for everyone.

This kind of organization and conceptual representation facilitates to a great extent the comparative analysis between individual and collective productions, which are

the basic object of the investigation. Above all, it enables to see the process of social influence and creation of consensus quite objectively.

2. Method

2.1. Participants

The sample was composed of 24 Argentinian public university students in their second year of Psychology, with an average age of 19 years, all consistent members of the same group.

2.2. Procedure

The professor developed a 40 minutes master lecture entitled Hypothesis: its function in investigation, as a topic in a course of Research Methodology. The lecture was designed to strictly follow a text suggested by the professor. As, the students had to take their own notes of the lecture. Afterwards, they were requested to individually spend 15 minutes writing a conceptual map of the topic on a sheet of paper that was given to them, after they were briefed on the design of a conceptual map (a resource that is in widespread use). The students were able to consult their notes. Finally, in pairs, they were given another 15 minutes to collaboratively develop a single conceptual map, consulting their respective individual conceptual maps, but not their notes, which were taken away. Once the task was finished, they had to hand in both their individually and collectively developed conceptual maps. Some of the pairs were recorded, even though the analysis of this material was not included in this research.

3. Results

3.1. Analysis of the Cognitive Content

The episteme taught had a total of 66 cognitive units, distributed in different subtopics: what are hypotheses? Do we have to raise a hypothesis in every quantitative investigation? are hypotheses always true? What are variables? where do variables come from? What characteristics does a hypothesis need to have? kinds of hypotheses: research or work hypotheses (hypotheses describing a fact or a value, correlational hypotheses, hypotheses of group differentiation, hypotheses establishing cause-effect relations), null hypotheses, alternative hypotheses.

A cognitive unit is the simplest cognitive element in which information can be broken up. Even though the analysis does not consider it, it is interesting to state that, in general, cognitive units in concept maps are notoriously smaller than those in notes, filtering between 30% and 50% of the information. This means that concept maps involve a more synthesized organization of the conceptual aspect. What is actually analyzed is the level of synthesis of this function between the two kinds of concept maps: the individual and the collective.

Table 1 shows the amount of cognitive units in the individual and collective concept maps of each pair.

Table 1. Amount of Cognitive Units in the Individual and Collective Concept Maps in Each Pair.

	Student A	Student B	Collective	Student A	Student B
Pair 1	17	14	15	(+)	(-)
Pair 2	17	15	13	(+)	(+)
Pair 3	15	13	14	(+)	(-)
Pair 4	9	14	13	(-)	(+)
Pair 5	11	14	14	(-)	(=)
Pair 6	18	17	16	(+)	(+)
Pair 7	12	11	9	(+)	(+)
Pair 8	17	15	17	(=)	(-)
Pair 9	13	16	14	(-)	(+)
Pair 10	24	14	18	(+)	(-)
Pair 11	16	21	21	(-)	(=)
Pair 12	13	14	13	(=)	(+)

At first sight, the situation is highly variable among the pairs. In 3 cases [pairs 2, 6, 7], the collective production shows less cognitive units than the individual maps of the members in the pair, which evidences a certain filtering or reduction of the information contributed by the individual members. In 5 cases [pairs 1, 3, 4, 9, 10], collective scores are somewhere between the two members of the pair, and in 3 cases [pairs 5, 8, 11] it is equal to the higher value of the individual production of one of the members. The quantity of cognitive units in the collective production never exceeded the individual cognitive units of both members of the pair, which might indicate that the collective production is basically composed of the elements contributed individually by each member, instead of generating new cognitive units. Nevertheless, caution must be exercised with these considerations, unless the elements contributed by each member are qualitatively discriminated, identifying the coincidences and the differences. This is shown in Table 2, discriminating, in the collective production, between the cognitive units present in both individual productions (“*Symmetrical Sum*”), the cognitive units present in only one of the individual productions (“*Asymmetrical Sum*”), the cognitive units present in both individual productions but absent in the collective map (“*Symmetrical Subtraction*”), the cognitive units present in only one of the individual productions but absent in the collective map (“*Asymmetrical Subtraction*”), and finally the cognitive units present in the collective production but absent in both of the individual productions (“*Construction*”).

Comparing the proportion of “*Symmetrical Sum*” and “*Symmetrical Subtraction*” (cognitive units present in both individual maps and also in the collective map or absent) to the proportion of “*Asymmetrical Sum*” and “*Asymmetrical Subtraction*” (cognitive units present in only one of the individual maps and also in the collective map or absent), a distinction can be made between couples markedly homogeneous (68% or more between “*Symmetrical Sum*” and “*Symmetrical Subtraction*”) and heterogeneous couples (lower percentage regarding “*Asymmetrical Sum*” and “*Asymmetrical Subtraction*”). Thus, pairs 5 (78.57%), 8 (68.42%) and 11 (68.18%) would be clearly homogeneous, and therefore symmetrical, since it is not significant to differentiate the unequal contributions between the members.

Table 2. Qualitative Production of the Individual Contributions to the Collective Production, discriminating among “Symmetrical Sum”, “Asymmetrical Sum”, “Symmetrical Subtraction”, “Asymmetrical Subtraction” and “Construction”

	Symmetrical Sum (SS)	Asymmetrical Sum (AS)		Symmetrical Subtraction	Asymmetrical Subtraction		Construction	GENERAL TOTAL
		Student A	Student B		Student A	Student B		
Pair 1	9	3	1	2	3	2	2	
Pair 2	8	3	2	1	5	4		
Pair 3	9	4	1		2	3		
Pair 4	7	1	4	1		2	1	
Pair 5	10		2	1		1	2	
Pair 6	13		3		5	1		
Pair 7	5		4	1	6	1		
Pair 8	12	4	1	1		1	2	
Pair 9	7	1	6	2	3	1		
Pair 10	13	6	0	1	3	0	0	
Pair 11	15	1	5	0	0	1	0	
Pair 12	8	6	0	1	2	3	0	
TOTAL	116	29	29	11	29	20	7	241
PERCENTAGE %	48.13	12.03	12.03	4.56	12.03	8.30	2.90	

In turn, pairs 1, 2, 3, 4, 6, 7, 9, 10 and 12 would be heterogeneous, since the proportion of inter-individual inequality regarding contribution to the collective product is significant (the inter-individual equality or coincidence does not reach 78%). On the whole, a distinction can be made of different degrees of heterogeneity: pairs 1 (55% of homogeneity, 5 (59.09% of homogeneity) and 10 (60.86% of homogeneity) show moderate heterogeneity, whereas pairs 2, 3, 4, 7, 9, and 12 show high heterogeneity.

Likewise, heterogeneity can be symmetrical or asymmetrical, depending on the degree of comparative contribution between the members of the couple. The contribution of each member is the result of the subtraction of its “Asymmetrical Sum” and its corresponding “Asymmetrical Subtraction”. The difference between both contributions defines the degree of symmetry-asymmetry. Thus, the differences of inter-individual contribution can be established in the 12 pairs: 1, 0, 4, 1, 1, 7, 9, 4, 7, 3, 3, 7. Taking the median of these twelve differences as a cutoff (3.5), the limits of symmetrical heterogeneity (difference lower than 3.5) and asymmetrical heterogeneity (difference greater than 3.5) can be established.

In short, the twelve pairs demonstrate three basic modalities regarding the individual contribution to the collective production.

SYMMETRICAL HOMOGENEITY: pairs 5, 8 and 11.

MODERATE SYMMETRICAL HETEROGENEITY: pairs 1 and 10.

MODERATE ASYMMETRICAL HETEROGENEITY: pair 6.

HIGH SYMMETRICAL HETEROGENEITY: pairs 2 and 4,

HIGH ASYMMETRICAL HETEROGENEITY: pairs 3, 7, 9 and 12.

3.2. Analysis of the Formal and Graphical Aspects

Table 4 shows, for each pair, the relation between the individual maps and the corresponding collective map. The referential categories used in the analysis of cognitive

content are recalled: “Symmetrical Sum”, “Asymmetrical Sum” (discriminating the subjects/students), “Symmetrical Subtraction”, “Asymmetrical Subtraction” (discriminating the subjects/students) and “Construction”.

Table 3. Categories used for the Analysis of the Formal Aspects and Graphics of the Maps.

		List of categories of the formal aspects
Main Idea		Highly emphasized
		Present but not emphasized
		Absent
Beginning		In the middle
		In the upper middle
		In the upper-left side
		In the middle-left side
		Others
Map structure	Radial	Clockwise
		Anti-clockwise
	Flow	Integrated structure
		Fragmented flow structure
		No structure or schizoid
Word-Graph Relation		Predominance of Word over grapheme
		Word-grapheme balance
Kind of Graph		Rectangle or square
		Circumference o ellipse
		Clouds
Resources to prioritize concepts		Space closeness or remoteness
		Underlining
		Font size of capital-small letters
		Size or thickness of the grapheme
Connectives		Use of color or highlighter
		Straight arrows
		Curved arrows
		Straight lines
		Curved lines
		Square or curly brackets
		Other kind of arrows or lines
Linguistic		

Note: “Statement of the main idea”, “Place of the beginning”, “Map structure” and “Word-Graph Relation” entail a choice of only one alternative. “Kind of Grapheme”, “Resources to prioritize concepts” and “Connectives” include alternatives that are not exclusive.

Table 4. The Relation between the Formal and Graphic Characteristics of the Individual and Collective Maps of Each Pair

	Symmetrical Sum (SS)	Asymmetrical Sum (AS)		Symmetrical Subtraction	Asymmetrical Subtraction		Construction	SUM TOTAL
		Student A	Student B		Student A	Student B		
Pair 1	5	2			2	4		
Pair 2	5	3			3	3	2	
Pair 3	7	2	1	1	1	1	2	
Pair 4	6		6	1	1		1	
Pair 5	7	4	1	1		3		
Pair 6	7	2	1		3	1	2	
Pair 7	7	3		1	2	2	2	
Pair 8	4	1	4		2	2	1	
Pair 9	6	2	2		2	2		
Pair 10	3	2	3		3	1	1	
Pair 11	4	2	2	1	4	4		
Pair 12	1	3	2		6	5	1	
TOTAL	62	26	22	5	29	28	12	184
PERCENTAGE %	33.70	14.13	11.96	2.72	15.76	15.22	6.52	

As well as with the analysis of cognitive content, the pairs can be classified according to the different basic modalities:

SYMMETRICAL HOMOGENEITY: There is no pair that reaches the reference percentage (68%), since the number of formal alternatives in which they may or may not coincide is much lower than the quantity of cognitive units.

MODERATE SYMMETRICAL HETEROGENEITY: pairs 3 and 6.

MODERATE ASYMMETRICAL HETEROGENEITY: pairs 4, 5 and 7.

HIGH SYMMETRICAL HETEROGENEITY: pairs 9, 11 and 12.

HIGH ASYMMETRICAL HETEROGENEITY: pairs 1, 2, 8 and 10.

The cutting line between moderate and high heterogeneity is marked by the presence of 50% of formal elements coinciding in the collective map and both of the individual maps (without reaching 68%, which is the cutoff for homogeneity). Thus, pairs 3, 4, 5, 6 and 7 fall within the scope of moderate heterogeneity, whereas pairs 1, 2, 8, 9, 10, 11 and 12 show high heterogeneity, since the percentage of formal coincidences between the individual and the collective maps is lower than 50%.

Regarding the cutoff between symmetry and asymmetry, the median between the twelve differences between the contributions of both members of the pair was also used, contributions which consider not only the individual elements that are present (sum) in the collective production, but also those that disappear (subtraction). The twelve differences are the following ones: 4, 3, 1, 7, 6, 1, 3, 3, 0, 3, 0, 0. Therefore, the median or the limit between symmetry and asymmetry was 3.

4. Discussion

The classification suggested of the collective performances, starting from the relation between the respective individual productions with the collective production, allows to have an intelligible framework of the different modalities of collaborative production, based

on the objective material gathered, which was analyzed as of empirical criteria clearly expressed. It is not, then, the use of a merely hermeneutic criterion.

The First great distinction of the classifying model is between the homogeneous and the heterogeneous modalities, based on the cognitively matching co-participation. The second difference is between symmetrical and asymmetrical co-participation, in which not only what each subject actively contributes, but also what each subject subtracts (does not appear in the collective production) is considered. In other words, social influence does not determine only the active contribution to the collective product, but also what could be subtracted. The symmetry-asymmetry issue is undoubtedly complex. Heterogeneity within a group production is not at all negative; on the contrary, if it is symmetrical, it guarantees plurality of points of view. Asymmetry, on the other hand, prevents access to the advantages of multiplicity of viewpoints. There are two factors that are the basis of an asymmetrical cognitive relation: the different levels of capacity and the lineage or personal leadership degree. The former is of cognitive nature, while the latter answers to a feature of the personality. In order to find out which of these factors prevailed in the cases of asymmetry, it would have been necessary to analyze the communicational exchange between the members and, above all, the greater or lesser use of argumentative discourse. Despite the recording of some pairs, this analysis was not included in this research.

One of the first questions of this research was what is new about collective production, in other words, what is its added value, if any. In social psychology, it is often ascertained that the whole is more than the sum of the parts, or that group behavior is not reducible to that of its members. If this were true, collective production would be necessarily richer, cognitively speaking, since the contribution of each member would result in an enriched product. However, the facts in [Table 1](#) show that this does not occur in most of the cases: in no pair does the collective production beat, regarding the quantity of cognitive units, the individual productions, whilst in nine pairs the collective production is beaten by both, or at least one, of the members.

By examining the quantity cognitive units that the collective production subtracts from the individual productions, a clearly synthesizing of selective feature is evidenced. The distribution of this subtraction between the members is undoubtedly dependent to the greater or lesser symmetry-asymmetry established in the relation, but it is an indisputable fact that collaborative interaction motivates selective and synthesizing mechanisms. Far from considering this as a loss or decrease of cognitive value of the collective production, it should be considered as a constructive effect. Thus, said constructive effect would not be shown only in the creation of unprecedented or original cognitive units (which had not been present in any of the individual productions), but also in this process of selection and cleansing.

An important issue is the relation between the formal aspects of the maps and the specifically cognitive aspects. The following table helps to visualize said relation.

Table 6 and Table 7 provide a summary of the homogeneity-heterogeneity and of the symmetry-asymmetry referred to in the cognitive contents and the formal aspects.

It is evident that there are no significant differences between Content and Form regarding heterogeneity, that is, it cannot be affirmed that in Content a certain type of heterogeneity prevails and in Form, another. What is more, there is no coincidence or difference pattern either, since in 5 cases there is a coincidence in the degree of heterogeneity, but in 7 there is not. In other words, there seems to be no relation between Content and Form regarding the degree of heterogeneity.

There are no significant differences between Content

and Form here either, which means that Symmetry of Asymmetry doesn't prevail in any of the aspects. However, there is a difference that is actually remarkable: the one that refers to coincidence-difference between Content and Form of symmetry-asymmetry within the pairs. Oddly enough, there are 10 differences and only 2 coincidences, that is, there is a negative or reversed relation or association phenomenon. Which could be the explanation?

The graphic analysis of the maps clearly shows that only one of the members wrote it down (cf. Table 5), which in most of the cases governed the formal contribution. It could be assumed that the author profited from this central function, including in the collective production the graphic elements of its own individual production, or at least as many as possible of them. As a result, the collective map would be, formally, determined by the decisive influence of one of the members, which would explain the notorious asymmetry between both students in this aspect. This would mean that in pairs with symmetrical content (7), the participation becomes asymmetrical regarding the formal elements contributed, the author's contribution governing. The same phenomenon would occur in the cases of asymmetrical content (5). In all these cases, the member that cognitively controls the production (the collective map includes more cognitive units of this member's individual map) is not the member that writes down the map, which explains, as to form, that the final product is more symmetrical, to which the category "Symmetry" corresponds (pairs 3, 6, 9 and 12), or even though categorized as "Asymmetry" (pair 7), notably reducing the gap shown in Content.

Table 5. The Relation between the Collaborative Modalities resulting from the Analysis of the Contents (Cognitive Units) and the Analysis of the Formal Aspects and Graphics of the Collective Maps

	CONTENT		FORM		AUTHOR
	Homogeneidad Heterogeneidad	Symmetrical Asymmetrical	Homogeneidad Heterogeneidad	Symmetrical Asymmetrical	
Pair 1	Moderate Heterogeneity	Symmetrical	High Heterogeneity	Asymmetrical	1
Pair 2	High Heterogeneity	Symmetrical	High Heterogeneity	Asymmetrical	1
Pair 3	High Heterogeneity	Asymmetrical	Moderate Heterogeneity	Symmetrical	2
Pair 4	High Heterogeneity	Symmetrical	Moderate Heterogeneity	Asymmetrical	2
Pair 5	Homogeneity	Symmetrical	Moderate Heterogeneity	Asymmetrical	1
Pair 6	Moderate Heterogeneity	Asymmetrical	Moderate Heterogeneity	Symmetrical	1
Pair 7	High Heterogeneity	Asymmetrical	Moderate Heterogeneity	Asymmetrical	1
Pair 8	Homogeneity	Symmetrical	High Heterogeneity	Asymmetrical	2
Pair 9	High Heterogeneity	Asymmetrical	High Heterogeneity	Symmetrical	1
Pair 10	Moderate Heterogeneity	Symmetrical	High Heterogeneity	Asymmetrical	2
Pair 11	Homogeneity	Symmetrical	High Heterogeneity	Symmetrical	2
Pair 12	High Heterogeneity	Asymmetrical	High Heterogeneity	Symmetrical	2

Table 6. The Quantity of Moderately Heterogeneous Pairs (Including the Homogeneous) and the Highly Heterogeneous Pairs Regarding "Content" and "Form"

CONTENT		FORM	
Moderate Het.	High Het.	Moderate Het.	High Het.
6	6	5	7

Table 7. The Quantity of Symmetrical and Asymmetrical Pairs Regarding "Content" and "Form"

CONTENT		FORM	
Symmetry	Asymmetry	Symmetry	Asymmetry
7	5	5	7

5. Conclusion

The most general conclusion is that the analysis of socio-cognitive collaboration must be differentiated from instrumental operations, as in the collaborative elaboration of a report one thing is the cognitive aspect (through group discussion) and another is the writing and composition of the text through an instrumental device. In the case of this investigation, the instrumental device (drawing of a map) was qualitatively very different from the preponderantly linguistic support in the cognitive dimension. It is not the same to express knowledge exclusively through words than to do so through graphemes (of course, accompanied

by words). That is why it is not the same to elaborate a collective summary from individual notes, than to elaborate a collective map from individual maps, which, in turn, were elaborated from notes. In other terms, socio-cognitive collaboration is necessarily and distinctively marked by the kind of task, and its analysis must be done in accordance with this concrete aspect.

It must also be considered that socio-cognitive collaboration requires recognizing different manners of performance, which can even be externally promoted or guided [20]. The analysis of these different modalities presupposes bearing clearly in mind the basic criterion from which this difference is established. In this investigation, the basic criterion was that of exchange homogeneity and symmetry, which refers to the degree of social influence.

One limit to the investigation was having restricted the analysis to the product of collaboration, that is, to the maps drawn. No analysis was made of the process itself of the construction of said product and of the negotiation of consensus. For that, it would have been necessary to have the register, at least recorded, of said process. Even though some pairs were recorded, it was not possible to do so with all the pairs.

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