Appropriation of the Concept of the Logical Quantifiers by the Teachers and Pipuls from the Secondary of the Goma Town in the D.R.Congo

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Abstract: *This work aims the assessment of the level of appropriation of the concept of logical quantifiers by the math teachers and the pupils from Goma city. Indeed, after studying a mathematical logic course and several opportunities of uses of the logical quantifiers, the finalists of the math department of the TTC (Technical Teaching college) are supposed to use the logical quantifiers correctly and to well interpret the proposals formulated with logical quantifiers. Is this still the case? The experiment of the land seems to sustain the opposite. It is what caused the present reflection in order to consist of the state of things and to proposes some tracks of solutions likely to improve the know-how and the know-how to make some teachers of Mathematical of the city of Goma in the understanding of the mathematical statements. To reach this objectifies, we used has questionnaire. This questionnaire has been addressed to has sample of 96 teachers, of which 21 stepped up and 75 bachelors, qualified in math teaching and to 400 pupils of the secondary of the city of Goma./ it was butt the uses of logical quantifiers, the research of the negation and the interpretation of the logical proposals formulated with the help of logical quantifiers. The dated descended of the investigation cuts been presented in pictures to double entry and cuts been translated have percentages. The studied phenomena cuts been considered and cuts been could in evidence by the importance of their respective percentages. The results of this work could in evidence, among the teachers of Mathematical and the pupils of the Secondary of the city of Goma, has bad uses of the logical quantifiers and has bad interpretation of the proposals formulated with the help of the logical quantifiers. To the basis of this bad uses of the logical quantifiers and the bad interpretation of the proposals quantified is the not mastery of the concept of logical quantifiers and the concepts of Mathematical logic by the teachers of mathematical of the city of Goma.*

Keywords: Logical quantifiers; Know-how; Know-how to make; Stated mathematical

1. Introduction

Mathematical logic is the base of the demonstrations in Mathematics. It is the base of Mathematics studied the reasoning and its nature rather than its formulation. Mathematical logic fixes the first axioms on which theorems, corollaries and demonstrations are built.

Thus, the effectiveness of the teaching of Mathematics supposes a sufficient control and a judicious use of the concepts of mathematical logic. In this connection, El Faqih (1991) has, within the framework of its thesis of doctorate into didactic of mathematics, developed the question about the teaching of logic while declaring: *"If it is true that a teaching of logic, as it was conceived in its contents and in its presentation, led to a failure, it is not very obvious that an absence of a minimum of logic is not a generator of a certain number of difficulties that block normal unfolding their studies"*

Moreover, an efficient control of concepts of mathematical logic without the concepts on the logical quantifiers is not possible because "the quantification is an object present in the majority of the mathematical activities" (El Faqih, 1991). In Tunisia, the need of the concept of logical quantifiers in the teaching of mathematics was stigmatized by F Chellougui (2000) in these terms:

"- the absence of the training clarifies quantification, in Tunisian secondary education, armature difficulties for learners in their mathematical reasoning.

- A bad use of the quantifiers does not allow a conceptual clearness in the comprehension of the mathematical statements.

- The use of the logical quantifiers allows a methodical, clarified and adequate reasoning ".

By what precedes, a certain number of questions are posed: How teachers of Mathematics and pupils of the secondary from the Goma town use the logical quantifiers? How do they interpret the proposals formulated using the logical quantifiers?

For better founding this questionnement, we addressed to 96 teachers Mathematics, including 21 graduated and 75 bachelors in pedagogy applied to Mathematics, and to 300 pupils of the secondary from the Goma town, a questionnaire asking them to make use of logical quantifiers, to find the negation and to interpret logical proposals formulated using logical quantifiers. The reduced number of the teachers belonging to our sample is with the very accentuated deficiency, in Goma town teachers qualified for the teaching of mathematics in secondary school.

Following this questionnement, the objective of this research is brought back to the evaluation of the level of appropriation of the concept of logical quantifiers by the teachers of Mathematics and the pupils from Goma town. This work is ordered, thus, around the following assumptions of research:

1) The teachers of Mathematics and the pupils of the secondary from the Gomat town make a bad use of the concept of logical quantifiers**;**
2) The teachers of Mathematics and the pupils of the secondary school from the Goma town make a bad interpretation of the proposals due to the logical quantifiers

2. Presentation of the Goma Town (Oveneke King and Al., 2009)

The Goma town is located in the East part of the Democratic Republic of Congo, between 01° 41′ South and 29° 14′ east. It extends on a surface from 7572 ha (or 75,72 km^2) and is subdivided in 2 communes respectively divided into 7 and 11 administrative districts:

The commune of Goma with Mikeno, Mapendo, Les Volcans, Katindo, Himbi, Kyeshero and Lac vert as districts;the commune of Karisimbi , with Murara, Kahembe, majengo, Virunga, Mabanga Northern, Mabanga Southern, Kasika, Katoyi, Mugunga, Ndosho and Bujovu as districts.

The Goma town is limited:In North by the territory of Nyiragongo; In the South by the lake Kivu: In the East by the Rwandan Republic; In the West by the territory of Masisi and the national park of Virunga. The Goma town is a city with tourist vocation and a development pole by the fact that: it is localised in the Eastern highlands, near the national park of Virunga and the border with Rwanda.It is with the edge, in North, of the lake Kivu. It is built on lava flows of which most recent are those of the Nyiragongo volcano of 2002 which cover a good part of the city.

About the climate, Goma town is at a high altitude (1500 m) and dominated by a moderated type climate with wet tendency. Its average temperature is of 20,5° C and annual average precipitations rise 1500 mm.

3. Materiel and Methods

In this part, we were mainly interested to know how the teachers of Mathematics and the pupils of the secondary school in Goma town use the logical quantifiers and how they interpret the proposals formulated using logical quantifiers. That is why we conceived and addressed, to the teachers and the pupils of the secondary school from Goma town, a survey questionnaire made up of exercises requiring a priori, not only the implementation of a quantified writing, but also the interpretation of the proposals formulated by using logical quantifiers.

As the objective of our study was to evaluate the level of appropriation of the concept of logical quantifiers by the teachers of Mathematics and the pupils of the Goma town, we used, to carry out our surveys, a written questionnaire addressed to 96 teachers of Mathematics and 300 pupils of the secondary school from the Goma town.

To avoid great variations of possibilities of answers between inquired of the same category (teachers or pupils), the 96

teachers concerned with our investigation are all qualified in the teaching of mathematics. As for the pupils, they result from 10 secondary schools from the Goma town that organize the scientific section, that means 30 pupils (including 15 from f 4th and 15 from of 5th forms from scientific section) per school. The choice of these classes was justified by the fact that, on this level, the pupils have already acquired the basic vocabulary in Mathematics, but they also have already had, since the 1st year of the secondary school, several occasions of using the quantifiers during lessons of Mathematics.

The investigation took place from April, 20th to May 20th 2018 and was made by direct administration (JAVEAU, ,1992): the person questioned note itself her answers on the questionnaire.

The data from our investigation were presented in two-dimensional boards and were translated in the form of percentages. The studied phenomena were considered and highlighted by the importance of their respective percentages. The presentation of the data was made on the basis of two basic variables: The use of the quantifiers and the interpretation of the proposals formulated by using logical quantifiers. The evaluation of the use of the quantifiers was made on the basis of two parameter, namely: the formulation and the research of the negation of the quantified proposals; The evaluation of the interpretation of the proposals due to the logical quantifiers was carried out through the research of the value of truth and the comprehension of a quantified proposal.

4. Results and Discussion

The data from our investigation were, for their best interpretation, gathered in two categories: Those from the survey carried out near the teachers and those from the survey carried out near the pupils.

4.1 Results of the survey carried out near the teachers

Table 1: On the use of the quantifiers by the teachers of Mathematics from the Goma town

N° of the question	Good answers	%	Bad answers	%
3	52	54,1	44	45,8
4.1	81	84,3	15	15,6
4.2	41	42.7	55	57.2
4.3	55	57.2	41	42,7
4.4	66	68.7	30	31.2
4.5	70	72.9	26	27

Taking into consideration this table, one notes that on 96 teachers constituting our sample:

1) 52, to say 54,1 %, defined correctly the neutral element of an internal law of composition. Among the bad answers produced for this question, let us quote, on a purely illustrative basis: A law of composition interns T in a unit E admits a neutral element if and only if:

" $\forall$ X ϵ E, ∃ E ϵ E/X T E = E T X = X **"** (the neutral element is E);

"∃ X ϵ E/ $\forall$ E ϵ E, X T E = E T X = **E"** (the neutral element is E);

" $\forall$ X ϵ E, $\forall$ E ϵ E/X T E = E T X = X **"** (the neutral element is E);

" $\forall$ X ϵ E,$\exists$!E ϵ E/X T E = E T X = **E** "(the neutral element is E)**;**

It is noted that the percentage (46,2%) of teachers that define the neutral element badly is raised and close to that of the teachers defining this concept correctly.

The falseness of the preceding definitions resides, not only in the comprehension of the direction of the quantified proposals and the neutral element, but also in the use of the order of the logical quantifiers.

2) 81 teachers, to say 84,3%, defined correctly the negation of the proposal "Any man is mortal";41, to say 42,7 %, defined correctly the negation of the proposal "It exists only one creative God of the sky and the ground";55, either 57.2% , defined correctly the negation of the proposal **"**It exists Congolese uncorrupt";66, or 68.7 %, correctly defined the negation of the proposal " $\forall$ **x** ϵN, $\exists$ **y** ϵN / **x ≤ y**" and 70, are 72.9%, defined correctly the negation of the proposal "$\exists$ **x** ϵℤ / $\forall$ **y** ϵℤ, **x + y = 2**".

It rises, from what precedes, that many teachers of mathematics of the secondary school from the Goma town have difficulties in the use of the logical quantifiers and the research of the negation of the proposals requiring the use of the logical quantifiers in their formulation.

Table 2: The interpretation of the proposals due to the logical quantifiers by the teachers of Mathematics from the Goma town

No. of the question	Good Answers	%	Bad Answers	%
5.1	41	42,7	56	57,7
5.2	37	38,5	59	61,6
5.3	58	60,4	38	39,5
5.4	44	45,8	52	54,1
6	51	53,1	45	46,8

The data of this table indicate that the teachers of Mathematics from the Goma town interpret the quantified proposals badly bus not knowing to find their value of truth.

Indeed: On the 96 surveyed teachers: Only 41, to say 42,7%, correctly determined the value of truth of the proposal "$\forall$ **x** ϵ **N**, $\exists$ **y** ϵN/ **x ≤ y**" ;only 37, to say 38,5%, correctly determined the value of truth the proposal "$\exists$ **x** ϵℤ / $\forall$ **y** ϵℤ , **x + y = 2**"; only 58, to say 60,4%, correctly determined the value of truth of the proposal "$\forall$ **x** ϵℤ, **x >0**";only 44, to say 45,8%, correctly determined the value of truth of the proposal "$\exists$ **x** ϵN / **x = 1**" and only 51, to say 53,1 %, correctly interpreted the proposal "$\forall$a ϵℝ, $\exists$ b ϵℝ / ab = a" ..

4.2 Results of the survey carried out near the pupils of the secondary schools from Goma town

Table 3: The use of the quantifiers by the pupils of the secondary schools from the Goma town

No. of the question	Good Answers	%	Bad Answers	%
3	94	23,5	306	76,5
4.1	216	54	184	46
4.2	106	26,5	294	73,5
4.3	182	45,5	218	54,5
4.4	110	27,5	290	72,5
4.5	152	38	248	62

By reading the data of this table, one notes that on 200 pupils constituting our sample:

1) 94 pupils, is 23,5 %, correctly define the neutral element of an internal law of composition. Parmii the bad answers produced for this question, let us quote, on a purely illustrative basis: A law of composition interns T in a unit E admits a neutral element if and only if:

" $\forall$ X ϵ E, $\exists$ E E/X T E = E T X = X" (the neutral element is E);

"$\exists$ X ϵ E/ $\forall$ E ϵ E, X T E = E T X = E" (the neutral element is E);

" $\forall$ X ϵ E/ $\forall$ E ϵ E / **X** T e=e T X = X" (the neutral element is E);

" $\forall$ X ϵ E /$\exists$!E ϵ E / **X** T E = E T X = E "(the neutral element is E)

The falseness of the preceding definitions resides, not only in the comprehension of the direction of the quantified proposals and the neutral element, but also in the use of the order of the logical quantifiers. This is included understood well because those which teach them make the same errors, as which would say "Like father, like son". That is reflected negatively on the appropriation of the logical quantifiers by the pupils (to be convinced some, it is enough to observe the percentages of tables n1et n3).

2) 216 pupils, to say 54 %, defined the negation of the proposal correctly "Any man is mortal";106, is 26,5 %, correctly defined the negation of the proposal "It exists only one creative God of the sky and the ground";182, either 45,5, correctly defined the negation of the proposal **"**It exists uncorrupt Congolese ";110, or 27,5 %, correctly defined the negation of the proposal " $\forall$ $\forall$ x ϵN, $\exists$ y ϵN / x ≤ y" and 152, to say 38%, correctly defined the negation of the proposal " $\exists$ x ϵℤ / $\forall$ y ϵℤ ,x + y = 2" .

Table 4: The interpretation of the proposals due to the logical quantifiers by the pupils of the town of Goma

No. of the question	Good answers	%	Bad answers	%
5.1	118	29,5	282	70,5
5.2	92	23	308	77
5.3	136	34	272	68
5.4	158	39,5	242	60,5
6	96	24	304	76

From the data of this table, it results that, like the teachers of Mathematics, the pupils from the Goma town interpret badly he quantified proposals and they are not able to find the value of truth of proposals.

Indeed, on the 400 surveyed pupils, only 118, to say 29,5 %, correctly determined the value of truth of proposal " $\forall$ x ϵ□, $\exists$ y ϵ □ / **x ≤ y**"; only 92, to say 23%, correctly determined the value of truth of the proposal $\exists$ **x** ϵℤ / $\forall$ y ϵ ℤ ,**x + y = 2**";only 136,to say 34%, correctly determined the value of truth of the proposal "$\forall$ x ϵ N, **x > 0**" ; Only 158, to say 39,5%, correctly determined the value of truth of the proposal "$\exists$ **x** ϵℤ / **x =1**" and only 96, to say 24 %, correctly interpreted the proposal " $\forall$ **a** ϵℝ, $\exists$ **b** ϵ ℝ / **ab = a** ".The results of tables n° 2 and n° 4 confirm that the uncontrol of concepts of logical quantifiers by the teacher influences negatively the appropriation of the known as concepts by the pupil.

5. Conclusion

This research highlighted a bad use of the quantifiers and a bad interpretation of the proposals formulated using the logical quantifiers by teachers of Mathematics and pupils from the Goma town. This induces difficulties in the mathematical reasoning of learners, involves the lack of conceptual clearness in the comprehension of the mathematical statements and does not allow a methodical, clarified and adequate reasoning.

The bad use of the logical quantifiers and the bad interpretation of the proposals due to by the logical quantifiers by the teachers of mathematics and pupils from the Goma town are caused by the uncontrol of the concept of logical quantifiers and, generally, of the concepts of Mathematical logic by teachers of mathematics of the Goma town. Also, the Congolese legislator did not envisage anywhere, with the national program of mathematics, the concepts of mathematical Logic and, in particular, the concepts on the logical quantifiers. Mathematical logic being the base of the mathematical reasoning and the field which fixes the first axioms on which are built theorems, corollaries and mathematical demonstrations, the uncontrol of this concept by the teachers of Mathematics and, in addition, by the pupils from the Goma town generates difficulties, at the pupils, in the comprehension and the assimilation of the course of Mathematics, particularly of the concepts, like the set theory, the relations and the algebraic structures , requiring the use of the logical quantifiers. This is a danger to the future generations which will be taught by the pupils of today, already malformed.

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