IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 6, Issue 2 Ver. III (Mar. - Apr. 2016), PP 54-59
www.iosrjournals.org

Diagnosis of the obstacles as for the graphical representation by the TGN and the questionnaire

Abdelouahed El Maroufi, Mohammed Mouradi, and Mohamed Khalil Zarhouti
Interdisciplinary laboratory of Search in Didactics of the Sciences and Techniques(LIRDST)
Faculty of the sciences Dhar El Mahraz
Sidi Mohamed Ben Abdellah-Fès university Fes Atlas-Fès-Maroc

Abstract: *The aim of work is to study and analyses the relative to the teaching and the learning of the concept: Graphic representation of a function at for high school syllabus. These reports showed that the teaching content is perceived by the learners as an challenging task. To diagnose the difficulties and obstacles, we have adopted to two methods: A method of generation of ideas that is to say, the Technique of the Nominal Group (TGN) and the Questionnaire (pencil /paper). The obtained data have allowed us to notice that the distinction between the algebraic register and the graphic register seems to present difficulties for these learners.*
Key words*: Graphic representation, function, teaching of mathematics in high school, register representation, GNT.*

Résumé : *La visée de notre travail trouve son origine dans des observations et des constats relatifs à l'enseignement et l'apprentissage du concept : représentation graphique d'une fonction au lycée. Ces constats ont montré que ce contenu d'enseignement est perçu par les apprenants comme une tâche inaccessible. Pour le diagnostic des difficultés et obstacles, nous avons eu recours à deux méthodes : une méthode de génération d'idées, à savoir la Technique du Groupe Nominale (TGN) et le Questionnaire crayon / papier. Les données obtenues ont permis de noter que l'articulation entre le registre algébrique et le registre graphique semble présenter des difficultés pour ces apprenants.*
Mots clés : *Représentation graphique, fonction, enseignement des mathématiques en première année sciences expérimentales, registre de représentation, TGN.*

I. Introduction

The last reform of the mathematics in Morocco in 2006, introduced a new way of teaching notion of function. In fact, functions are taught during the third year of junior high school(middle school), More specifically, linear and affine functions are introduced prior to other form(type) of functions preserved for common-core levels(first year of senior high school (lycee) syllabus sciences, level right before the first year experimental sciences of high school diploma) other notions closely linked to the functions such as: the parity, the sense of variation, the variation table, the graphical representations of the usual functions of type $x \longrightarrow ax^2$ and $x \longrightarrow a/x$. however, the classic theoretical notions of analysis: limit, derivation, etc. appear only in of the first year applied sciences , one year before graduation year (baccalaureate).

The graphical representation of a function is one of the major pillars of studying in functions at the o first-year experimental sciences level in Moroccan high schools. We notice that several pupils feel difficulties doing this task. Consequently, our choice to analyze the difficulties assimilating and conceptualizing this notion, with whom the pupils are confronted, is backed by the following reason:

- The first year, experimental sciences (baccalaureate, list which precedes the final year of the high school), establish actually fundamental grounds for basic notions: to trace a curve of a digital function, to know the derived function, the inflexion point and the branches infinites, in particular the asymptotes, the asymptotic directions, the tangent point, etc.
- The official guidelines insist on the mathematical activities which take into account the graphical representation of the functions. (Ministry of Education, on 2007).

Besides, in first year baccalaureate experimental sciences, the graphical representation of the functions polynômiales, rational, trigonometric and irrational, establishes a cornerstone to approach that of the logarithmic and exponential functions in the second year of the graduation year of the high school in the Moroccan education system. (Ministry of Education, on 2007).

In this work, we are interested in knowling *graphical representation of a function* the purpose of which is to improve the quality of the teaching and reduce the obstacles of learning, and to bridge the gap between the scientific reality and the representations for the students to this concept.

II. Objective And Problematic

In spite of the importance which takes the graphical representation of a function, pupils find enormous difficulties to do this task. So, is drawing graphical representations really is hindrance for pupils? What solutions can we propose to reduce these difficulties? In the light of these questions, our objective is to reveal and to study the obstacles and the difficulties which face the pupils regarding the graphical representation of a function, as well as to propose solutions so that pupils can correctly represent a function graphically.

III. Methodology Of Research

III.1. Method of data collection

To approach the problem of our work and answer our search question, we adopt a working methodology implementing the investigation: investigation based on the Nominal Group Technique (TGN) in the first stage and in form (questionnaires) in the second.

III.2. Representation of the sample

As regards the TGN, we randomly gathered, first of all, population q group of 11 pupils of the first year baccalaureate option experimental sciences. Then, in the second place, from the results of the TGN, we developed a questionnaire with 35 pupils chosen at random; its signing was done two weeks after the end of the course.

III.3. Frame has a practice

III.3.1 Description of the technique TGN

The nominal group technique (TGN) is a technique created in the late 60's of the last century by researchers in psychology. These researchers were able to prove afterward that it is perfectly adapted to the psychosocial studies of functioning in small group (10-15 people) with a decision-making nature; it was applied at first in the field of the management. However, because of practical nature, its application various practices of the social sciences and become the method of research for the objective, systematic and quantitative description of the contents showing communication.

This technique is part of self-assessment and at the self-diagnosis methods. It allows researchers to make the choice of priorities within a group of people gathered in the same place and it by exchangeable combining the individual work and group discussion.

So that the collected data stemming from the GNT, are reliable, it is necessary to fulfill the following six stages:

Stage 1: Every participant writes the answers that he judges solution to the nominal question.
Stage 2: Collect the ideas produced by the participants and expose them in front of the group, write them a table.
Stage 3: The organizer watches to clarify the meaning of the various expressed statements. He can cancel some if he considers them redundant or not relevant to the problem.
Stage 4: Presentation of the held answers and the discussion.
Stage 5: The participants are invited to choose 10 proposals among those presented and to classify them in order of priority expressed by values going from10 (for the most important idea) to 1 (the least important idea). We attributed to each of the answers a value, noted $\Sigma p_{i,}$ which decreases of the first answer to the nominal question to the last one.
Stage 6: The organizer has to raise a picture presenting the answers and their weight corresponding.

Nominal III.3.1.1 question

It is necessary to keep mind first of all that according to Grenier and Lagarde (2000), the nominal question which will be presented to the group, must be precise, unambiguous, and general question of the some level. It must be absolutely validated by people with the same characteristics as those who will be invited to participate. This validation will allow us to make sure that the question will create relevant information, that there it only a way of including the question and that she allows precise answers. We ask 11 pupils the following nominal question:

What difficulties and obstacles do you face while study in the graphical representation of a function?

III.3.1.2 Results and interpretations

After choosing 11 pupils for a sample, we encourage then to express themselves freely and without constraints. The data collection highlight 24 answers which we present in the table. According to the standards of the GNT, we eliminated the redundant responses (statement) and those who seemed not relevant such as the answers that make sense only in respondents terms logic. So, the number of the valid answers is reduced to 12. Afterward, we asked to the pupils to choose 10 among to classify them in order of priority by assigning the value 10 in the answer at the top of the page, in the second and so on up to the last one, by assigning it the value

1. Once the data are collected, we draw the table 1 where the answers are classified in accord with the declining value to the decreasing.

N of classification before the vote of the pupils	Statements	Weight($\sum$ Pi)	Order of classification after the vote of the pupils
7	Difficulty tracing the representative curve of a function, from the sound variation table	97	1
10	Maximal number of pupils in a class	79	2
9	Program too loaded with and limited time	70	3
6	Difficulty interpreting geometrically the limits: $\lim_{x\to+\infty} \frac{f(x)}{x}$and $\lim_{x\to-\infty} \frac{f(x)}{x}$during the drawing of the graphical representation.	65	4
4	Difficulty determining intersection point(s) between a curve and a X-axis solving the equation *f (x) =0*.	50	5
11	Lack of exercises of strengthening.	48	6
3	Forgetting of the units of measure while drawing of the curve	43	7
2	Difficulty assimilating the notion of asymptotes and asymptotic direction	41	8
1	Difficulty translating the resolution of $f\ '\ x) = 0$ by tangents parallel to the X axis.	35	9
5	Lack of communication between the teacher and the pupils	32	10
8	Too brief or scant explanations from teachers.	27	11
12	Badly explained lessons	26	12

Table 1: result of the TGN

The examination of the picture 1 indicates that, the answer which comes at the head of the list with the highest value ($\sum$ Pi =97) concerning the conversion of the symbolic register, more exactly, the register variation table in the graphic register establishes actually a major difficulty for the pupils of the first year experimental sciences. This perhaps returns, according to the table the didactic transposition of the education of graphical representation prevents these pupils from making this task of the fact that, on one hand, the number of the pupils in a class is very high, this reason is confirmed by the answer of the pupils which corresponds to the value ($\sum$ Pi =79). On the other hand, the value ($\sum$ Pi =70), of the answer 3 of the pupils during TGN, indicate that this difficulty of conversion is due to the too loaded program and in the much limited time granted to the teaching of this concept.

Answer 8, of value ($\sum$ Pi =41), concerning the difficulty assimilating the notions of asymptotes and asymptotic direction, establish, an obstacle for the pupils to build the curve of a function. As for answer 4, quoted on the table 1, which it part of the change of the algebraic register to the graphic register, the value ($\sum$ Pi =65), reveals the degree of difficulty which the pupils face making this conversion. However, this degree increases when we ask the pupils to pass from an algebraic register handling activities on the limits of the function, towards the graphic register. This increase originates in fact from the notion that the limit of a function really raises problems, according to several researchers as Mrs H. Elbouazzaoui (1988) and N. Mawfik (2006).

Besides, because the program is too long and the hourly volume dedicated to teaching graphical representation of a function is too much limited, the teacher does not assign enough exercises for consolidating this concept. This result was established with value ($\sum$ Pi =48), of the answer 6 of the pupils. The lack of this type of exercises has repercussions on remembering of the conditions (as the unit of measure …) while drawing of curve of a function, this is confirmed by answer 7 of the pupils with value ($\sum$ Pi =43).

As regards the conversion of algebraic register which shows itself in the notion of derivation the graphic register, the issue is part of the obstacles of conversions for the pupils, according to their statements by answer 9 with value ($\sum$ Pi =35),

In finally, according to answers 10, 11 and 12 of the pupils, the teaching of the graphical representation requires wide explanation and communicative acts between the teacher and his pupils with the aim of overcoming the obstacles which face the pupils.

III.3.2 Questionnaire Investigation

From the results of the TGN, which accentuate the degree of difficulty in connection with the concept: the graphical representation of a function, we built a questionnaire wade of five activities? Relying on the theory of Raymonde Duval (1993) on the semiotic representations to categorize a set of items, establishing these activities, in five categories $\mathbf{C}_{\mathbf{i}}$. In this context, Duval asserts that, the notion of function requires the use of several registers.

$\mathbf{C}_{\mathbf{1}}$: Working within algebraic register: we asked to the pupils to calculate the limits, to define the derived function, to solve equations …

C $_2$: Operating within the symbolic register (here picture of variation): the task is to draw the variations table, by placing the arrows indicating the direction of variations of such function.
C $_3$: Processing within the graphic register: we want to know the skills of the pupils to trace a curve by respecting branches infinites, conversion points of a curve with the axes of the mark …
C $_4$: Converting the symbolic register in the graphic register: our purpose is to encircle the difficulties which face the pupils during the passage of the symbolic register in to the graphic register.
C $_5$: The Conversion of the graphic register in to the algebraic register: we want to know the degree of assimilation among the pupils to make this type of conversion.

III.3.2.1 Results Analysis

The obtained results are postponed on the picture 2 below:

$N^O C_i$	Nature of the domain	% Right answers	% False answers	% No answers
C_1	Processing data within algebraic register (determination of limit, the by-product, the resolution of the equation …)	43,3	51	5,7
C_2	Processing data within symbolic register (Picture of variation)	54,7	39,3	6
C_3	Processing data within graphic register	25 ,6	66,4	8
C_4	Conversion of the register of variation table into the graphic register	17,7	70	12,3
C_5	Conversion of the graphic register in the algebraic register	13,5	75,2	11,3

Table 2

According to the table 2, two remarks turn out important. The first one is in connection with the graphic register which shows itself by the difficulties which face the pupils in the face of the conversion of the symbolic register in the graphic register (82,3 %), these pupils do not manage to settle this type of conversion, opposite 17,7 % of the pupils who made this task. The underachieving students have problems at the level of the reading of the variations table and they are not capable of interpreting the symbols, not posted in the variations table, graphically in a mark. Furthermore, 75,2 % of the pupils feel difficulties converting the graphic register into the algebraic register, this difficulty is stressed by the didactic transposition in the textbooks which almost marginalizes the conversion of the register graphic into the algebraic register. Besides, 74,4 % of the pupils find a great difficulty when the treating the data within the graphic register. These difficulties emanate from the fact that the positioning of the chapter which handles the graphical representation of the functions. In a very long syllabus, this hinders the assimilation of the various registers especially at the level of conversion between the graphic and algebraic registers, as well as at the level of the operating within the graphic register. Accordingly, the teacher is forced to briefly approach these registers and to minimize the activities meant to strengthen the assimilation of these registers whether they are at the level of the treatment or at the level of the conversion.

The second remark to be made relates to the difficulty at the level of handling a function both within the algebraic register and the symbolic register. In this context, we notice that 56,7 % of the pupils do not manage to do the task rendering it into the algebraic register whatever the determinates of the limits, the calculation of its diverted or the resolution of the equations are. As regards the concept of limit, we highlighted previously that this concept raises many problems for the pupils, especially in first year of the baccalaureate school experimental sciences. For lack of activities interested in the calculations of derivation and the conversion points of the graphical representation of a function with the X -axis, most of the pupils do not manage to fulfill to make these tasks.

On the other hand, as regards treatment of the symbolic register, more exactly the variation table, we note that 54,7 % of the pupils do this type of task, versus 45,3 % of the pupils who encounter difficulties answering this question concerning this mathematical operation. The underachieving students do not conceptualize process of the variation table, because they get used tracing the curve of a function without to resorting to this type of the table that involves so many symbols, the latter raises problems for the pupils in question. Consequently, this obstacle makes it clear that the man required initials man create an obstacle to the actual learning and favor the on-surface learning, according to Mr Romainville (on 2000, on 2001).

IV. Conclusion

This work had for purpose the diagnosis of the difficulties and the obstacles relative to the learning of the sequence of education: the graphical representation of a function at the level of the first year experimental sciences of high school. We coupled two methods of analysis: a direct one, the Nominal Technique of the Group (TGN), and an indirect one, the Questionnaire pencil / paper. The TGN, which consists of a method of generation of ideas allowed an overview of the difficulties and the obstacles the pupils face, inherent during the graphical representation of a function. The results obtained by the questionnaire have proved corresponding and additional to those of the TGN. So, this analysis allowed highlighting that the pupils feel difficulties then drawing of the graphical representation of a function, in particular, as regards the conversion between the graphic and algebraic registers. Therefore, the teacher has to, during the education of this concept, adapt the teaching pace to learning speed of the students, propose situations that consider the various registers of representations.

The end of this study, it shows that the method of generating of ideas: TGN can be a tool of diagnosis of the difficulties of the learners. The obstacles and the detected problems are to be verified and to be confirmed by the classic methods of diagnosis such as the questionnaire and the interview.

Bibliographical References

[1]. Chevallard, Y. (1985). *The didactic transposition of the learned knowledge in the taught knowledge.* The wild thought. Grenoble.

[2]. Delbecq, Has. L., Van de Ven, H, and Gustafson, D. Hour (1975). *Group techniques for program schedule, To guide to Delphi Nominal Group and.* Chicago; Scott Foresman.

[3]. Duval, R. (1993) Register of semiotic representation and cognitive functioning of her thought. *Annals of the didactics and Cognitive Sciences,* n o 5, 37-65. IREM of Strasbourg.

[4]. Elbouazzaoui, hour (1988). *Designs of the pupils and the professors about the notion of the continuity of a function.* Doctoral thesis. Laval university. Quebec. Canada.

[5]. Attic, J. and Lagrade, Mr. (2000). *12 e colloquium of the association for the search in the collective,* College of Outaouais Campus Félix-Leclerc, nominal technique of the group (TGN), the method of picking of the data to be known, p: 26-27. Available on:

[6]. http://www.er.uqam.ca/nobel/r17165/RECHERCHE/COMMUNICATIONS/ARC_Actes2000.pdf

[7]. Lamarti, L., Ben Bouziane A ., Akrim, a hour, Janati, R., Elkouali, Mr. and Talbi, Mr. (in February 22nd, 2008). Evaluation of the components of the duplicated lecture note concerning the external geodynamics for a better use of the module. *African magazine of didactics of the sciences and the Mathematics,* n o 3.

[8]. Lapointe, J. (1995) *The conduct of a search in education and in training.* Press of the university of Quebec.

[9]. Mawfik, N. (2006). Understanding of the notion of continuity of a digital function with real variable at the pupils of the Moroccan secondary sector. *African magazine of didactics of the sciences and the Mathematics*, the number 1.

[10]. Romainville, Mr. (2000). *The failure in the university of mass.* Paris: the Harmattan.

[11]. Romainville, Mr. (2001). *The evaluation of the quality of the higher education.* The third congress Graters.

[12]. Tavignot, P. (1995). About the didactic transposition in didactics of the Mathematics. *LOOP MMAGAZINE of the Search in education,* n o 15, 31-60.

Appendix: the questionnaire

I. We consider function f where ($\lim_{x\to+\infty} f(x) - x = 0$)and its variation table as follows :

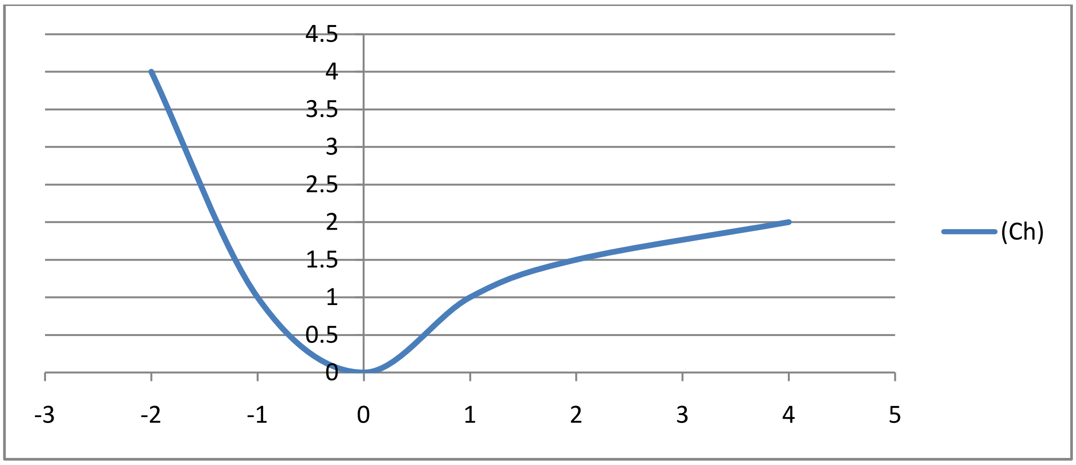
x	-∞		0		1		2		+∞
f′(x)		+	0	-	‖	-	0	+	+∞
f(x)	*1*		2		-∞ ‖ +∞		3		+∞

Trace his graphic representative in an orthonormal coordinate (O $\vec{i}$,) $\vec{j}$), we take as unit measure 1, 5 cm.

II. Let be g a numerical function defined by: $g(x) = \ x - \frac{1}{x}$

a. Determine the limits to the boundaries of *Dg*, the domain of definition of the function g.
b. Determine the derived function of the function g for x in *Dg*.
c. Deduct the table of variation of the function *g*.
d. To find conversion points enters the curve of the function *g* and the axes of the coordinate system
e. Trace (Cg) the graphic representation of the function g.

III. We consider h a numerical function of real variable x, (Ch) its graphic in an orthonormal coordinate (O, $\vec{\imath},\vec{\jmath}$) :



(Ch) the graphic representation of the function h

Based on this curve, determine:

a. $\lim_{x\to+\infty} h(x)$ $\lim_{x\to-\infty} h(x)$

b. The asymptotic directions of the graphical representation of the function h.

IV.

a. Let be t a numerical function defined by : $t(x) = x^3 - 3x + 3$
b. Determine the derived function of the function t for everything xof IR.
c. Draw the variation table of the function t.
d. Deduce the extremums of the function t.
e. Trace the graphical representation of the function of the function t.

V. *S is a* numerical function graphical representation of which defined by:

a. Determine graphically $D_{S,}$ the whole of the function *S*
b. Determine the limits of the function to the borders of D_S
c. Trace the variation table of the function *S*