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Apprentice of graphic representation of a digital function to secondary cycle through activities done in group

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ABSTRACT

The intention behind this work based on a graphic representation of a function to secondary cycle, found a recurrent assumption of the difficulty felt by students reflected in bad marks along continued evaluations and in the national baccalaureate exam.

The aim of this study is to get rid off the eventual causes of these difficulties and try to propose an effective teaching strategy for a good understanding of this part of lessons to students of 1st year baccalaureate experimental sciences. In this case we worked with group integrating technical activities on integration of limits and derivation.

In this respect, we could unfold that the integration of these activities is interesting for a good understanding of graphic representation of a function, but this could not be efficacious only through applying an active didactic method “Group working method” which does not only interests students of low level but also those of average ones, and high levels as well. Besides, this method is well appreciated by all students; they propose to generalise it on all subjects and lessons (Maths).

Indexing terms/Keywords

Graphic representation of a function, Group working method, activities, activities done in group.

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INTRODUCTION AND PROBLEM

Active learning is, in short, any learning activity engaged in by students in a classroom other than listening passively to an instructor's lecture. As we will show below, this includes everything from listening practices that help students absorb what they hear, to short writing exercises in which students react to lecture material, to complex group exercises in which students apply course material to "real life" situations and/or new problems. The term cooperative learning covers the subset of active-learning activities that students do in groups of three or more, rather than alone or in pairs. Cooperative-learning techniques generally employ formally structured groups of students assigned to complex tasks, such as multiple-step exercises, research projects, or presentations. Cooperative learning is to be distinguished from the more general term collaborative learning, which refers simply to any situation in which groups work together. Cooperative learning uses groups to work toward a common goal with positive interdependence, individual accountability, and heterogeneous groupings (Cooper & Mueck, 1990). Active-learning techniques, then, are those activities that an instructor incorporates into the classroom to foster active learning. The underlying premise for collaborative and cooperative learning is founded in constructivist epistemology. (Johnson, Johnson & Smith 1991) have summarized these principles in their definition of a new paradigm of teaching" First, knowledge is constructed, discovered, and transformed by students. Faculty create the conditions within which students can construct meaning from the material studied by processing it through existing cognitive structures and then retaining it in long-term memory where it remains open to further processing and possible reconstruction. Second, students actively construct their own knowledge. Learning is conceived of as something a learner does, not something that is done to the learner. Students do not passively accept knowledge from the teacher or curriculum. Students activate their existing cognitive structures or construct new ones to subsume the new input.
Third, faculty effort is aimed at developing students' competencies and talents. Fourth, education is a personal transaction among students and between the faculty and students as they work together. Fifth, all of the above can only take place within a cooperative context.

Sixth, teaching is assumed to be a complex application of theory and research that requires considerable teacher training and continuous refinement of skills and procedures" (p16).

Working in cooperative small groups provides an opportunity for students to exchange ideas and challenge their own knowledge (Johnson, Johnson & Smith 1991) and small group work has been shown to improve student academic achievement, critical thinking abilities, social skills, and self-esteem,(Johnson, and Johnson 1994) though peer assessment components are not necessarily valued by students(Munk and George 2003). According to Vygotsky (Vygotsky 1978) small group work is particularly effective when instruction is offered at or slightly above a student's own level or "zone of proximal development."

In this paper we attempted to develop the apprentice of graphic representation of digital function to students of 1st year baccalaureate experimental sciences option, integrating group working activities.

METHODOLOGY

We have done first a scrutiny with a group of 10 teachers of mathematics of secondary cycle who answered three open questions and an enclosed one based on the difficulties encountered by students when representing a function. The causes and solutions proposed to surmount their problems.

The teacher's answers have improved the study of a function integrating activities related to geometrical interpretations of "limits" and "derivation" through applying the method of group working in a class of 34 students (1st year baccalaureate option experimental science) divided in 6 groups of 5 students and a group of 4 students and a group of 4 students, the course length is 35h/7 weeks.

By the end of this experience, students are divided into 3 classes (the 1st is experienced, the second and the third are witnessing apart form the 2nd class students followed the same activities as the 1st class, but these activities were done individually. The 3rd class followed the course through a transmitting method who have undergone the same evaluating test.

A questionnaire has been addressed to students who assisted this experience just before handing in the evaluating test to assess the appreciation of group working method.

RESULTS AND DISCUSSION

1- Questionnaire with teachers

The teachers confirm that all students have difficulties to draw graphic representation of digital function.

These difficulties are:

- Geometrical interpretation of "limits" and "derivation".
- Graphic representation of parts of a curve within the domain of definition and the apprentice draw the curve one in a unique continued part though it is constituted from two parts or more.

- Impreciseness of graphics representation of the curve (the disrespect of the concavity of the curve and the absence of tangents especially in the extremum.).

The causes of these difficulties:

- Fear from mathematics to the apprentice is caused by the absence of requisites; he does not make any effort.
- The abstract aspect of the subject does not allow students to feel the ability of functions.
- The apprentice is not able enough:
    - To make the liaison between different questions of the exercise. In other words, he does not understand the exercise as a whole.
    - To read correctly the horizontal chart of variation. The elements which do not belong to the domain of definition, the points where the function is not derivative.
    - The geometrical interpretation of limits, the number derived and the second derived.
    - To understand the notion of the infinite.
- The apprentice had some deficiencies in:
    - Working with the indefinite x, y, t…
    - Working with a right line as a geometrical figure and analytical notion which constitutes hence a basis to draw the curves.
- Concerning the precision of one representation of a curve, it may be possible that the apprentice is adopted to draw geometrical figures and lines using geometrical tools (for example: a ruler…) not to forget that the curves to them are represented always in a form of segments.
- The predominance of the abstract aspect of the courts without a practical application renders the student incited towards what he is learning, we note that the graphic representation of a curve is everywhere in our daily life.

Proposed solutions to solve these problems to the apprentice:

- Diversify the situation of acquisition during the representation of limits concentrating more on the geometrical interpretations of limits, derived numbers and extremums of a function.
- Adopt the apprentice to read the data beginning with a curve of limits, tangents, asymptotes, the image of a number … introducing situations and convenient activities.
- Concentrate more on the linear functions, and affine functions as they are analytical notions and geometrical, and the counting of an image of a real number through a function; therefore, the apprentice understands well the notion of a real variable.
- Integrate the TIC within the course “graphic representation of a curve”
- Reduce the number in each class to 24 students.
- Reinforcing students with difficulties to maintain certain learning.

Accordingly, we tried to develop our course by integrating some activities on limits and derivations; we are inspired by activities proposed in Maths handbook **“FI-RIHAB”** 1st year baccalaureate, option experimental sciences.

Limits activities are:

Activity 1: The finite limit of a function around the endless.

Activity 2: The infinite limit of a function around the endless

Activity 3: The finite limit near to a real number.

Activity 4: the infinite limit of a function around a number (right and left limit).

Activity 5: limits of trigonometric functions.

Derivations of activities are:

Activity 1: instantaneous speed and the derived number.

Activity 2: tangent of the curve of a function in one point.

Activity 3: the derivability of right function and left as well.

Activity 4: monotony of a function and the signal of a derived number.

Activities of graphic representation of a function

Activity 1: asymptote parallel to the axis of abscises.

Activity 2: asymptote parallel to vertical axis

Activity 3: oblique asymptote.

Activity 4: parabolic branches.

Activity 5: concavity of a curve and the point of inflexion

Activity 1: axis of symmetry of a curve and center of symmetry of a curve.

2-Experimentation of group working method within study activities of a function for secondary cycle:

2-1 Application of group working method in a lesson:

We have subdivided the class in 6 groups of 5 students and a group of 4 students.

Each group is composed of a good student, two have a middle level and two others are weak.

We have avoided that the members of each group are acquainted; each group has a reporter and an animator.

The animators have the right to ask for help from other groups and if all the groups do not have the right answer, the teacher intervenes to guide them without giving any answer only after many attempts so as they auto-correct the exercise. The teacher tries to involve all members to participate during the activity.

2-2 Evaluation test

By the end of the experimentation all students of 3 groups (Experimental and the two witnesses.) have undergone the same test of acquisition on a graphic representation of a function. This test aims essentially to know the students degree of mastery of their level of knowledge mentioned in Bloom's taxonomy namely:

- Acquisition of knowledge (Memorisation).
- Comprehension of a knowledge acquired.
- Application of this knowledge in practice.
- Analysis of this acquired knowledge.
- Synthesis of acquired knowledge and the evaluation.
- The decision making with regard to acquired knowledge.

In our case, we did not evaluate students according to the last level of knowledge who correspond to the decision making.

3- Questions type given in the evaluation test:

The subject of evaluation is composed of four 4 questions exercises:

Exercise 1: questions of the course in the form of definitions.

Exercise 2: questions of the course in the form of a sentence to complete; we have given graphic representation and we asked students to fill in the blanks with appropriate limits. In the other questions we have given students the curve and we asked them to draw a chart of variation.

Exercise 3: we have given the chart of variation of a function f(x) and the chart of signals and its secondary derived function f''(x), we asked students to draw the graphic representation of the curve of the function f(x).

Exercise 4: we have given a function f(x) and we asked students to study it.

Results of evaluation test

We present what follows the compared outcomes of the test of knowledge .Then the declarations of students who assisted to the method of working group so as to proclaim their appreciation concerning the working group method.

3-1 compared results of the test of knowledge:

Cognitive activity demanded	**The average mark of the experimental group**	**The average mark of the group witness 1** (activities applied individual)	**The average mark of the group witness 2** (without activity or working group)
Acquisition of knowledge (Memorisation)	11.89/20	11.1/20	11.16/20
Comprehension of knowledge acquired	11.60/20	09.29/20	05.85/20
Application of this knowledge in practice.	10.48/20	ults	02.84/20
Analysis of this acquired knowledge.	08.86/20	03.89/20	01.75/20

Synthesis of acquired knowledge	08.86/20	03.89/20	01.75/20
The general average	**10.34/20**	**06.6/20**	**04.67/20**

- The obtained results by students in evaluation test showed clear supremacy of students who have worked in group (experimental group) on students of two groups witnesses.
- Group working helps to achieve the complex objectives of the application of Bloom's taxonomy, analysis and information synthesis.
- More than that, we witnessed a great motivation of all students who followed group working method even those who have low level at the beginning, they could have average marks, in their memorisation of knowledge and application, whereas, students of average level experimental group, obtained probably the same marks as the best ones of group witness who followed activities in an individual manner.

3-2 Analysis of questionnaire addressed to students:

- 20,59% of students judge that mathematics are easy, 52,94% confirm that they are moderately easy and 26,47% find it difficult.
- Nearly 67% of students see that difficulties of mathematics is due to the lack of practical application and of teaching method whereas 97,06% judge that it results from the lack of acquired things.
- 76,07% of students confirm that the use of group working method in studying a function facilitates the understanding of this part of the course and 88,23% of students confirm that it helps in the resolution of the exercises.
- 90,7% of students see that the use of group working method will be efficacious in all the courses of mathematics and 88,24% see it utile within the courses studied.
- More than 90% of student judge group working method helps working more in communicating with others, exchanging ideas with them, making research by themselves and their representation in confrontation with socio-cognitive, learning how to collaborate with others and developing autonomy and initiative to them.

In so doing, students have well appreciated group working method and found it not only motivating in this course but in all courses (Mathematics and other).

CONCLUSION

This study helps us to show that integrated activities is interesting to a good understanding of graphic representation of a function but this could not be efficacious only through applying an active didactic method with regard to group working method which affects not only students of weak level but also students with average ones and of good level as well. Furthermore, this method was well appreciated by all students who assisted the activities and propose to be generalised in all course studied (Mathematics or others…).

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