FUNDAMENTAL ISSUES OF TEACHING IN GROUP APPLIED IN CLASSES OF PHYSICS AT "FAN S. NOLI" UNIVERSITY, ALBANIA

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Abstract: Contemporary teaching and learning didactics in physics has subdued a paradigm switch of direction, from a traditional teaching method, into an interactive group collaboration between students and teachers. The teaching side has adapted a system composed by three core elements: organizing, consulting and controlling the learning side. Today's aspects of teaching physics, are driven by expertise notions, keeping focus on the primary target of reasoning on a conceptual basis, including physics models, real problem solving and complex demands. All of the aforementioned, is made possible from delivering structured knowledge, which can be negotiable, intertwined, hierarchic and multiple, in ideas. Teaching methods keeping central focus on the student, are more and more popular on college levels[53][54][55]. Recent studies recommend group studying as a primary activity for college students[56][57]. This article treats specific aspects of student collaboration between students of "Fan S. Noli" University in Korça, Albania. A much needed experimentation of this university's group collaboration was conditioned from a multi-background performance of student's flow of participation. The experimentation of this collaborative – interactive study method, was realized by creating four formal study groups and some non-formal study groups. The results obtained along with their proper argumentation, was comparative, referred on pre-college education, as well as on sidelined groups from the collaborative – interactive method. The selection criteria for formal and non-formal groups were different. The students of formal group were selected with a spectrum of different results referring to their pre-college education, including the minimal and maximal possible results as well as referring to the responses through the method of stimulating their quick responses to the questions of teachers in class work. Non-formal groups were ad hoc clustering, which were evaluated only by stimulating their ad hoc reaction. The obtained results and their argumentation are relative, referred firstly to the results inherited from the pre-college education for the formal groups (experimental groups) and secondly to the groups excluded from the collaborative work (traditional groups). Interactive activation, through collaborative work in groups, produced an average effectiveness enhancement of learning Physics, significantly greater than traditional methods. Based on comparison of results obtained from the work on collaborative groups with the pre-college ones, for the same students group in Physics, is observed that the performance of the formal groups team wise, is grown on average by 2.2 %.
Keywords: group collaboration**,** formal group, non-formal group, interactive method, ad hoc clustering.

1. METHODOLOGY

The implementation of recognized and recommended forms of collaborative work in a group is included. The groups selected for experimentation were *Non-Formal Groups* and *Formal Groups.*

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Non-formal groups are temporary, they are organized internally within the classroom with 3 students, asking them to discuss a question posed or solve a problem.

Formal groups are long-term groups organized to complete a task postponed in advance. The timeframe for solving the task was determined by the degree of its complexity and the specific requirements. The optimal time was 3 weeks.

Study teams, which are long-term groups (one semester) and with sustainable membership, are in the process of being experimented, so the results will be presented in another article.

Group organization. The students of one of the bachelor's year courses at: "Fan S. Noli" University of Korça, who developed the subject of Physics, were divided into two main subgroups:

1) *Subgroup I*, with which it was worked according to traditional didactic method, the teacher explains, the student hears. (Further *subgroup I* will be referred to as "traditional group")
2) *Subgroup II*, which was the group that was selected to apply collaborative work (Further, for *subgroup II*, we will refer to as "experimental group")

Subgroup II was subdivided into subgroups in smaller groups, as follows:

a) 4 formal groups with 5 members each
b) Informal groups of 3 members each

The selection criterion for the creation of formal groups:

Not casual. Selected students: First, they should have a range of different results from pre-university education, including the minimum and maximum possible levels. Second, the selection took into account the quality of responses through the method of stimulating quick feedback from students versus teacher questions at the beginning of the course.

Selection criterion for shaping non-formal groups: Casual.

Co-operation tactics in group. *Initial Phase: Stimulation of ad hoc reactions*

The stimulation of rapid feedback in lectures and seminars from the participants at the beginning of the course, versus the questions asked by the teacher, is an important preliminary stage, including the needs of selecting formal groups[58].

Students, when they start the Physics course at the university, need incentives to rediscover existing knowledge and to evaluate them. Meanwhile, the teacher is informed about the needs each student has to effectively develop the university's Physics program and at the same time to recognize the needs of the students in this subject.

Example of ad hoc reaction questions:

1) How did we call in Physics, changing the position of an object in space and time?
2) When the body traverses equal segments of road in equal intervals of time, with what kind of motion we are dealing with? But when the segments of the traversed road are different for equal intervals of time?
3) Is force, the source of motion?

Non-formal groups. They are temporary and have been created there, during lectures and seminars. In short, the way of working with them was:

The lecturer raises the question and expects individual answers; Then encourages student collaboration of informal groups to discuss some cases with one another in order to argue the final response.

Example:

Specifically, one of the questions asked was: Is the concept of the road the same as that of displacement?

Three Individual Responses were:

a) They are different but I cannot explain the reason.
b) The road is a curved trajectory while displacement is straight.
c) Not because one is a number and the other a vector.

The final consensus response in the non-formal group:

The concept of displacement and the road is not the same; as the displacement is represented by a vector while the road with a scalar. The displacement is determined by the vector that originates the starting point of the motion and

[58] Chickering, Arthur W., Gamson, Zelda F. (1987, March). "Seven principles for good practice in undergraduate education". American Association for Higher Education, Washington DC. Journal Articles (080) AAHE Bulletin, p.3-7

for the extremity its point of completion. The road is represented by all the possible broken lines that track the body to arrive at the destination.

Formal groups

1) Each of the formal groups selected according to the above criteria was housed in the university library premises, at an hour and a specified date, beyond the teaching schedule. Each student was encouraged to look for additional material about the assignment by using additional literature and relevant information on the Internet.
2) The group, after collecting the material related to the subject, chose it and divided the tasks (translation, logical organization of the material and its writing)
3) The groups were encouraged to invite their companions from other courses, studying the subject of Physics, to discuss together about the task.
4) Groups were encouraged to discuss the task with math lecturers on selected topics that included mathematical argumentation of concepts.
5) The lecturer, with the duty of a counselor, encourager and explainer, was present during the initial phase.

Performance phase in task groups. This phase involves the grouping of the observations for the discussions between them. Since the group has students with a relatively higher performance than the other, experimentation has shown that mutual discussions are in favor of these two; meanwhile, there has been an increase in the communication and explanatory skills of the best students and the need for argumentation of the issues raised by both parties.

Example: The discussion about the two-dimensional motion of the material point revealed the necessity of proving mathematically that the trajectory of a body thrown at an angle with the horizon is parabolic. Logically, the conclusions were drawn that the maximum throw distance of the body should be taken at an angle of 45 degrees. While the maximum climbing height for the same initial speed value is approximately 90 degrees. Why not for 90 degrees? Because for this angle, we have to jump vertically upwards, where the trajectory is a straight line (one dimensional) and not a parabola (two dimensional).

Defining a writing structure and effective time for tasks. Teamwork requires that, during the individual work phase, the structure / scheme of organizing the material should be unique. Students needed to learn how to structure the selected material and how to write a task. In order to make this, we have been briefly informed about the disassociations - examples, with the demands of the formality of the subject, the scoring of the perceived diagram, the legal foundation, the perception of the physical phenomena of the perpetrators, the models used, the mathematical treatment of the solutions, to finally deliver the argumentation of the results and opened questions.

The students in the group would also like to learn how to manage the moment when the task was accomplished.

They was encouraged to:

- Start immediately the work, after the assignment.
- Determine a work schedule with specific deadlines by allocating the work volume.

Example: The first week is dedicated to collecting the selection and translation of the material. The second week was devoted to structuring the task and starting the settlement of issues. The third week is dedicated to the individual outcome of the treatment / solving of physical issues, as well as argumentation and discussion in the group to decide with consensus, the final form of group task.

The free and ongoing contact of the lecturer, for consultation and counseling, was indispensable at every stage.

Individual Responsibilities. Students in formal groups need to know what is expected of them, so you have to be clear about the objectives to be achieved after group work: The main objective is:

Be able to present and argue in front of the group, class and broader, group task, and be able to answer questions from the audience. They are promoted during the presentation to explore ideas individually, which are not included in the assignment.

Individual Skills versus Collaborative Work in a Group. Students demonstrate ideas, skills, preparation and different ways of working. All are recommended and need to express what they know and are capable of doing in Physics. For this reason, they should be given the opportunity to share their information and learning ways with others in general. This is accomplished, if they come in contact with each other and the working groups are the ideal tool to accomplish the final task.

2. RESULTS AND DISCUSSIONS

The results of four formal student groups, which have collaborated regarding the deepening of concepts, models of Mechanics and solving the complex problems of this field, are shown in Table 1 and Figure 1.

Formal group A	***< Evaluation> in Physics in pre-college education***	***Task I assign:*** *Theoretical Topic in Physics* ***Realization time:*** *3 weeks*	***Task II assign:*** *Complex problem* ***Realization time:*** *3 weeks*	***<Evaluation> Task I, II***	***Average growth***
Stud. 1	8.6	Linear motion analysis. Examples of motion analysis	Solving a complex problem with various aspects of topic	9.2	2.8%
Stud. 2	5.5			4.8	
Stud. 3	9.5			9.4	
Stud. 4	7.3			8.4	
Stud. 5	6.6			7.1	
Mean	7.5			7.8	

Formal group B	***< Evaluation> in Physics in pre-college education***	***Task I assign:*** *Theoretical Topic in Physics* ***Realization time:*** *3 weeks*	***Task II assign:*** *Complex problem* ***Realization time:*** *3 weeks*	***< Evaluation> Task I, II***	***Average growth***
Stud. 1	5.3	Motion in two-dimensions. Throwing the body at an angle with the horizon	Solving a complex problem with various aspects of the topic.	5.0	1.2%
Stud. 2	9.3			9.2	
Stud. 3	7.5			7.8	
Stud. 4	5			5.4	
Stud. 5	6.5			6.7	
Mean	6.7			6.8	

Formal group C	***< Evaluation> in Physics in pre-college education***	***Task I assign:*** *Theoretical Topic in Physics* ***Realization time:*** *3 weeks*	***Task II assign:*** *Complex problem* ***Realization time:*** *3 weeks*	***< Evaluation> Task I, II***	***Average growth***
Stud. 1	9.6	The law of universal gravitation. Acceleration of free fall in different planets. Artificial Earth's satellites.	Solving a complex problem with various aspects of the topic	9.5	3.2 %
Stud. 2	8			8.4	
Stud. 3	6.5			6.6	
Stud. 4	7			7.6	
Stud. 5	7.3			7.9	
Mean	7.7			8.1	

Formal group D	***< Evaluation> in Physics in pre-college education***	***Task I assign:*** *Theoretical Topic in Physics* ***Realization time:*** *3 weeks*	***Task II assign:*** *Complex problem* ***Realization time:*** *3 weeks*	***< Evaluation> Task I, II***	***Average growth***
Stud. 1	6	Conservation law of energy. Examples of energy transforming forms.	Solving a complex problem with various aspects of the topic	6.5	1.6%
Stud. 2	5.3			4.8	
Stud. 3	8.6			8.5	
Stud. 4	5.6			5.9	
Stud. 5	6.3			7.3	
Mean	6.4			6.6	

Table 1. Comparative results between pre-and post-work collaborative groups referred to students of formal groups

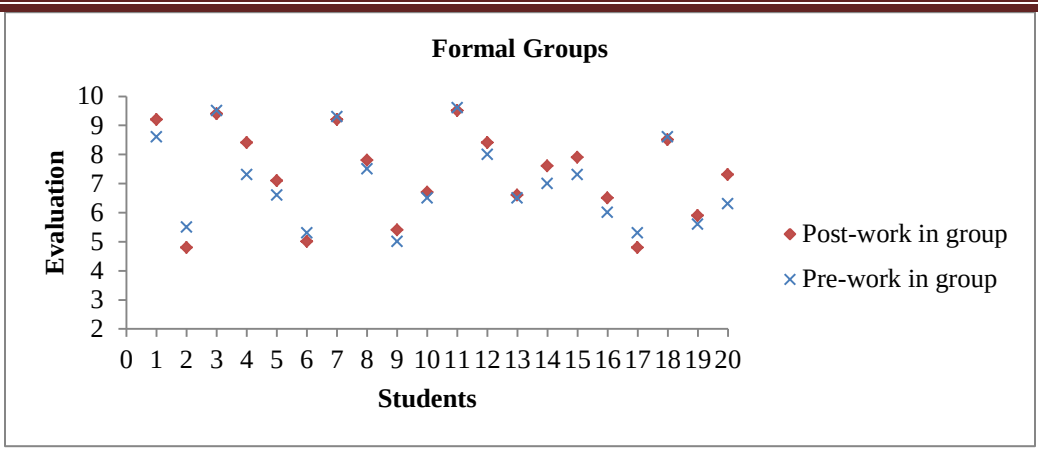

Fig. 1. *Graphically illustration of comparative results between pre-and post-work collaborative groups referred to students of formal groups*

Based on comparison of results obtained from the work on collaborative groups with the pre-college ones, for the same students group in Physics, is observed that the performance of the four groups team wise, is grown on average by 2.2 %. It's evident that this is a consequence of their individual increasing performance at 75% of the group. The average growth of the results varies from a group to another due to the heterogeneity of the group (distribution of average evaluation of the students), referred to pre-college evaluation. Formal group C, with relatively higher average, has the highest growth (3.2%), due to relatively higher pre-college evaluation. Middle students have an increase of about 2.6% higher than the weak students, while the good students have an average growth of only 1%.Outcomes for the effectiveness of ad hoc clustering in lectures, for experimental groups versus traditional groups (the teacher explains, the student listens) are shown in Table 2 and Figure 2. To enable comparison, the samples of selected students should have rigorously the same pre-university evaluation in Physics. The respective scores for the two groups are presented in two last columns of the table.

< Evaluation> in Physics in pre-college education	***Relevant students with the same evaluation from two groups***	***Experimental Group***	***Tradicional group***
		Evaluation/scores	***Evaluation/scores***
5	Student1 vs. Student1	3	0
5.5	Student2 vs. Student2	4	1
6	Student3 vs. Student3	5	3
6.3	Student4 vs. Student4	5	2
6.5	Student5 vs. Student5	4	1
7	Student6 vs. Student6	6	3
7.3	Student7 vs. Student6	6	5
7.5	Student8 vs. Student8	6	2
9.3	Student9 vs. Student9	8	7
9.5	Student10 vs. Student10	10	7
	Mean	5.7	3.1
	Standart Deviation	1.83	

Table 2. Comparative results during ad hoc reactions between students of experimental and traditional groups

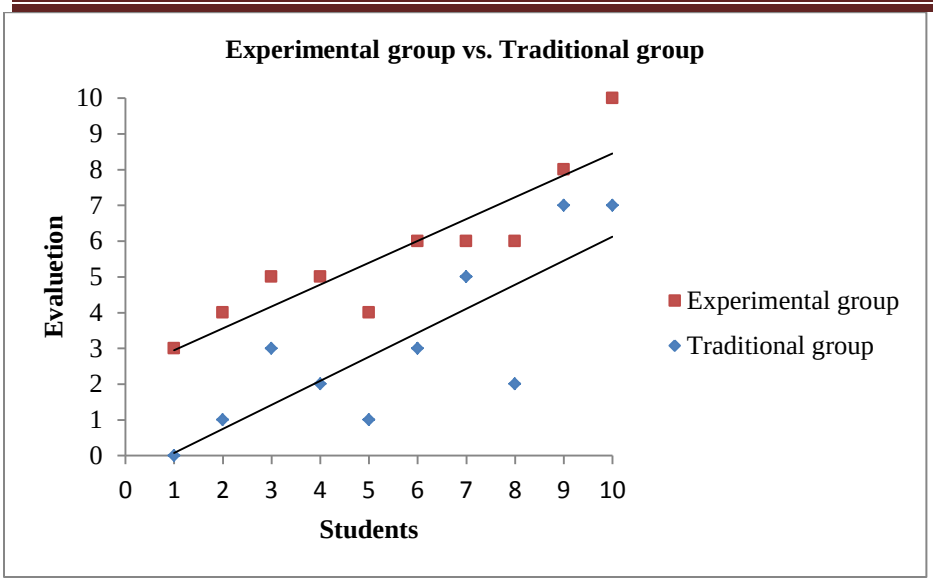

Fig. 2. Graphically illustration of comparative results during ad hoc reactions between students of experimental and traditional groups

It is evident that, referring to the chapter of Kinematics, the experimental group has a deviation in evaluation of about 45% higher versus the traditional one.

3. CONCLUSIONS

1. Interactive activation, through collaborative work in groups, produced an average effectiveness enhancement of learning Physics, significantly greater than traditional methods.
2. Interactive collaboration encouraged contacts, deepened Physics debate, developed communication bridges, increased the opportunity for information in Physics, and fed the passion for this discipline.
3. Collaboration in group drew attention to various talents and different learning methods, allowed active use of teaching techniques and experimentation of deadlines for carrying out the course assignments.
4. Cooperation in group made the weak students better, and the good ones perfected in communication and explanation.
5. Each group member was responsible and interdependent on everyone else, relied on each other, and no one could have succeed alone if everyone doesn't cooperate in group.

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