GROUP DYNAMICS TO IMPROVE TEAMWORK AND COLLABORATIVE COMPETENCIES IN CHEMISTRY STUDENTS

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Abstract

The development of tools for improving teamwork and collaborative competencies has become very important in the teaching-learning process as well as becoming one of the generic competences of University degrees, particularly in the Chemistry area. Teamwork can help students to be more effective in solving problems in a successful way as well as taking less time for acquiring competencies for individual students.

This study was focused on working with first-year students in the degree of Chemistry, by participating as members of a team to develop and present a research work on one specific subject in the Chemistry field.

In this sense, team dynamics can be applied in a novel way to students with the aim of developing competences related to leadership, decision making, collaboration and communication, all of them oriented towards favouring their interaction within the team. These dynamics are highly valuable in this particular case to achieve the common goal of working on a specific subject and, at the long term to prepare them for their professional career.

In this work, four different team dynamics were proposed, all of them aimed to the improvement of student’s skills in teamwork. Furthermore, the degree of satisfaction of all students with these activities was evaluated through a survey. Most of the students participated actively in these dynamics, resulting in groups of highly motivated individuals with a clear vision of their objectives and tangible evidence of their achievements.

In summary, it has been demonstrated that the dynamics of teamwork are an excellent tool to train undergraduate students in the acquisition of skills to improve their learning of Chemistry concepts as well as to integrate themselves successfully in work teams, managing and leading them in specific tasks.

Keywords: Team dynamics, competencies, Chemistry degree.

1 INTRODUCTION

Groups represent a very important role in the people’s socialization, either in the individual or collective context. According to Merton, a group is "a number of people who interact with each other according to established patterns". In addition to the plurality of individuals, Merton establishes two necessary conditions for the group’s formation: (i) to interact with each other and (ii) to do so in accordance with established schemes or norms [1].

Social psychology is the branch of psychology responsible for theorizing and analyzing those phenomena and interactions occurring in groups [2]. Group dynamics can be defined as the interactive social process where different people interact and behave in a team environment. The nature and composition of these groups can be very varied, from very small to large, including discussion groups [3].

The introduction of these concepts in students should be one of the major goals of University professors, being one of the generic competences in many degrees and in particular in Chemistry. Working as a team allows students to achieve their objectives in complex tasks in less time than necessary for the individual acquisition of the main competences related to a university degree [4].
It has been stated that transforming a group of students into an efficient and effective team leads to an improvement in their interpersonal relationships and academic performance. This is the true objective of the aforementioned work, achieved through group dynamics, which have the power to raise student’s own ideas and personal motivations, as well as to empower the group to be better integrated and directed towards their goals.

2 METHODOLOGY

This research has been carried out by professors in the area of Analytical Chemistry, as well as by pre-doctoral students from different areas of Chemistry, who supervised the research work of first-year students in the Chemistry degree. This group dynamics session (180 minutes) was carried out by students in a particular classroom environment and the supervision by the pre-docs. The first year students have been distributed in groups of four members and each group has been supervised by one pre-doctoral student to carry out a research work on a particular subject related to Chemistry.

In this sense, group dynamics were applied effectively to students with the aim of developing competences related to leadership, decision making, collaboration and communication, all of them oriented towards favouring their interaction within the team and to achieve the common goal of the correct development of their first research work.

Groups were formed by students with no previous knowledge between them and resident in different locations. The group dynamics were applied within the classroom and in close spaces. The methodology to run each dynamics always started with an explanation by the senior student, including the objective, details, meaning and applicability.

The first dynamics objective was to reflect how the group is perceived and how each individual is perceived within the group, as well as identifying how each member could participate and/or collaborate to strengthen the group’s cohesion and convert the working group in a real team. This dynamics consisted of completing a file anonymously with the objective of expressing how everyone feels within the group. The coordinator asked the members to sit down forming a large circle. Each participant was given a sheet with points to answer, where none could be left blank. It is very important in this dynamics that they could express clearly and sincerely their ideas and needs in their answers, including a reflection of their strengths and weaknesses, limitations, abilities, etc.

When the time given for this exercise was over, all sheets were collected randomly and distributed again between the group members with the purpose that each one had the answers of one of his/her teammates. Every answer was read aloud, so that the other group members could try to identify who of them was by the identification of both, their virtues and defects, which can be directly applicable to their research work.

The second dynamics consisted of a small game of mimicry. When several people have to interact to achieve a common goal it is very important to have excellent internal communication. The coordinator requests a volunteer to try to communicate something to the first group member without speaking or writing, only acting on each word of the sentence. The first component must do it to the next and so on.
Finally the last component of the group should receive the message, with a limited time to discover the subject of the exercise, which was related to films, sayings or topics related to the research work that is being carried out by each group. With this dynamics the group interaction was reinforced, generating a relaxed atmosphere and highlighting the importance of internal communication in the work team.

Image 2. Students performing the second dynamic called Mimic game.

The third dynamics was called the Group Pyramid. The objective is to give priorities to the needs that a group has in the research work to be performed and to show them in percentages by analogy with the Maslow Pyramid. The coordinator distributed to all group members a sheet with the pyramid where they must individually put the percentages by weight they consider as appropriate to each part of the work. Furthermore, results were put in common between them to discuss and agree the final percentages for each activity. Finally, all groups were called to a common discussion of their respective results trying to reach a general agreement between all of them.

Image 3. Students performing the third dynamic called Group Pyramid.

The last dynamics was the so-called “Elevator Pitch”. This technique is characterized by brief but intense speech, to get effective, precise and clear messages making use of the Elevator Pitch forces. A previous brainstorming discussion must be carried out inside the group for the creation and sale of an invention. All members of the group should transmit the benefits of their invention to their colleagues in a limited time. In this way, the ability to organize the team under pressure and the degree of involvement they have, as well as their individual role can be evaluated. Communication is also encouraged, so it is necessary that they apply what they have learned in the previous dynamics to complete their own research work, as well as the oral defense.
3 RESULTS

The results of the assessment and perception of students of these group dynamics were obtained from a survey conducted at the end of the semester. These results largely confirmed the idea of the importance of group dynamics to achieve the social cohesion between all members of the group, as well as to assess the need of their knowledge and application to play each individual role for the good development of the research work.

The required information has been collected from a survey that was answered by students anonymously. Students were requested to answer 14 questions, nine of which with multiple answers and the other five with open answer to reflect their opinions.

The total number of students participating in this survey was 50, all of them enrolled in the first year of the Degree in Chemistry. The main results of this survey are shown below.

![Image 1](image1.jpg)

![Image 2](image2.jpg)

![Image 3](image3.jpg)

*Figures 1 and 2*
Figure 1 clearly shows that only 38% of the students surveyed had previous knowledge of group dynamics or had previously participated in one of these exercises. This is a major issue when analysing the results of the group dynamics, showing some lack of habit in these activities during the Primary and Secondary education although they are considered as compulsory in some previous educational stages.

Figure 2 showed the importance of these dynamics to improve stability and balance within the work group. This result is important for application in every group, since these dynamics have allowed mutual personal knowledge between students and their cohesion. It should be recalled that they are first-year students, who have just met few months before and do not know each other in their work attitudes and performance. As a result of these group dynamics the level of knowledge and relationships between their members have improved significantly favouring a deeper personal interrelation.

![Figures 3 and 4](image)

It is also important to highlight that the relationships between the senior students and the work group was in general fluid and smooth. This result was clearly reflected in the surveys, indicating that the group dynamics helped to strengthen the relationship between the senior student and the work group (Figure 3).

In the same way, more than 92% of the first-year students believed that senior students helped to facilitate the success of the team work, contributing to better organization of the overall group (Figure 4). In conclusion, it was observed that the figure of the tutor student was strongly supported by the first-year students, who showed high levels of confidence in the figure of their mentors and their participation as coordinators in the group dynamics.

![Figures 5 and 6](image)

Figures 5 and 6, reflect those dynamics that have appeared more appropriate to address the bibliographic work to be performed by students during their research work. They were also those dynamics easier to understand by students. From these results it can be observed that 68% of the...
students considered the Pyramid Group dynamic as the most suitable to take into account what to do and when for the bibliographic work, while the Mimic game was the most entertaining and easy to understand for 66% of students.

For the open question number 7 it is significant to note that 90% of the students identified the main objectives of each dynamic and that this helped them in the preparation of the group work. Many students highlighted the Elevator pitch dynamic as one of the first opportunities they had to speak in public. They also highlighted the importance of taking priorities and the good organization inside the team in the Pyramid group, being also very useful to know the strengths and weaknesses of teammates in every group, as well as resulting in correct communication in the Mimic game.

Figure 7 reflects the great usefulness of all these dynamics as considered by students. According to data obtained from the surveys, the Group Pyramid dynamic obtained the maximum score followed by the Elevator pitch. The dynamic that they considered less useful for their purposes and interests was the Mimic game.

With regard to the orientation of these dynamics, most of the students considered adequate the approach for all of them (Figure 8). The contributions of the Pyramid group and Elevator Pitch dynamics also stood out in this section of the survey.

Students also highlighted their high interest in all dynamics. All of them generated a good classroom atmosphere with total participation, with high involvement in the tasks by the students in each group (Figure 9).
The students were also required to give a global qualification to all dynamics used in this work. They emphasized the high note for all the dynamics and in particular to the Group Dynamic and Elevator pitch (Figure 10).

Figure 11 reflects the need and importance of working dynamics in the Chemistry Degree as an essential methodological tool in the training of future graduates. Students considered that all lessons learned in these group dynamics sessions will be useful for their future studies and professional career.

Another question from the survey with open response showed several aspects in these dynamics that the students (approximately 28%) considered to improve for future introduction of these group dynamics. Some of the proposed variations were in line with the introduction in the use of techniques and tools for oral presentations of work and more activities aimed to improve trust for partners inside each group. The remaining percentage considered that these dynamics were adequate and it was not necessary to modify any aspect.

Finally, Figure 12 shows that 90% of the students did not know other group dynamics to apply in the classroom. Those who knew some dynamics were also focused on improving the relationship between members of the same team.

4 CONCLUSIONS

It should be highlighted that some of the aspects of the information obtained from the students by their answers to the survey, the evaluations made by the students themselves about the group dynamics activities carried out were totally positive. We can conclude that the teamwork dynamics are an excellent tool to train undergraduate students in the acquisition of the necessary skills to integrate successfully in work teams, as well as to participate and lead teams.

The use of group dynamics has also enhanced the participation and integration of students, promoting group cohesion, establishing emotional ties and greater motivation in the students. In the same way, these dynamics are also an excellent opportunity to promote individual success, from their leadership role, a milestone that can be extrapolated to their studies. For these reasons, we consider that group dynamics are novel and necessary elements in the teaching and learning processes for students in the degree of Chemistry.

REFERENCES

