ARONSON PUZZLES AND ROLE-PLAYING GAMES: POWERFUL TOOLS FOR TEACHING PLANT YIELD BREEDING IN A MASTER DEGREE SUBJECT

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Abstract

The use of games in teaching is a widely used tool in primary and secondary school, but it can also be used in Higher Education at Bachelor and Master Level. Two games frequently used are Aronson puzzle and role-playing games. Both are collaborative and tend to involve the student in a new situation that has to be solved with the help of his/her partners. The use of these games in the classroom favour teamwork, oral communication, critical thinking and student’s relationships. Plant breeding subjects tend to solve complex problems that have many points of view and have to take into account different strategies. The use of Aronson puzzle and role-playing games adapt to the kind of problems that are solved in Plant Breeding subjects because they allow students to face a situation using different approaches and allow them to identify the advantages and disadvantages of each strategy exposed. In addition, these techniques allow a high interaction between the students and provide a relaxed learning environment. Also, the involvement of the student is very high, increasing the motivation in the subject. The election of the topics to be discussed can help the students to be aware of the contemporary issues related to the subject and to propose new approaches to solve specific problems. These techniques were implemented in a subject of a Master Degree in Plant Breeding. Two different activities were carried out, each of them with one the techniques described above. Activities were carried out in two different academic years. The results were quite satisfactory, the student’s involvement was very high, and they encouraged the teacher to repeat the games in following years. The academic performance of the students was also very high, reaching conclusions according the academic level of the subject. In this paper, the benefits and disadvantages of these techniques are discussed and its concrete application in a specific subject of a Plant Breeding Master is described.

Keywords: Critical thinking, Classroom interaction, Contemporary issue knowledge.

1 INTRODUCTION

Game based learning (GBL) is a popular teaching strategy that with new technology holds a considerable promise for helping to engage learners [1]. GBL can be used in primary, secondary and higher education and can enhance the educational process [2]. Games have a diverse format, genre and dynamics [1] and can be categorised into: behavioural change, affective and motivational outcomes, perceptual and cognitive skills and knowledge acquisition and content understanding [2]. Two of the games that can be used are Aronson puzzle (or jigsaw classroom) and role playing games.

Aronson puzzle is a research-based cooperative learning technique invented and developed in the early 1970s by Elliot Aronson [3] where basically a theme, that can be divided in multiple parts or segments, is presented to the students. Later the students are divided in groups and each of the members of the group is designed as an “expert” in a part or segment of the problem to be solved. Experts of each part are joined and discuss the main points of their segment. After that the “experts” return to their groups and discuss the main points of each of the segments [3]. It is a collaborative learning approach that allows students to become “experts” in one component of a lesson’s content and then to share it with a “home” group [4], [5]. The objective of this strategy is to enhance the listening, engagement, and empathy skills of all students [4]. The Aronson puzzle may be useful in teaching concepts that require integration of different types of material or situations where students’ perspective is important [5].

In role playing games [6] the teacher tells a problem or story to the students (the players), which are given different roles that have to represent. The students have to interact according to their role and reach a solution to the problem, normally as an agreement, enhancing collaborative work and communication skills. This strategy can be used to solve different problems and situations and with different kind of students [7].
Master degree subjects tend to have a small number of students and their engagement tends to be higher. Normally students are also working and their knowledge of the subject is higher comparing with bachelor students. Traditional teaching strategies normally discourage master students and master lectures seems to bore them. By this reason, different teaching strategies should be used to encourage student participation and take advantage of student involvement. Knowledge transmission should get a non-prominent position and critical comprehension should be strengthen.

Master Plant Breeding subjects focus in complex problems that can be solved from different points of view and should take into account different strategies. Students should take into account all the possible solutions and choose the most suitable according to different criteria (environmental, economic, technical, biological...). In the present paper two different activities were designed to solve different plant breeding problems in a second year master subject. Involvement and active participation of the student was pursued. Benefits and disadvantages of these techniques are discussed and their concrete application in a specific subject of a Plant Breeding Master is described.

2 METHODOLOGY

The activities were carried out in a second year subject of Plant Breeding Master Degree at Universitat Politècnica de València (Spain). The subject (Plant Yield Breeding) has four ECTS (European Credits Transfer System) of theory sessions (40 hours) and one ECTS of computer sessions (10 hours). The students were organized in one single group, with Spanish as medium of instruction. In each academic year, between 15 and 25 students were registered.

The subject was divided in fifteen modules and for ten of them; the students had to prepare a scientific paper exposition related to the module and devoted to a contemporary issue. The general context of the module was outlined by the teacher and during the next session expositions were performed by the students. Two different activities were designed to encourage students participation and a critical comprehension of different concepts of the subject.

The first activity consisted in a role playing game related to organic agriculture. Depending of the number of students one or two groups were formed. Each of the students was assigned a role. Some of the roles were supporting organic agriculture while others were against this type of agriculture. In addition, some neutral roles were assigned. The teacher presented to the students a fictitious letter from an American millionaire that wants to invest an important amount of money in the village where the roles of the students belong. The students have to decide the final destination of the money by agreement and unanimity. The teacher supervise the process and at the end of the activity the process is summarized and the most important events and conclusions are highlighted. This activity was carried out during nine academic years.

The second activity consisted in Aronson puzzle. Students were divided in groups of 5 or 6 students. Each of the student was previously assigned a paper related with a plant breeding technique, becoming in an “expert” in that technique. Each of the groups were part of a fictitious plant breeding company that has to decide its future plant breeding strategy of a crop. The day of the activity the groups have to choose their leader and name of the company and later “experts” join to discuss benefits and disadvantages of the assigned breeding technique. After the discussion the students return to their group and discuss the strategy of the company. Finally the leader of each group presents their conclusions to the class and a debate takes place. This activity was carried out during two academic years.

3 RESULTS

The first activity was carried out during nine academic years. A lecture of 2 hours was dedicated to the activity. The students usually need all the time for the activity as they get deeply involved in the game. Normally, all the students participate in the game. However, some of the students’ participation monopolise the debate and they avoid or reduce others participation. One of the roles of the game was the “major” of the village, thus his/her role in the game was to organize students’ participation and guide them to reach a solution. Some of the years the “major” organized the game better so it resulted in a fluent communication between the students, but other years the result was not so optimum. In the later situation, teacher intervention was needed. The assignment of the roles was by chance, but another option can be a directed assignation of the roles if a deep knowledge of character of the students is achieved. However, in our opinion, chance is a better way to assign roles, because
surprise encourage student participation as they do not know in advance, neither the teacher, their role in the game.

Most of the student involved deeply in their role, and they enjoyed their participation. A relaxed environment was soon achieved in the game, and normally they went ahead with the game without teacher intervention. A friendly atmosphere was created without problems. We have to take into account that students form part of a small group of that have studied together during one or two years, and in most of the cases they work together in the laboratory. This fact makes student interaction deeper. Moreover, they take advantage of the previous knowledge of their partners in the game to favour the position of his/her role in the game.

Students’ arguments to support their position in the game (according to the assigned role) were based in knowledge of the subject, but also external information from other subjects or news was used. Some of the arguments were scientific, but also they used opinions based in feelings or in economy. In some cases, they even used arguments that were not ethical (always they were aware that it was a game), and the implications of that kind of arguments was discussed at the end of the game.

Teacher interaction in the game was minimal, and normally the only intervention was to tell them that the game was over. At the end of the game, a detailed discussion of the main arguments was carried out and final conclusions were extracted. All the students agreed with the purpose of the game and were satisfied with the results.

The game encouraged students participation in the lecture and critical thinking about the different points of view about a problem. In our case biotechnology versus organic agriculture was the main topic of discussion and the random assignation of the roles made the students support a position that probably they did not agree with and make them think about others point of view. In some studies with similar experiences a resistance of the students to participate was detected [8], while in others, students accepted the methodology [6]. In our case, no reluctance to participation by the students was detected. Also, the time devoted to the topic of the game needed to be longer than the time that can be dedicated in a normal lecture; in any case, the benefits outweighed the disadvantages, like in other studies [6]. Moreover, role games help student to develop outcomes that are difficult to develop in normal lectures [9] and also encourage social learning [7] and concept learning [10].

The other game implemented in the lecture was the Aronson puzzle. Student agreement with usefulness of games in the lecture (after participating in the role game) encouraged the teacher to make similar activities, so the last two academic years this new game was implemented based in the Aronson puzzle [3]. The game was designed to take place at the end of the subject as it needed previous knowledge. A two-hour activity was designed. As a deeper knowledge of the topic assigned to each of the students was needed, paper assigned to each of the “experts” were delivered to the students in advance. That can generate a problem, because if a student does not attend the session of the day of the activity the group has a lack of “expertise” in one of the topics. That make a challenge to the affected group that they have to overcome. Fortunately, it only happened to one group in one of the academic years. Student engagement was very high in both academic years, “experts” used information from the paper assigned, and from previous lectures and subjects that make them integrate several concepts. Each of the groups formed a fictional breeding company that has to design a strategy for breed a crop. The only limitation was that they could not do everything and the economic resources to implement the strategy were limited. Because this reasons, students were forced to take decisions. After the activity, advantages and disadvantages of each the solutions given were discussed. Students took into account all the strategies presented and they showed a higher level of involvement and knowledge of the subject.

The Aronson puzzle pedagogy provides opportunities to share knowledge and enhances learning [4]. Learning for peers is efficient and help students to see concepts from a different point of view [5]. In our case, students’ engagement was very high and they involved in the task without problems. All of them read previously the assigned paper and participated in the activity applying the learned knowledge from the paper, previous concepts of the subject and other subjects of the master degree. They even used their knowledge from the media or their own experience to support their arguments. The proposals of the groups were well founded and all the class discussed their advantages and disadvantages. Collaborative work and an alternative learning experience are some of the benefits of the experience. In our opinion, the activity fulfilled the expectations and with small modifications will continue in the following years.
4 CONCLUSIONS

Both activities carried out in the subject were accepted by the students and their level of involvement was very high. Students learned new things, took advantage of previous knowledge and interacted with their partners. The amount of time dedicated to each of the activities can be very high, but the benefits of the activities outweigh the time lost. Small groups are more suitable for this kind of activities, but they can be implemented in larger groups by dividing the group in smaller groups were the activity is repeated. A careful design of the activity is needed. Involvement of the students help to carry out the activity with success, so it is easier to implement the activity in subjects chosen by the students or subjects of the last year of the degree. In any case, they can be implemented in the first years of a degree, with modifications.

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REFERENCES


