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LEARN TO COOPERATE AND COOPERATE TO LEARN: EMPOWERING CRITICAL THINKING SKILLS THROUGH COOPERATIVE PEER REVIEW

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Abstract

Peer-review and feedback allied to cooperative work are important components of an active learning and development of critical thinking skills process. It is therefore important to understand the role and influence of feedback provision in peer review activities between cooperative groups. This study analyzes the perceptions and attitudes of 15 students of a Master course on Didactics on the feedback given in peer review activities (between groups), based on their responses to a survey. Results showed, among other aspects, that collaborative work and feedback exchange among groups fostered the contact with different perspectives towards the same situation, and that its critical analysis allowed the students to enhance different skills, the most referred one being the critical thinking.

Keywords: Peer review, Cooperative learning, Critical thinking.

1 - INTRODUCTION

Under the Bologna reform implemented since 2010, students are meant to be the main actors of their learning achievements. It is expected that they develop an active self-learning process fostering lifelong learning (Ramos et al., 2013). Among others, self-learning should involve the development of analytical, problem solving, argumentation, working in groups and communication skills (Staicic & Turk, 2010). However, in our view, students who come to the University, in general, have limited capacity to use and apply these skills (Dias, Franco, Almeida & Joly, 2011) and they have poor training for individual learning,

regardless of their prior learning area. Alike, the role of teachers changed towards that of modulators (Ray, 2011). Among other strategies, cooperative learning (CL) is a helpful active pedagogy fostering the gain of higher academic achievements, aiming at the acquisition of knowledge and of personal and social skills resulting from the collaboration between the teacher and the students, and of the students between themselves within work teams (Tsay & Brady, 2010).

CL benefits from the use of strategies promoting feedback provision and peer review. Peer review is a process used as a learning enabler in various scientific domains (Lu & Law, 2011; Yu & Wu, 2013). As a cooperative tool, it promotes the development of skills related to diagnosis, evaluation, synthesis and communication (Bauer, Figl, Derntl, Beran & Kabicher, 2009; Hamer, Ma & Kwong, 2005) and assists the peer feedback during students' activities (Ozogul & Sullivan, 2007).

The benefits and difficulties of peer review and feedback provision (Nelson & Schunn, 2009) have been studied for some time (Bijami, Kashef & Nejad, 2013; Boase-Jelinek, Parker & Herrington, 2013; Lundstrom & Baker, 2009). In addition, our previous experience in an engineering course, showed the impact of individual web-based peer review on written documents as a learning facilitator and a promoter of communication and critical reasoning (Dominguez et al., 2014). Nonetheless, an important drawback regarding the activity was the increase in the teacher workload related to the final feedback provision and the grading of the whole process, which was developed with students grouped in duos. Drawing on from our previous findings, and being aware of the potential of cooperative group learning and of peer review, we decided to analyze the effects of activities involving peer review and feedback provision on the development of critical thinking (CT) skills when the activities are performed between cooperative groups. Thereby, we aim to contribute to a field that has still much to be explored. Based on the analysis of an experience performed by 15 students in a Master course of Teaching at University of Trás-os-Montes e Alto Douro, in which they were challenged to reinforce a set of personal and cognitive skills, using a web-based cooperative writing environment and a cooperative group peer assessment approach, our reflection in this article meets the following objectives:

- To examine students' overall perceptions towards feedback between cooperative groups and in particular to retrieve students' individual opinionon the usefulness and quality of received feedback;
- To ascertain which skills were developed during peer review activities according to the students' own perspectives.

2 - STATE OF THE ART

CL is often defined as a pedagogical strategy where small, heterogeneous groups of students are requested to work together for a given period to accomplish

shared learning goals. Task achievements or learning outcomes are accomplished if all group members also accomplish their assignments (Johnson, Johnson & Smith, 2014; Johnson, Johnson & Stanne, 2000). This learning approach has been associated to increased students' achievement and knowledge retention (Johnson et al., 2000; Johnson & Johnson, 2009), when compared to individual, traditional individualistic and competitive learning (Johnson et al., 2000; Tanner, Chatman & Allen, 2003). Students encourage and support each other, assume responsibility for their own and each other's learning, employ group related social skills, and evaluate the group's progress (Dotson, 2001).

According to Johnson and Johnson (1994) there are five basic elements for CL: positive interdependence, face-to-face interaction, individual and group accountability, appropriate use of social skills, and group processing. Working together into an activity whose outcome result from the engagement of the entire group as a whole strengthens important soft skills including teammate interactions, respect for others' opinions and, globally, CT. The teacher, assuming the role of facilitator, enables the students' progressive autonomy (Slavin, 1995). It also enhances the interactive process intra and inter-groups and the development of analytical, synthesis and evaluative skills in face of presented arguments and opinions (Gokhale 1995; Johnson & Johnson, 2009; Nezami, Asgari, & Dinarvand, 2013). According to Ennis (1996), these are the core skills for the development of CT.

CL activities may present a variety of forms and techniques, allowing its use in various learning contexts and its adaptation across a wide range of situations and age groups, regardless of the scientific domain.

Peer review itself is a process used oftenas a learning enabler in various scientific domains and CLcontexts (Lu & Law, 2011; Yu & Wu, 2013). It was also used to strengthen students' CT skills (Dominguez et al., 2014). It allows and encourages students to take an active role in managing their own learning (Pearce, Mulder & Baik, 2009). For the effective use of feedback by students, several critical factors have being pointed out. Two major issues regard the perception of fairness of the process, which may be critical to the acceptance and engagement on the activity (Kaufman & Schunn, 2011) and the students' evaluation of the colleagues' skills in giving feedback, which modulates the trust amongst peers (Mwalongo, 2012). A different concern regards the type of feedback that is provided during the activity. Feedback should provide guidelines when it is specific and clear (Shute, 2008). To be effective, it should give information about the progress and/or on how to proceed. Hence, feedback should be purposeful, meaningful, and compatible with students' prior knowledge and provide logical connections (Hattie & Timperley, 2007). Moreover, the feedback provision may reflect the influence of different variables like students individual characteristics (e.g. level of cognitive

skills, motivation, etc.) and the participation of the teacher in the process of review/assessment (Nelson & Schunn, 2009; Sadler & Good, 2006).

Available information on the use of activities involving peer review and feedback giving in small groups of 4 or 5 individuals is scarce. As a cooperative tool, it promotes the development of the skills related to diagnosis, evaluation, synthesis and communication (Bauer et al., 2009; Hamer et al., 2005), besides enabling peer feedback on the students' activities (Ozogul & Sullivan, 2007). When performing the review of their colleagues' work, students actively participate in the overall learning process (Karandinou, 2012). They have the opportunity to interact with different perspectives and opinions about the work at stake, analyze critically the ideas, comment, compare the work, give, and receive feedback that can be used to enhance their own work. A similar outcome would be expectable from the application of the same framework to cooperative groups of about 4 students (peer review between groups). In fact, Gillies (2004) observed a positive effect of the development of CL strategies in structured students' groups in comparison to the non-cooperative groups. He showed that in structured groups there is a stronger team correlation and social willingness to accept responsibility in teaching each other.

When peer review is combined with cooperative group work, students are required to regulate their individual behavior in accordance with the goals of the team, the number of interactions increase, introducing additional dynamics. Therefore, it is important to understand the role of group feedback in teams' performance, during cooperative activities designed to strengthen CT skills.

3 - METHODOLOGY

The activity under analysis was carried out with 15 participants, 87% women, aged from 21 to 29, at a master level (2nd semester/4-semester program). It was focused on one component of the syllabus: Environmental Sciences Teaching. This unit aims to provide knowledge in education for children from 6 to 12 years old. In particular, the objectives of this particular component was to familiarize students with the CL methodology, with the importance and the use of a good feedback in teaching/learning activities and at a cognitive level with the global warming subject. Students were meant to reinforce the competencies of writing, synthesis, analysis, interpersonal communication, collaborative work, and CT.

The 15 students who participated in the study were organized in cooperative groups of three or four elements. In-class, the groups analyzed a scientific paper selected by the teacher, following the approach described in Dominguez et al. (2014). Their written output was subsequently submitted to peer-review. The activity followed this schedule:

1) In the 1st session, all the groups played the role of "student-author groups". They had to produce a written document, containing a synthesis

of the paper and the analysis of the article (chosen by the teacher) using the FRISCO guidelines (Ennis, 1996), in a Google Drive (digital) template (designed by the teacher). According to Ennis (1996) CT can be approached with the six dimensions of the FRISCO acronym (focus, reasons, inferences, situation, clarity, and overview – for additional information, see Dominguez et al., 2014);

2) In the 2nd session, papers were blind switched between groups. At this time all the groups were "student-reviewer groups". They had to review the work of their peers' group and give their opinion following the FRISCO guidelines (Ennis, 1996), as well as the model of a good feedback from Nelson and Schunn (2009);
3) In the 3rd session, each student-author group should consider/argue their peers' group feedback and improve (or not) its work (within the same template);
4) In the last session, each student filled the survey about the activity, available online (Google Forms).

3.1- Data collection and analysis

Data presented below were extracted from the students' final survey, which was analyzed in order to assess their perceptions about the activity. In particular, it represents the information contained in six questions related to the influence of the cooperative methodology (inter-group review) and to the quality of feedback on the skills established in this work.The survey included closed and open-ended questions. Data from closed-ended questions were examined using the descriptive analysis, percentages in the group. Responses to the open-ended questions were evaluated through content analysis (Cohen, Manion & Morrison, 2011). From the final survey, we selected 9 questions on feedback for the role of students as authors; 7 questions for the students as reviewers; and 6 questions concerning students' perceptions, opinions and reasons about the acquired skills.

4 - RESULTS

In their role as authors, all the students liked/liked a lot being evaluated by their colleagues. Analyzing the content of responses related to the reasons underlying this evaluation, the most pointed reason (93%) was that it allowed detecting aspects needing to be improved. Feedback also allowed them to interact with different ideas and opinions (27%). 33% of the students viewed received feedback as important to improve their work and 20% said that it allowed them greater involvement and commitment to the task. Two students' comments were: "*When we are evaluated by peers we have better perception of what we did wrong and what can be changed and corrected; also, we get opinions from another person who has done the same work…"; and "I agree, because we must always*

listen to others and respect their opinions. In addition, it allows us access to new ideas and strategies that can be adopted to improve our work".

Still in their role as authors, all students said they used the feedback received. Analyzing the content of the qualitative responses, the main reasons given were that they received constructive feedback (100%); it helped them to reflect on the work, to improve it (87%), and to contact with other valid points of view (13%). A student's opinion: "*I used it because the feedback from my colleagues was always positive and constructive. It helped me to always improve my work, giving a logical sequence of ideas and arguments that led me to reflect and change some errors present in my work*". All of the students stated that the received feedback included a summary with an overall analysis of their work, identifying possible errors and failures, and including recommendations for improvements and solutions. To 67% of the students the received feedback was constructive while for 27% it was positive and motivational, whilst for the remaining 6% it was insignificant (superficial, without relevant comments). The students' majority agreed/strongly agreed that the feedback provided was not superficial, though 20% found it indifferent. Students (86%) agreed/strongly agreed that the feedback was detailed, though not always clear. Also the majority (93%) considered the feedback was fair because it was coherent and reflected the work they performed. Students referred they used the feedback to solve the errors or failures identified by their colleagues (67%). Considering the overall assessment made by the reviewer-colleagues to their feedback, 73% of the "authors" considered it effective and the remaining very effective.

As reviewers, students liked/liked very much to assess other colleagues' group-work, which could be due to the feeling that revision activity allowed them to develop several skills. CT was the most mentioned skill (27%), but they also referred accountability, argumentation and counter-argumentation, and their readiness in expressing alternative views.

Students (27%) believed that reviewing process allowed them to see different perspectives and thereby acquired more autonomy in the learning process. Two students' opinions: "*Because it allowed me to develop argument and counter-argumentation skills. It helped me to reflect on what is critical thinking and how to develop it*"; and "*Because it is very important to show to colleagues our opinions, not only for us to develop critical thinking, but also to help them improve less positive aspects.*"

As reviewers, most students believe they are equally skilled to assess their colleagues as the teacher (80%), while a small number of students (20%) were indifferent. Students referred that the feedback provided to their colleagues included a summary with a general appreciation of their work (67%), with the identification of errors and failures, and included suggestions for improvements. The feedback given was mainly constructive (53%) as well as positive and

motivational (47%). Students (73%) checked that their colleagues used the feedback they gave reading the document and seeing the changes made by the author. All of the students agreed/strongly agreed that the feedback given was detailed and clear.

Summarizing, students' opinions were coherent in both roles, either as authors or as reviewers. Among them, 46% did not prefer the role-played, while 27% agreed/strongly agreed that they enjoyed more being authors than reviewers and 27% being reviewers rather than authors. Students who preferred to be authors considered this role more interesting and helpful for developing more skills. The mentioned skills were synthesis, sharing their own ideas, and enhance their argumentation skills. A student wrote: "*I developed more capabilities as author; being reviewer, I only gave feedback and recommendations. Being an author, I developed synthesis skills, and gave feedback and argued*". The possibility of developing more skills was also the reason for students liking to play both roles. Some of these students felt that they developed different skills as authors and as reviewers. As authors, they developed synthesis skills, and as reviewers, they pointed out the importance of providing feedback. The CT development emerges as a related ability for these students, in their roles as authors and as reviewers. Some students' comments were: "*It's good to be on both sides, because in the author role I experienced to withdraw from a paper all important aspects and develop my critical thinking. While as reviewer it is also very important because I gave constructive feedback to the other groups so that they can improve while I also develop my own critical thinking*"; "*Both roles are interesting ... Both are important experiences in the development of critical thinking*". One student stated that he preferred the reviewer role as he considered *"…more interesting reviewing and commenting than initially performing the task*".

In an overall overview and evaluation of the activity, students (93%) considered it satisfactory and very satisfactory, and 87% agreed/strongly agreed that the peer-review activity increased their CT skills. About 93% of them agreed/strongly agreed that the peer-review activity was important for their training, 93% considered it allowed them to improve their synthesis and CT skills; 87% thought that the activity improved their accountability; all of them felt they improved their collaboration skills and their respect for others' opinions. In the students' views: "*Because I was in a group where the work has always been developed with great commitment by all, where we collaborated, we respected different opinions, helped everyone, and we developed all the skills of critical reflection and synthesis, as we did everything so we could all achieve our goals"; and also "It allowed the discussion of different ideas and allowed me to develop the ability to accept different opinions*".

When students were asked if they were to maintain the activity in the same way, all of them said they would choose to do it again in cooperative groups, because

it developed several cognitive and social skills (60%). The most referred cognitive skills were the analysis, synthesis, and CT. The most mentioned social skills were collaboration (60%), sharing (54%), and mutual aid (33%). Another valued aspect was the exchange of ideas that the cooperative groups' work allowed (53%). Two students comments were: "*As a group we have more opportunities to exchange ideas and opinions, so we can structure a better answer*"; "*I consider that group-working develops very important skills such as respect for the others' opinions, and it also develops cognitive conflicts and allows everyone to learn better*".

5 - DISCUSSION AND CONCLUSIONS

Our study showed that cooperative peer review activities allowed each student to develop various cognitive and social skills. The methodology steps used were recognized as motivating and of the utmost importance for the students in their professional education.

The peer review activity in cooperative groups seems to have generated good results, according to students' perceptions. These results are similar to those of other studies which show that giving and receiving feedback significantly contributes to improve the work and some the skills (Dominguez et al., 2014; Ozogul & Sullivan, 2007). Nonetheless, and from this case analysis, this peer review activity between cooperative groups seems to enable students to contact with different perspectives in their own groups. Feedback is richer or more complete because it results from a previous discussion of the teammates' opinions, thus increasing the number and the quality of the interactions. This can be a valued contribution to the studies on peer review and CL.

All participants in the study either as authors or as reviewers revealed very positive attitudes and perceptions about the feedback giving in a cooperative environment and agreed that changing the roles was important. Their opinions were also very positive regarding the development of cognitive and social skills, which led all students to agree that if they had to choose again to perform the activity they would do it according to this cooperative group methodology. This confirms what has reviewed on the benefits of cooperative groups (Dotson, 2001; Johnson & Johnson, 2000; Johnson et al., 2014).

Either as authors or as reviewers, students used the feedback given by their peer groups to improve their work. They found it constructive and helped them reflect on the limitations of their own work enabling them to improve it. The feedback use and effectiveness is largely related to the teacher's role (Brookhart, 2008) in guiding students to develop good feedbacks (Hattie & Timperley, 2007). In this experience, feedback allowed students to contact with general and specific appreciation aspects of their work. The feedback quality was considered as good as the one provided by the teacher.

Both as authors or as reviewers, students claimed to have developed CT as a general skill from giving feedback, and more specifically skills on synthesis, argumentation and counter-argumentation, integration and respect for different perspectives and views, individual accountability, different opinions and learning autonomy. Giving and receiving feedback has been pointed out by the literature as being a good promoter of learning autonomy (Lopes & Silva, 2010, 2012; Zimmerman, 2000).

This work only reflects the perceptions of the students. However, the population was small, which may weaken the results. In further studies, we intent to include the cognitive gains in the assessment through the analysis of the contents of the written interactions produced by the students and a higher number of students will be involved.

One last reflection has to do with the role of the teacher. Though this aspect needs to be further addressed, giving feedback in cooperative groups allows the teacher to spend more time orienting and giving feedback to students, compared to the time spent if the students worked in pairs, which may also enhance the quality of the feedback provided.

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