

Optometry Students' and Educators' Perceptions of Group Work and Peer Assessment in Italian Higher Education

Fabrizio Zeri^{1,2,3}, Riccardo Cervio⁴, Marta Mosci⁴, Silvia Tavazzi^{1,2} and Shehzad A. Naroo³

¹University of Milano Bicocca, Department of Materials Science, Milan, Italy.

²University of Milano Bicocca, Research Centre in Optics and Optometry (COMiB), Milan, Italy.

³Ophthalmic Research Group, School of Life and Health Sciences, Aston University, Birmingham, UK.

⁴University of Milano Bicocca, Optics and Optometry degree course, Milan, Italy.

Received December 19, 2019, accepted June 26, 2020.

Correspondence: fabrizio.zeri@unimib.it

Abstract

In health-related professions, education has unique challenges. Problem-based learning can be extremely useful and driven by strategies such as group-work (GW) and peer assessment (PA), which are both used as formative and assessment tools. This study aimed to explore experience and perceptions about GW and PA held by educators and students in optometry. In a first survey, 45 Italian educators (43.8 ± 13.0 years old) of optometric clinical modules answered an email questionnaire investigating their attitudes towards GW and PA. In a second survey, 66 3rd-year undergraduates (22.5 ± 2.0 years old) answered a questionnaire investigating the perception and attitudes towards GW and PA at the beginning and at the end of a module of Advanced Optometry structured with a formative/summative GW activity with a final PA. Two-thirds of optometry educators declared they use GW, but not as a summative assessment tool. Only a quarter of the sample answered that they used PA at least once. Educators' attitudes towards GW were more positive than PA ($p < 0.001$). About 60% and 80% of the interviewed students stated they have never participated in GW and PA, respectively. Students' pre-course attitudes towards GW and PA resulted in values close to the middle of the scale with no significant differences and positive correlations between them ($p < 0.001$). When students' GW attitudes were compared with educators' GW attitudes, the latter were more positive. Students' post-course attitudes towards GW and PA were enhanced. Although GW and PA are considered very good strategies to improve teaching, the results of the present study have demonstrated that the use of these strategies in Italian optometric higher education is limited. However, the study has also demonstrated that Italian optometry educators have positive attitudes towards "social" teaching strategies especially for GW. Furthermore, optometry students showed improved attitudes towards these strategies once exposed to them. Overall, the results of the study open the possibility to integrate "social" teaching strategies to improve the effectiveness of optometry education.

Keywords: Group-work, peer assessment, optometry education, problem-based learning.

Riassunto

La formazione accademica delle professioni sanitarie presenta delle criticità uniche. L'apprendimento basato su problemi (problem-based learning) può essere estremamente utile e condotto usando il lavoro di gruppo (group-work; GW) e la valutazione fra pari (peer assessment; PA) sia come strumenti di formazione che di valutazione finale degli studenti. Questo stu-

dio ha puntato ad esplorare l'esperienza e la percezione verso il GW e il PA da parte di educatori e studenti in optometria. In un primo sondaggio 45 docenti italiani di moduli di optometria clinica (43.8 ± 13.0 anni) hanno risposto ad un questionario inviato per mail che ha indagato le loro attitudini verso il GW e il PA. In un secondo sondaggio 66 studenti del terzo anno della laurea triennale in optometria hanno risposto ad un questionario che ha indagato le loro attitudini verso il GW e il PA prima e dopo la frequenza del modulo di Optometria Avanzata strutturato con un'attività formativa e valutativa di GW e con un PA finale. Due terzi dei docenti in optometria hanno dichiarato di usare il GW, ma non come strumento di valutazione finale degli studenti. Solo un quarto del campione ha risposto di aver usato il PA almeno una volta. L'attitudine dei docenti verso il GW è risultata più positiva che verso il PA ($p < 0.001$). Tra gli studenti intervistati rispettivamente il 60% e l'80% hanno dichiarato di non avere mai partecipato al GW e al PA. L'attitudine pre-corso degli studenti verso il GW e il PA è risultata su valori medi con assenza di differenze significative e correlazione positiva tra loro ($p < 0.001$). Quando le attitudini degli studenti verso il GW sono state comparate con quelle dei docenti, in questi ultimi sono risultate più positive. Comunque, l'attitudine post-corso degli studenti verso il GW e il PA è cresciuta. Nonostante il fatto che il GW e il PA sono considerate strategie molto valide per migliorare la didattica, i risultati del presente studio hanno dimostrato che il loro uso nell'educazione universitaria in optometria è limitato. Comunque, lo studio ha anche dimostrato che i docenti di optometria italiani hanno attitudini positive verso l'insegnamento che usa forme d'interazione "sociale", soprattutto per il GW. Inoltre, gli studenti di optometria hanno mostrato che l'attitudine verso queste strategie migliora una volta esposti a queste metodiche. Nel complesso, i risultati di questo studio aprono alla possibilità d'integrare l'insegnamento che usa l'interazione "sociale" per migliorare l'efficacia della formazione optometrica.

Parole chiave: lavoro di gruppo, valutazione tra pari, formazione in Optometria, apprendimento basato su problemi.

Introduction

Learning is a social activity. Race (2007) noted that 'learning from others is the most instinctive and natural of all the learning contexts experienced'. In health-related professions, such as medicine, nursing, and optometry, education is particularly challenging since the students have to recall a broad theoretical knowledge and skills in a clinical setting (Frenk et al., 2010). Moreover, the ability to think critically and work effectively in a team is required (Hrynchak & Spafford, 2015). There are many ways to improve teaching in Higher Education (HE), especially for health-related professions, using the positive influence of social activity. Two of these ways are group-work (GW) and peer-assessment (PA).

GW is where a small group of students meets to discuss a particular issue or perform a particular task. Student-student interaction is at the base of GW functioning, leading to an enhanced experience of learning (Biggs & Tang, 2011; Fry et al., 2008). There are two slightly different forms of learning in a group: collaborative and cooperative (Bruffee, 1995; Hammar Chiriak, 2014; Panitz, 1999). Collaborative learning includes interaction, collaboration and utilization of the group's competencies; whereas cooperative learning happens without direct interaction, for example students independently producing a different part of the group's project work would be cooperative

(Bennett & Dunne, 1992; Galton & Williamson, 1992). Whilst cooperative learning is teacher-centred, collaborative learning is more student-centred (Panitz, 1999) and more appropriate for learning that requires a critical approach (Bruffee, 1995). GW is becoming increasingly common in HE (Hammar Chiriac, 2014) especially as a formative tool and it is now largely utilized in schools and universities worldwide (D. W. Johnson & Johnson, 2009). Also, in optometry programs there is more attention to the use of student-centred learning models (Hrynchak & Spafford, 2015; Weisinger & Prideaux 3, 2011). However, the use of strategies of GW as a formative assessment tool is a more recent phenomenon but could be useful in reducing teachers' marking workloads and in promoting students' interpersonal skills (Biggs & Tang, 2011). The assessment of GW usually focuses on social skills and the group processes but can also be extended to include knowledge acquisition (Forsell et al., 2020). There is robust evidence supporting the effectiveness of GW in learning (D. W. Johnson et al., 2014). In particular, a series of specific outcomes will be triggered by positive interdependence within a work group rather than simply motivating individuals to work harder. The elaboration of known content, deriving standards for judging better, reflective awareness of how one arrives at a given position, applying theory to practice, the development of new insights and the more frequent use of higher level reasoning strategies are common positive outcomes (Biggs & Tang, 2011). Ortiz et al. (1996) demonstrated that teamwork resulted in better individual performance. However, this happened after participants became more skilled in the teamwork element, about five weeks after the beginning of the study. Moreover, group membership alone is not sufficient to produce better achievements since positive interdependence is also required (Hwong et al., 1993). In science education, working in small groups was effective in improving significantly higher final exam grades with respect to individual study, especially among the least prepared students (Gaudet et al., 2010). All these benefits could be particularly important in optometry education. In terms of subjective perception, the experience of students with GW and group assessment is extremely positive. Hammar Chiriac (2014) found out that the majority of students experienced that working in groups facilitated learning of academic knowledge, collaborative abilities or both. Students feel that GW is a method that leads to the development of a wider breadth of knowledge through discussion, clarification of ideas and evaluation of the ideas of others (Hassanien, 2006). Students perceive that the work group provides a secure support system which cannot be obtained when working individually (Janssen et al., 2010; Pfaff & Huddleston, 2003). Student attitudes toward small-group learning improved after the experience of GW (Gaudet et al., 2010; Walker, 2001). Finally, it has been shown that GW could be more suitable for some categories of students (e.g. women and minority groups) than teaching methods based on individual learning ability (Boud et al., 1999).

PA is another teaching and learning strategy that uses the positive influence of social activity. Here students make assessment decisions on another student's work or on group work (Forsell et al., 2020). It can be used for almost any aspect of student performance and can be either formative or summative (Race, 2001). There are a series of advantages of PA such as improving autonomy, responsibility and self-efficacy, finding out more about assessment culture, learning from each other's successes and weaknesses, and enhancing problem-solving skills (Falchikov, 2007; Race et al., 2005; Thomas et al., 2011). PA can also save the teacher time; however, it has been demonstrated that students tend to give lower grades to the better performing students than their teacher did (Sadler & Good, 2006). PA effectiveness can be improved if the educator explains clearly to the

students how they will benefit from participating (Biggs & Tang, 2011; Carless et al., 2006; Falchikov & Goldfinch, 2000; Thomas et al., 2011). However, PA has some drawbacks because it can be unreliable and can challenge the traditional power relationship between learner and teacher (Leach et al., 2001).

In biomedical education two approaches use GW and PA: the problem-based learning (PBL) (Barrows & Pickell, 1991) and the team-based learning (TBL) (Hrynchak & Spafford, 2015). They were both successfully used in optometry education (Hrynchak & Spafford, 2015; Lovie-Kitchin, 1991).

Although the cooperative learning theory and knowledge is well established among Italian researchers in education (Benati & Chiari, 2008; Comoglio, 1999), experience of GW, PBL or TBL based programs in biomedical education in Italy is not so common (Lotti, 2015). The present study aimed to explore the experience and perceptions of GW and PA held by educators and students in the field of Optometry in Italy. This field is particularly interesting because optometry is a health-related teaching discipline that only reached HE level in Italy at the beginning of this century, so no effects of previous structured traditions exist and no data is available so far.

Methods

Study 1: Optometric Educators Survey

Educators of optometric clinical modules (contact lenses, refraction, ophthalmic dispensing, binocular vision, visual optics and low vision) who were currently engaged in teaching of optometry courses at six Italian Universities and two private schools were invited, on a voluntary basis, to complete an anonymous email questionnaire. The study was conducted following the tenets of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study. Data was collected over a 3-month period from the end of 2017 to the beginning of 2018.

Questionnaire

The questionnaire (see Figure A.1) used in the interviews was developed to investigate the educators' experience and perceptions of GW and PA. The questionnaire covered three main sections: (1) Educator's information; (2) Educator's experience and perceptions about GW; and (3), Educator's experience and perceptions about PA. The educator's perceptions towards GW and PA (section 2 and 3) were assessed each through four questions adapted from the questionnaire used by Walker (2001). The list of advantages and disadvantages of GW and PA (section 2 and 3) was created by the authors through a process of consensus with a focus group.

Study 2: Optometric Students Survey

This second study was carried out during the first semester module of Advanced Optometry run in the 3rd year of the BSc in Optics and Optometry at the University of Milano Bicocca in Milan in the academic year 2017/2018. The aim of the study was to explore the perceptions of GW and PA held by students and then evaluate any possible change in their perceptions after they attended the module in which GW and PA were experienced. More specifically, 3rd-year students attending the module of Advanced Optometry were required to participate in a formal collaborative GW activity during the semester. This activity required them to be assigned randomly to small groups of maximum seven students to produce, for the end of semester, a 15-minute oral presentation about how to cope with a specific clinical dilemma. Each group was given a different dilemma on a certain subject related to clinical optometry highlighting the importance of a brainstorming modality of discussion (Biggs & Tang, 2011), in the light of evidence-based literature. Although the core of GW was student-student interaction, a preliminary phase was needed in which the module leader introduced the

GW in terms of the task, rules that should be used by the group, positive interdependence and individual accountability, expected social skills to be used, organizational tips (such as the appointment of group leader, modality of meeting etc.) activities timetable, and criteria for success. Two follow-up meetings were set up during the semester. Considering the importance of an evidence-based approach required in the task, a lecture on this subject was provided before the GW started. Moreover, to try to deliver the importance of positive interdependence and individual accountability during the GW, an interactive group game was conducted to demonstrate the dynamics of GW. The assessment of each group presentation was done during a unique presentation day at the end of the semester. Marks were determined by a co-assessment as the average of PA and staff assessment (conducted by the module leader and tutors) attributed independently. Co-assessment was preferred to pure PA because it allowed the tutors and module leader to keep a certain control over the assessment marks (Dochy et al., 1999; Freeman, 1995). Assessment was performed using a marking scheme on the four following criteria: appropriate description of the relevant aspects of the dilemma; strength of literature reviewed; coherence; and strength of the proposed clinical management of the dilemma and communication performance. The assessment formed 15% of the course overall assessment and the GW was rated as a team, so each individual group member received the same mark (White et al., 2007) although the fairness related to awarding all group members with the same mark has been criticized in a study carried out in optometry education (Conway et al., 1993).

GW and PA activity were tailored to align constructively the tasks to a specific learning outcome of the module that looked at the ability of the students to use evidence-based approach in order to make clinical decision and solve a problem in specific contexts of optometry. Considering that GW and PA were introduced for the first time in this module, this survey to study changes in attitudes and perception was particularly important in helping to decide on the continued use of GW and PA. The survey was carried out through a pre-course questionnaire that was handed out at the beginning of the first lecture of the course, and a post-course questionnaire that was handed-out at the end of summative PA of GW presentations at the end of the semester. The study was conducted following the tenets of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

Questionnaires

The pre-course questionnaire and the post-course questionnaire were identical except that in the former the questions about attitudes versus GW and PA (Q1–Q8) were phrased in the present tense, whilst in the second the past tense was used. In Figure A.2 only the pre-course questionnaire is reported. The pre- and post-questionnaire were paired together using the personal course number. The questionnaire covered three main sections: (1) Student's information; (2) Student's experience and perceptions about GW; and (3), Student's experience and perceptions about PA. The student's perceptions towards GW and PA (section 2 and 3) were assessed through four questions adapted from the questionnaire used by Walker (2001). The list of advantages and disadvantages of GW and PA (section 2 and 3) was the same as used above for educators (Figure A.1). However, for advantages three additional options about specific skills developed in the module, were included.

Statistical Analysis

Data about experience and perceptions with GW and PA are presented descriptively for both educators and students. Non-parametric statistics were used to analyze the data. To explore if the GW and PA experience was biased by personal demographics of the interviewees a chi-squared (χ^2) and Kruskal Wallis ANOVA were used. According to Walker (2001), to explore the relationship between perceptions of GW and PA, the ratings for the four questions (Q1–Q4) about GW and the four questions (Q5–Q8) about PA were added together (hereafter referred to as overall perception rating) for educators or students. The Spearman correlations (r_s) and paired comparison (Wilcoxon-signed rank test) between overall perception rating of GW and PA were calculated for educators and students, respectively. For the student group only, the GW and PA perceptions in the two conditions (pre vs. post) were compared by a Wilcoxon-signed rank test. Also, the comparison between the main important GW and PA advantages and disadvantages perceived by students pre- and post-course were compared using a chi-squared (χ^2) test. Finally, educators' and students' perceptions of GW (Q1–Q4) and PA (Q5–Q8) were compared with a Mann-Whitney Test.

Results

Study 1: Optometry Educators Survey

Forty-five Italian educators (mean \pm standard deviation age of 43.8 ± 13.0 years, range 24–67 years; 11 females and 34 males) from five Universities (Florence, Milan, Padua, Rome, and Turin) and two private optometry schools (Bologna and Vinci) answered the questionnaire.

Twenty-three (51.1%), six (13.3%) and 16 (35.6%) of interviewees stated they have used GW "more than once", "once" and "never" respectively. Amongst the interviewees who declared use of GW none used this activity as a summative assessment tool. Six (13.3%), five (11.1%) and 34 (75.6%) of the educators interviewed stated they have used PA, "more than once", "once" and "never". Among interviewees who declared that they use PA, only one out of eleven used this activity as a summative assessment tool. The effect of personal variables on experience with GW and PA are reported in Table 1.

Non-parametric ANOVA showed that differences in experience with GW is linked with differences in years of experience, with more experienced educators having used GW more. Although non-parametric ANOVA did not show a significant effect of the 3 levels of GW experience of educators with their age, paired comparisons showed that educators who declared that they had used GW more than once are older than those who declared having never used GW (Mann-Whitney, $p < 0.01$). Non-parametric ANOVA also showed that differences in experience with PA is not linked with differences in years of teaching experience. However, paired comparisons between educators who declared that they had used PA more than once, and those who declared never having used PA, showed a significant difference both for age and years of teaching (Mann-Whitney, $p = 0.01$ and $p = 0.03$, respectively).

The educators' perceptions of GW and PA are reported in Figure 1. No significant correlation between the overall perception rating for GW (Q1–Q4) and PA (Q5–Q8) was found ($r_s = 0.23$, $p = 0.13$). Moreover, Wilcoxon-signed-rank test showed that there is a significant difference between the overall perception rating for GW and PA ($p < 0.001$).

The main important advantages and disadvantages of GW and PA perceived by educators are reported in Table 2.

Table 1: Educators' experience with 'group work' and 'peer assessment' as a function of personal variables of interviewees (N = 45).

Experience	Gender (N: males/females)	Age (years) (median, mean ±SD)	Teaching experience (years) (median, mean ±SD)	Institute/s of teaching (N: academia/school/both)	Module taught (N: one/more than one)
Group-work					
Never	11/5	39.0; 39.3 ±10.4	3.5; 8.0 ±8.7	13/1/2	13/3
Once	18/5	39.0; 39.0 ±12.5	5.5; 10.3 ±10.2	1/3/2	5/1
More than once	5/1	46.0; 48.1 ±13.4	22; 20.4 ±13.9	4/10/9	11/12
Comparison	$\chi^2 = 0.69, p = 0.7$	Kruskal Wallis, $p = 0.07$	Kruskal Wallis, $p = 0.01$	$\chi^2 = 17.9, p = 0.01$	$\chi^2 = 5.7, p = 0.06$
Peer assessment					
Never	25/9	40; 41.6 ±12.4	7.5; 12.8 ±12.6	17/12/5	25/9
Once	6/0	46; 45.6 ±17.0	10; 17.2 ±17.5	0/1/4	2/4
More than once	3/2	54.5; 54.3 ±5.6	28; 23.0 ±9.8	1/1/4	2/3
Comparison	$\chi^2 = 2.67, p = 0.26$	Kruskal Wallis, $p = 0.07$	Kruskal Wallis, $p = 0.12$	$\chi^2 = 14.3, p < 0.001$	$\chi^2 = 5.1, p = 0.08$

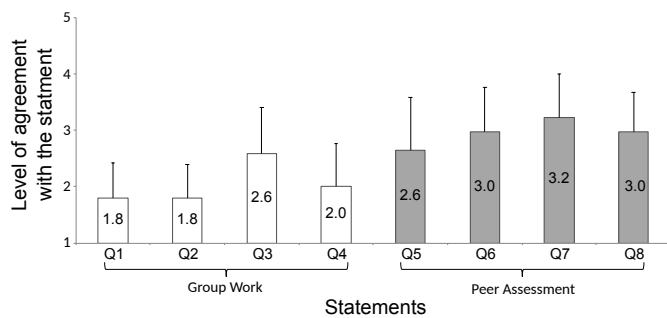


Figure 1: Mean and SD of the results of the four questions about GW (white bars) and PA (grey bars) asked to Educators (N = 45).

Table 2: Main advantages and disadvantages of 'group work' and 'peer assessment' perceived by educators (N = 45).

Main advantage	N	%	Main disadvantage	N	%
Group-work					
Improving communication skills, discussion and debate	25	55.6	Participants' contributions are different	27	60.0
Improving subject knowledge	6	13.3	Strong personality of some participants can negatively affect collaboration of peers	6	13.3
Improving collaboration among peers	6	13.3	Final assessment of GW is more difficult	6	13.3
Improving problem solving skills	6	13.3	Personality difference can create anxiety and stress	3	6.7
Improving planning skills	1	2.2	Other	2	2.2
Not answered	1	2.2	Not answered	1	2.2
Peer assessment					
Developing critical reflection	27	60.0	Students are not inclined to judge peers	16	35.6
Encourage commitment	7	15.6	Students are less accurate and expert than lecturers	15	33.3
Students can learn from success/failures of peers	5	11.1	Students have the bias to judge all peers in the same way	10	22.2
Learning improve if students are involved in assessment criteria	4	8.9	Students can give poor ranks for personal reasons	2	4.4
Other	1	2.2	Other	2	4.4
Not answered	1	2.2			

Study 2: Optometry students Survey

Seventy 3rd-year undergraduates answered the first questionnaire but only 66 (mean ± standard deviation of age = 22.5 ± 2.0 years; range: 20-29) were included in the analysis because they also answered the second questionnaire. Three (4.5%), 20 (30.3%) and 41 (62.1%) students interviewed stated that they have participated in GW "more than once", "once" and "never", respectively. Two students did not respond to the question relating to previous experience with GW. Six (9.1%) and 50 (81.8%) students interviewed stated they had participated in GW "once" and "never", respectively. Six students did not respond to the question relating to previous experience with PA. Experience with GW and PA was not affected by personal demographics of interviewees, such as gender, age or average marks obtained in their university career (Table 3).

Table 3: Students' experience with 'group work' and 'peer assessment' as a function of personal variables of interviewees.

Experience	Gender (N: males/females)	Age (years) (median, mean ±SD)	Average of exam marks (thirtieths)* (median, mean ±SD)
Group-work			
Never	20/21	22.0; 22.9 ±2.2	24.3; 24.4 ±1.9
Once	12/8	21.0; 22.0 ±1.9	23.8; 24.6 ±2.6
More than once	2/1	22.0; 22.0 ±2.0	24.0; 24.6 ±2.9
Not answered	2/0	21.0; 21.0 ±0.0	missing values
Comparison	$\chi^2 = 2.63, p = 0.45$	Kruskal Wallis, $p = 0.13$	Kruskal Wallis, $p = 0.9$
Peer assessment			
Never	27/27	22.0; 22.4 ±2.1	24.0; 24.4 ±2.3
Once	3/3	23.0; 23.0 ±1.8	24.0; 24.7 ±2.4
More than once	0/0	no cases	no cases
Not answered	6/0	21.5; 21.5 ±0.6	23.7; 24.3 ±1.7
Comparison	$\chi^2 = 5.5, p = 0.06$	Kruskal Wallis, $p = 0.28$	Kruskal Wallis, $p = 0.99$

*Italian marking system (30 is the highest mark achievable, 18 is the lowest pass mark).

The perceptions of GW and PA, both pre- and post-course, are reported in Figure 2. For Q2, Q3, Q5 and Q7 the shift is statistically significant (Wilcoxon-signed-rank test; all $p < 0.01$). Significant correlations were found between the overall ratings for GW and PA both pre-course and post-course ($r_s = 0.36, p < 0.001$ and $r_s = 0.27, p = 0.03$, respectively). However, a Wilcoxon-signed-rank test showed no significant difference between the overall perception rating for GW and PA both pre-

course and post-course ($p = 0.27$ and $p = 0.72$, respectively).

The comparison between the main GW and PA advantages and disadvantages perceived by the students, pre- and post-course, are reported in Table 4. The distribution of the main advantages perceived pre and post for GW was not significantly different ($\chi^2 = 11.2$, ns) whereas the distribution of the main disadvantages was significantly different ($\chi^2 = 18.9$, $p < 0.01$). The distribution of the main advantages pre and post for PA was significantly different ($\chi^2 = 13.4$, $p < 0.05$) whereas the distribution of the main disadvantage did not show any significant difference ($\chi^2 = 2.9$, ns).

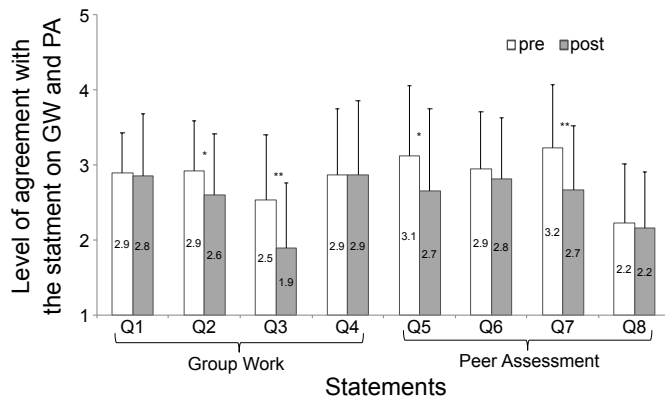


Figure 2: Mean and SD of rating of four questions about GW (Q1–Q4) and PA (Q5–Q8) asked to the students pre- and post-course (N = 66). Wilcoxon-signed-rank test: * $p < 0.001$; ** $p < 0.001$.

Comparison Between Educators and Students perceptions about GW and PA

Educators’ and students’ perceptions (pre-course) of GW (Q1–Q4) and PA (Q5–Q8) are compared in Figure 3. Educators were more positive about Q1, Q2 and Q4 (Mann Whitney, all $p < 0.001$). For Q3 no difference was seen between educators and students (Mann Whitney, all $p = 0.60$). Perceptions about PA were also more positive in educators for Q5 (Mann Whitney, all $p < 0.05$) and more positive for students for Q8 (Mann Whitney, all $p < 0.001$). No differences were found between the two groups for Q6 and Q7 (Mann Whitney, $p = 0.90$ and 0.94 , respectively). The differences between educators and students in Q1, Q2 and Q4 remained the same even when students’ data after GW experience (post-course) was considered (Figure 2) (Mann Whitney, all $p < 0.001$), whereas the difference for Q3 became significant (Mann Whitney, $p < 0.001$) because the students’ attitude moved from 2.5 to 1.9 (Figure 2). If students’ post-course attitudes only were considered, then the difference between educators and students in Q5 would disappear (because students’ attitude moved from 3.1 to 2.7), and the difference for Q7 would become significant (Mann Whitney, $p < 0.001$, because students’ attitude moved from 3.2 to 2.7, Figure 2).

Table 4: Distribution (number [N] and percentage) of main advantage and disadvantage of GW and PA perceived by students (N = 66) pre- and post-course.

Main advantage	N Pre	% Pre	N Post	% Post	Comparison Pre-Post	Main disadvantage	N Pre	% Pre	N Post	% Post	Comparison Pre-Post
Group-work											
Improving subject knowledge	6	9.1	3	4.5	$\chi^2 = 11.2$ ns	Strong personality of some participants can negatively affect collaboration	2	3.0	2	3.0	$\chi^2 = 18.9$, $p < 0.01$
Improving problem solving in clinical optometry	4	6.1	5	7.6		Participants’ contributions are different	20	30.3	8	12.1	
Improving decision making in clinical optometry	0	0.0	1	1.5		Personality differences can create anxiety and stress	11	16.7	5	7.6	
Improving evidence-based approach in clinical optometry	10	15.2	18	27.3		Group-work reduce individual study time	20	30.3	41	62.1	
Improving collaboration among peers	14	21.2	7	10.6		Final assessment of group-work is more difficult	9	13.6	3	4.5	
Improving communication skills, discussion and debate	20	30.3	12	18.2		Other	2	3.0	5	7.5	
Improving problem solving skills	5	7.6	6	9.1		Not answered	2	3.0	2	3.0	
Improving planning skills	5	7.6	10	15.2							
Not answered	2	3.0	4	6.1							
Peer assessment											
Encourage commitment	13	19.7	24	36.4	$\chi^2 = 13.4$, $p < 0.05$	Students are less accurate and expert than lecturers	35	53.0	34	51.5	$\chi^2 = 2.9$ ns
Learning improves if students are involved in assessment criteria	10	15.2	6	9.1		Students have the bias to judge peers in the same way	14	21.2	20	30.3	
Students learn from success/failure of peers	12	18.2	2	3.0		Students are not inclined to judge peers	3	4.5	2	3.0	
Developing critical reflection	30	45.5	31	47.0		Students can give poor ranks for personal reasons	12	18.2	7	10.6	
Other	1	1.5	1	1.5		Other	1	1.5	1	1.5	
Not answered	0	0.0	2	3.0	Not answered	1	1.5	2	3.0		

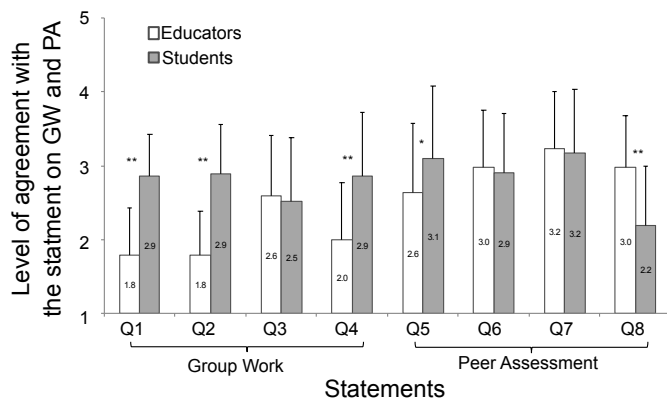


Figure 3: Comparison between educators (white bars) and students perceptions pre-course (grey bars) both for GW (Q1–Q4) and PA (Q5–Q8). Mann Whitney test: * $p < 0.05$; ** $p < 0.001$.

Discussion

This study explored experience and attitudes toward GW and PA among Italian educators (Study 1) and students (Study 2) in the field of optometry higher education.

Study 1

Looking at the results in terms of experience, this study found that GW is used by two-thirds of Italian optometric educators. Two factors were significantly associated with the experience of GW: teaching experience and the type of teaching institution. Firstly, the longer the teaching experience, the more likely the educator is to use GW. It is possible that the longer time spent in education may have led the educators to become aware of the value of bringing GW into their practice, notwithstanding the fact that the additional time required for its preparation and implementation are generally considered an issue among educators (Gillies & Boyle, 2010).

Regarding the type of teaching institution, it was shown that educators in an academic environment had the lowest level of experience of GW: 13 out of 18 (72%) in the “Academia” group declared they had never used GW compared to 7% and 15% of “School” and “Both” groups. However, the mean \pm SD of teaching experience resulted 7.4 ± 10 , 16.1 ± 13.3 and 23.2 ± 11.5 for “Academia”, “School” and “Both”, respectively, with a significant difference between the three groups (Kruskal Wallis test, $p < 0.01$). This led to the consideration that there is no direct effect of the type of teaching institution on the experience of GW, and rather it is the amount of teaching experience that may determine it. Interestingly, amongst interviewees who declared that they use GW none used this activity as a summative assessment tool. One explanation could be the fact that GW is considered more useful for students in formative assessment than in summative assessment (Frykedal & Chiriac, 2011). Another possibility may be linked to the rigid tradition in Italy to perform a classic written and oral assessment as formative assessment strategies.

The educators’ experience with PA is even less common than GW and the use of PA as a summative assessment was negligible.

Regarding the educators’ perception of the two pedagogical strategies studied, Figure 2 shows educators are more positive (lower scores) towards the GW than towards the PA (higher score). Lack of correlation between the overall perception rating for GW and PA as well as the difference between them demonstrates that the perception is different for the two strategies (Walker, 2001). The different educators’ perception towards GW and PA is confirmed by the fact that they use the first tool more.

Analysis of advantages of GW (Table 2) showed that edu-

cators perceived GW as a strategy to develop “group abilities” such as communication skills (56%) and collaboration skills (13%) and not as a means for the students to acquire academic knowledge (14%) as already highlighted in literature (Frykedal & Chiriac, 2011). On the other hand, analysis of the main disadvantages of GW (Table 2) confirmed the evidence of literature (Le et al., 2018) that educators feel that participants’ contribution to the GW may not be the same (60% of interviewees indicated this as the main disadvantage).

Finally, the majority of educators think that the main advantage of PA is the fact it allows critical reflection (60%), whilst in terms of disadvantages there is an equal split between factors linked to the quality of the assessment. In order to try to fight the barriers perceived by educators several tips have been suggested, such as introducing it gradually, providing mark-free rehearsal opportunities for the students, and providing really clear assessment criteria (Race et al., 2005). When PA is used for the first time a clear marking scheme should be provided at the beginning of the module and discussed with the students. Moreover, it may be introduced as a co-assessment strategy where the marks from the students are moderated by an average of the marks set by the staff (module leader and tutors). Interestingly, looking at the marks achieved in the final assessment of Study 2, no difference between the “pure” PA (only students) and staff PA was found ($t = 1.4$, $p = 0.18$). These results indicate that the disadvantages that students perceive are not reliable.

Study 2

The results of the second study highlight the fact that the optometry students attending the 3rd year had little experience with the pedagogical strategies investigated: 2 out of 3 students and 4 out of 5 students declared having never experienced GW and PA, respectively. This confirms the outcome that in Italian biomedical education experience of GW is not common (Lotti, 2015). As far as the perceptions of GW and PA are concerned, the results show that students had attitudes close to values in the middle of the scale (neutral attitudes) with no significant differences or positive correlations between them ($r_s = 0.36$, $p < 0.001$). However, being exposed directly to a teaching module in which GW and PA were used changed the attitudes of the students, which were improved for four out of the eight sub-scales studied. Specifically, amongst GW attitudes there was an enhancement of the perception that they will enjoy taking part GW (Q2) and that all members will be given the same possibility to contribute (Q3) (Figure 2). A very similar result was found by Walker (2001) for psychology students, which changed their attitudes after having experienced GW only for Q3. Students’ attitudes to PA showed an improvement with Q5 (every student should take part) and Q7 (I will feel confident to mark). The only difference to the Walker (2001) study was that they found a difference for Q4, too.

Analysis of advantages of GW in the pre-course phase (Table 4) showed that students perceived that GW was a useful strategy to develop “group abilities” such as communication skills (30%) and collaboration skills (21%). However, the effect of direct experience of GW in the module attended only slightly changed their preferences, with an increase of a particular subject knowledge: the evidence-based approach in clinical optometry. This could be explained by the fact that this goal was a learning objective of the module and the GW activity was specifically set up to develop it. This confirms that GW can successfully be utilised to develop clinical skills (Frenk et al., 2010). Finally, concerning the PA, students declared that the major advantage was the ability to develop critical reflection (Table 4). In terms of disadvantages, the strongest one seemed to be a concern that PA was less accurate, and no change was perceived

after having experienced PA.

In conclusion, although according to the literature in the field GW and PA are considered very good strategies to improve teaching, the results of the present study have demonstrated that the use of these strategies in Italian optometric higher education is quite limited. However, the study has also demonstrated that Italian optometry educators have positive attitudes towards “social” teaching strategies, especially for GW. Furthermore, optometry students showed improved attitudes towards these strategies once exposed to them. Overall, the results of the study open up the possibility of integrating “social” teaching strategies to improve the effectiveness of optometry education.

Conflict of interest

The authors declare that they have no conflict of interest related to this paper.

© Copyright Zeri, F., et al. This article is distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use and redistribution provided that the original author and source are credited.

References

Barrows, H., & Pickell, G. (1991). *Developing Clinical Problem Solving Skills: A Guide to More Effective Diagnosis and Treatment*. WW Norton.

Benati, S., & Chiari, G. (2008). *I meccanismi dell'apprendimento cooperativo: un approccio di scelta razionale*. Dipartimento di sociologia e ricerca sociale quaderni.

Bennett, N., & Dunne, E. (1992). *Managing Classroom Groups*. Simon & Schuster Education.

Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University*. Open University Press.

Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment and Evaluation in Higher Education*. <https://doi.org/10.1080/0260293990240405>

Bruffee, K. A. (1995). Sharing Our Toys: Cooperative Learning Versus Collaborative Learning. *Change: The Magazine of Higher Learning*. <https://doi.org/10.1080/00091383.1995.9937722>

Carless, D., Joughin, G., & Liu, N. (2006). *How assessment supports learning: Learning-oriented assessment in action*. Hong Kong University Press.

Comoglio, M. (1999). *Il cooperative learning. Strategie di sperimentazione*. (Ed. Gruppo Abele., Ed.). Ed. Gruppo Abele.

Conway, R., Kember, D., Sivan, A., & Wu, M. (1993). Peer Assessment of an Individual's Contribution to a Group Project. *Assessment & Evaluation in Higher Education*. <https://doi.org/10.1080/0260293930180104>

Dochy, F., Segers, M., & Sluijsmans, D. (1999). The Use of Self-, Peer and Co-assessment in Higher Education: A review. *Studies in Higher Education*. <https://doi.org/10.1080/03075079912331379935>

Falchikov, N. (2007). The place of peers in learning and assessment. In D. Boud & N. Falchikov (Eds.), *Rethinking assessment in higher education: Learning for the longer term* (pp. 128–143). Routledge.

Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research*. <https://doi.org/10.3102/00346543070003287>

Forsell, J., Forslund Frykedal, K., & Hammar Chiriac, E. (2020). Group Work Assessment: Assessing Social Skills at Group Level. *Small Group Research*. <https://doi.org/10.1177/1046496419878269>

Freeman, M. (1995). Peer Assessment by Groups of Group Work. *Assessment & Evaluation in Higher Education*. <https://doi.org/10.1080/0260293950200305>

Frenk, J., Chen, L., Bhutta, Z. A., Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P., Ke, Y., Kelley, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., & Zurayk, H. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. [https://doi.org/10.1016/S0140-6736\(10\)61854-5](https://doi.org/10.1016/S0140-6736(10)61854-5)

Fry, H., Ketteridge, S., & Marshall, S. (2008). *A handbook for teaching and learning in higher education: Enhancing academic practice*. Routledge. <https://doi.org/10.4324/9780203891414>

Frykedal, K. F., & Chiriac, E. H. (2011). Assessment of students' learning when working in groups. *Educational Research*. <https://doi.org/10.1080/00131881.2011.598661>

Galton, M., & Williamson, J. (1992). *Group Work in the Primary Classroom*. Routledge. <https://doi.org/https://doi.org/10.4324/9780203392713>

Gaudet, A. D., Ramer, L. M., Nakonechny, J., Cragg, J. J., & Ramer, M. S. (2010). Small-group learning in an upper-level university biology class enhances academic performance and student attitudes toward group work. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0015821>

Gillies, R. M., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation. *Teaching and Teacher Education*. <https://doi.org/10.1016/j.tate.2009.10.034>

Hammar Chiriac, E. (2014). Group work as an incentive for learning – students' experiences of group work. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2014.00558>

Hassanien, A. (2006). Student experience of group work and group assessment in higher education. *Journal of Teaching in Travel and Tourism*. https://doi.org/10.1300/J172v06n01_02

Hrynchak, P. K., & Spafford, M. M. (2015). *Optometry Students' Attitudes about Team-Based Learning* (tech. rep.).

Hwong, N. C., Caswell, A., Johnson, D. W., & Johnson, R. T. (1993). Effects of cooperative and individualistic learning on prospective elementary teachers' music achievement and attitudes. *Journal of Social Psychology*. <https://doi.org/10.1080/00224545.1993.9712118>

Janssen, J., Kirschner, F., Erkens, G., Kirschner, P. A., & Paas, F. (2010). Making the black box of collaborative learning transparent: Combining process-oriented and cognitive load approaches. <https://doi.org/10.1007/s10648-010-9131-x>

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*. <https://doi.org/10.3102/0013189X09339057>

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative Learning: Improving University Instruction by Basing Practice on Validated Theory. *Journal of Excellence in College Teaching*. <https://doi.org/10.1080/19397030902947041>

Le, H., Janssen, J., & Wubbels, T. (2018). Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration. *Cambridge Journal of Education*. <https://doi.org/10.1080/0305764X.2016.1259389>

Leach, L., Neutze, G., & Zepke, N. (2001). Assessment and empowerment: Some critical questions. *Assessment and Evaluation in Higher Education*. <https://doi.org/10.1080/02602930120063457>

Lotti, A. (2015). Problem based learning in Italian universities. *Journal on Medical Education and Practice*, 15(1), 5-1(1), 5–12.

Lovie-Kitchin, J. (1991). Problem-based learning in optometry. In D. Boud & F. Feletti (Eds.), *He challenge of problem-based learning* (pp. 203–210). St. Martin's Press.

Ortiz, A. E., Johnson, D. W., & Johnson, R. T. (1996). The effect of positive goal and resource interdependence on individual performance. *Journal of Social Psychology*. <https://doi.org/10.1080/00224545.1996.9713998>

Panitz, T. (1999). Collaborative versus Cooperative Learning: A Comparison of the Two Concepts Which Will Help Us Understand the Underlying Nature of Interactive Learning. <http://files.eric.ed.gov/fulltext/ED448443.pdf>

Pfaff, E., & Huddleston, P. (2003). Does It Matter if I Hate Teamwork? What Impacts Student Attitudes toward Teamwork. *Journal of Marketing Education*. <https://doi.org/10.1177/0273475302250571>

Race, P. (2001). *A briefing on self, peer and group assessment*. LTSN generic centre.

Race, P. (2007). *The lecturer's toolkit: a resource for developing assessment, learning and teaching*. Routledge. <https://doi.org/https://doi.org/10.4324/9780203968529>

Race, P., Brown, S., & Smith, B. (2005). *500 tips on assessment*. Routledge. <https://doi.org/https://doi.org/10.4324/9780203307359>

Sadler, P. M., & Good, E. (2006). The impact of self- And peer-grading on student learning. *Educational Assessment*. https://doi.org/10.1207/s15326977ea1101_1

Thomas, G., Martin, D., & Pleasants, K. (2011). Using self- and peer-assessment to enhance students' future-learning in higher education. *Journal of University Teaching Learning Practice*.

Walker, A. (2001). British Psychology Students' Perceptions of Group-Work and Peer Assessment. *Psychology Learning & Teaching*. <https://doi.org/10.2304/plat.2001.1.1.28>

Weisinger, H. S., & Prideaux 3, D. (2011). Modernizing Optometric Education in Australia: Ideas from Medical Education. *Optometric Education*.

White, F., Lloyd, H., & Goldfried, J. (2007). Evaluating student perceptions of group work and group assessment. In A. Brew & J. Sachs (Eds.), *Transforming a university: The scholarship of teaching and learning in practice* (pp. 71–80). Sydney University Press.

Appendix A – Educator’s and Student’s Questionnaires

<p>1. Educator’s Information:</p> <p>Gender: M/F Age: _____ Years of teaching _____</p> <p>Teaching institution/s _____ Module taught: _____</p>
<p>2. Educator’s experience and perceptions about GW:</p> <p>Have you ever used GW in a module delivery as a formative tool? Never <input type="checkbox"/> Once <input type="checkbox"/> More than once <input type="checkbox"/></p> <p>If you have used GW at least once, did you use it also as a summative assessment tool? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Please rate your level of agreement with the following statements according this scale 1 = agree very much, 2 = agree, 3 = not sure, 4 = disagree, 5 = disagree very much:</p> <p>-Q1: I think GW is a good idea for the students _____</p> <p>-Q2: I think that students will enjoy taking part in GW _____</p> <p>-Q3: I think that all students in the group will be given equal opportunity to contribute _____</p> <p>-Q4: I think that students will learn more about the subject matter working in a group than they would if they worked individually _____</p> <p>Among the following, please indicate the most important advantage of GW:</p> <p><input type="checkbox"/> Improving theoretical knowledge of the subject</p> <p><input type="checkbox"/> Improving peer collaboration skills</p> <p><input type="checkbox"/> Improving communication, discussion, and debating skills</p> <p><input type="checkbox"/> Improving problem solving skills</p> <p><input type="checkbox"/> Improving plan management</p> <p><input type="checkbox"/> Other (please specify) _____</p> <p>Among the following, please indicate the most important disadvantage of GW:</p> <p><input type="checkbox"/> Strong personality of one or more students in the group can negatively affect collaboration in the group</p> <p><input type="checkbox"/> Contribution of students may be unequal, and some may not engage at all</p> <p><input type="checkbox"/> Conflicting personalities within the group can create anxiety, stress and hostility</p> <p><input type="checkbox"/> GW can reduce time for individual study</p> <p><input type="checkbox"/> Other (please specify) _____</p>
<p>3. Educator’s experience and perceptions about PA:</p> <p>Have you ever used PA in a module delivery as a formative tool? Never <input type="checkbox"/> Once <input type="checkbox"/> More than once <input type="checkbox"/></p> <p>If you have used PA at least once, did you use it also as a summative assessment tool? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Please rate your level of agreement with the following statements according this scale 1 = agree very much, 2 = agree, 3 = not sure, 4 = disagree, 5 = disagree very much:</p> <p>-Q5: I think that students should take part in assessing their peers _____</p> <p>-Q6: I think that students will be able to assign grades to their peers in a responsible manner _____</p> <p>-Q7: I think that students feel comfortable when making PA _____</p> <p>-Q8: I think that students will make a fair and responsible assessment of their peers _____</p> <p>Among the following, please indicate the most important advantage of PA:</p> <p><input type="checkbox"/> PA encourages commitment and involvement of students</p> <p><input type="checkbox"/> Student learning improves if students are involved in assessment criteria</p> <p><input type="checkbox"/> Students can learn from success or unsuccessful performance of peers</p> <p><input type="checkbox"/> PA improves critical reflection</p> <p><input type="checkbox"/> Other (please specify) _____</p> <p>Among the following, please indicate the most important disadvantage of PA:</p> <p><input type="checkbox"/> Students are less objective and have less experience than educators</p> <p><input type="checkbox"/> Students are uncomfortable when judging their peers</p> <p><input type="checkbox"/> Students may be inclined to judge their peers too highly in order to keep them happy</p> <p><input type="checkbox"/> Students may discriminate peers for personal reasons (competition, envy, etc.)</p> <p><input type="checkbox"/> Other (please specify) _____</p>

Figure A.1: Summarised version (translated from Italian) of Educator’s questionnaire used in the survey.

1. Student's Information:
 Course number _____ Gender: M/F Age: _____ average of exams marks achieved in the academic career up to date _____

2. Student's experience and perceptions about GW:
 Have you ever participated to a GW in any academic module? Never Once More than once

Please rate your level of agreement with the following statements according this scale 1 = agree very much, 2 = agree, 3 = not sure, 4 = disagree, 5 = disagree very much:

-Q1: I think GW is a good idea _____
 -Q2: I think that I will enjoy taking part in GW _____
 -Q3: I think that all the members of the group will be given equal opportunity to contribute _____
 -Q4: I think that I will learn more about the subject matter working in a group than working by myself. _____

Among the following, please indicate the most important advantage of GW:

- Improving theoretical knowledge of the subject
- Improving peer collaboration skills
- Improving communication, discussion, and debating skills
- Improving problem solving skills
- Improving plan management
- Improving problem solving skills in clinical optometry
- Improving decision making skills in clinical optometry
- Improving evidence-based approach in clinical optometry
- Other (please specify) _____

Among the following, please indicate the most important disadvantage of GW:

- Strong personality of one or more students in the group can negatively affect collaboration in the group
- Contribution of students may be unequal, and some may not engage at all
- Conflicting personalities within the group can create anxiety, stress and hostility
- GW can reduce time for individual study
- Other (please specify) _____

3. Student's experience and perceptions about PA:
 Have you ever participated to PA in any academic module? Never Once More than once

Please rate your level of agreement with the following statements according this scale 1 = agree very much, 2 = agree, 3 = not sure, 4 = disagree, 5 = disagree very much:

-Q5: I think that students should take part in assessing their peers _____
 -Q6: I think that 3rd-year student students will be able to assign grades to their peers in a responsible manner _____
 -Q7: I think that I will feel comfortable when making PA _____
 -Q8: I think that I will make a fair and responsible assessment of my peers _____

Among the following, please indicate the most important advantage of PA:

- PA encourages commitment and involvement of students
- Student learning improves if students are involved in assessment criteria
- Students can learn from success or unsuccessful performance of peers
- PA improves critical reflection
- Other (please specify) _____

Among the following, please indicate the most important disadvantage of PA:

- Students are less objective and have less experience than educators
- Students are uncomfortable when judging their peers
- Students may be inclined to judge their peers too highly in order to keep them happy
- Students may discriminate peers for personal reasons (competition, envy, etc.)
- Other (please specify) _____

Figure A.2: Summarised version (translated from Italian) of the student's questionnaire used in the survey.