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Medical Students' Perceptions of Peer Assessment in a Problem-based Learning Curriculum

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رأي طلاب الطب بتقييم زملائهم ضمن منهاج مبني على حل المشكلات

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abstract: ***Objectives:*** Peer assessment (PA) is believed to support learning and help students develop both professionally and personally. The aim of this study was to examine medical students' perceptions of intragroup PA in a problem-based learning (PBL) setting. ***Methods:*** This study was carried out between September and November 2014 and involved six random groups of fourth-year undergraduate medical students (n = 60) enrolled at the Arabian Gulf University in Manama, Bahrain. While working on set tasks within a curriculum unit, each student evaluated a randomly selected peer using an English language adapted assessment tool to measure responsibility and respect, information processing, critical analysis, interaction and collaborative skills. At the end of the unit, students' perceptions of PA were identified using a specifically-designed voluntary and anonymous self-administered questionnaire in English. ***Results:*** A total of 55 students participated in the study (response rate: 92%). The majority of students reported that their learning (60%), attendance (67%), respect towards group members (70%) and participation in group discussions (71%) improved as a result of PA. Regarding problem analysis skills, most participants believed that PA improved their ability to analyse problems (65%), identify learning needs (64%), fulfil tasks related to the analysis of learning needs (72%) and share knowledge within their group (74%). Lastly, a large proportion of students reported that this form of assessment helped them develop their communication (71%) and self-assessment skills (73%), as well as collaborative abilities (75%). ***Conclusion:*** PA was well accepted by the students in this cohort and led to self-reported improvements in learning, skills, attitudes, engagement and other indicators of personal and professional development. PA was also perceived to have a positive impact on intragroup attitudes.

Keywords: Peer Group; Educational Assessment; Self-Assessment; Perception; Medical Students; Problem-Based Learning; Bahrain.

الملخص: الهدف: يعتبر تقييم الطلبة لأقرانهم محفزا لهم على تنمية مهاراتهم الشخصية و المهنية. الهدف: دراسة تصورات طلاب الطب لعملية تقييم أداء زملائهم ضمن مجموعات في منهاج يعتمد على حل المشكلات. **الطريقة:** تم إجراء هذه الدراسة من شهر سبتمبر حتى نوفمبر2014 حيث تم جمع البيانات من ست مجموعات من طلبة السنة الرابعة في كلية الطب البشري في جامعة الخليج العربي، المنامة، مملكة البحرين (عدد= 60). خلال التعلم ضمن مجموعاتهم في وحدة معينة من المنهاج طلب من كل طالب في المجموعة تقييم أداء زميله باستخدام أداة تقييم باللغة الانجليزية تم تصميمها خصيصا لهذا الهدف. اشتملت الأداة على تقييم الطلبة من حيث المسؤولية والاحترام، معالجة المعلومات، التحليل النقدي، التفاعل، و التعاون مع المجموعة. في نهاية الوحدة التجريبية قام الطلبة المشاركون بتعبئة استبانة باللغة الإنجليزية عبروا من خلالها عن رأيهم في هذه التجربة. **النتائج:** غالبية الطلبة اعتقدوا أن هذا التقييم ساهم في تحسن التعلم لديهم (60%)، نسبة حضورهم اللقاءات (67%)، احترامهم لزملائهم (70%) و مشاركتهم في النقاش ضمن مجموعاتهم (71%). معظم المشاركين اعتبرو أن هذا التقييم أدى الى تطور في قدرتهم على تحليل المعضلات (65%)، تحديد الأهداف التعلمية (64%)، الوفاء بالمهام المتعلقة بتحليل أهداف التعلم المنشودة (72%)، و تبادل المعلومات مع مجموعاتهم (74%). أخيرا نسبة كبيرة من المشاركين أعتبرو ان تقييمهم لزملائهم أدى إلى تحسن ملحوظ لديهم في مهارات الاتصال (71%)، القدرات التعاونية (75%) و التقييم الذاتي (73%). **الخلاصة:** عبر الطلاب المشاركون عن رضاهم عن هذه التجربة و أن تقييمهم لأقرانهم أدى إلى تقدم كبير في عملية التعلم والمهارات والسلوك لديهم و مدى انخراطهم في مجموعاتهم، و تطور على المستوى الشخصي و المهني وتأثير ايجابي على سلوك المجموعات.

مفتاح الكلمات: مجموعة الطلبة؛ التقييم التربوي؛ التقييم الذاتي؛ التصور؛ طلاب الطب؛ التعلم المبني على حل المشكلات؛ البحرين.

Advances in Knowledge

- *Peer assessment (PA) could be a valuable approach to improving self-directed learning and engagement in the educational process among medical students.*
- *The results of this study found that PA helped groups of fourth-year undergraduate medical students in Bahrain develop their analytical, collaborative and communication skills in a problem-based learning curriculum.*

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Application to Patient Care

- *Different types of learning models need to be investigated to determine which are most effective in medical education, as this will affect future patient care.*
- *Information processing, critical analysis, communication and collaborative skills are important in the medical profession.*
- *PA is likely to improve the interpretation of patient complaints, physical findings and results of investigations in future clinical practice.*

Problem-based learning (PBL) has rapidly found its way into all health science-related education. Currently, the vast majority of medical schools worldwide have integrated PBL into their curricula.[1] The worldwide implementation of this student-centred approach has opened an avenue to the development of innovative methods of evaluation, including self-assessment and peer assessment (PA).[2] In higher education, PA is a strategy whereby students actively engage in evaluating their peers using standard assessment criteria.[3] In most cases, this type of assessment takes place in a group context and typically takes one of three forms: intragroup (each member of a group assesses the performance of another individual within the same group), intergroup (one or more members in a group evaluate the performance of another group) and extra-group (individuals who are not group members assess the performance of a group).[4] Since PA and PBL both emphasise a student-centred approach, student peer evaluation seems to be an appropriate assessment tool for a PBL-based curriculum.

Kritikos *et al*. evaluated PA in an undergraduate pharmacy curriculum and found that it provided an opportunity for the development of a variety of skills, including self-directed learning, collaboration, critical analysis, professional judgment and teamwork.[5] Self-assessment may also be learnt concurrently with PA, since the skills needed to evaluate a colleague's performance may also be applied to oneself; this creates a unique opportunity for students to evaluate their own strengths and weaknesses.[6] Despite growing evidence of the benefits of PA in education, some studies have shown that this form of assessment is negatively received by students.[7] Other investigations have criticised the reliability of PA and raised doubts about its contribution to the overall assessment process.[6,8]

PBL is the primary learning approach used to teach students undertaking a six-year medical programme at the Arabian Gulf University (AGU) in Manama, Bahrain.[9] However, the use of PA in the context of small group learning has not yet been introduced at AGU or among any other medical schools in the unique cultural setting of the Gulf Cooperative Council (GCC) region. This study therefore aimed to develop and implement a process of intragroup PA among groups of medical students taking part in PBL tutorials at AGU. Students' self-reported perceptions of PA and its impact on skill development were assessed, including any improvements in self-directed learning, critical analysis, professional growth, teamwork, collaboration and self-assessment.

Methods

This study was conducted between September and November 2014. At the time of the study, there were approximately 950 students enrolled in the six-year AGU undergraduate medical programme during the academic year 2014–2015; of these, 140 were in their fourth year of study and were divided into 14 groups of 10 students each. Six groups were randomly chosen for inclusion in the study as they were considered representative of all 14 groups in this year. Fourth-year students were selected for the study since they had experienced PBL for three preceding years and were thus deemed capable of assessing their peers in a PBL context. Fifth- and sixth-year students were not suitable for the purposes of the study as they were clinical students and no longer took PBL tutorials. All students were accepted into the undergraduate medical programme after successfully completing high school in their countries of residence with excellent grade point averages and passing an English language test and a personal interview.

PA was introduced to the participating groups in the last four problems of the musculoskeletal and integumentary unit of the curriculum. This course typically enrols approximately 120–140 fourth-year medical students every academic year; these students are divided into small groups of 10 students. A total of 140 students participated in this unit between October and November 2014, engaging in twice weekly PBL tutorials. During the first tutorial of the week, students discuss a clinical case scenario and reach their learning needs facilitated by a tutor. During the second session, the group gathers and students present the information they have collected over that week to address their learning requirements.

At the end of their second PBL tutorial, students were asked to evaluate the weekly performance of a randomly selected peer in their group using an evaluation form. By the end of each problem, every

student had evaluated one of their peers and had themselves been evaluated by one of the other group members. Assessment criteria used in the peer evaluation form were based on those of Das *et al*. and an assessment tool currently in use by the College of Medicine & Medical Sciences at AGU.[10] Input was also received from experts in the university's medical education unit.

A total of 22 items in the assessment tool covered all of Bloom's taxonomy of learning domains and were divided into four key areas: clinical reasoning skills (cognitive), reflection on practice (cognitive/affective), teamwork (affective) and presentation (psychomotor).[11] Specifically, participants evaluated the performance of group members in the following areas: responsibility towards and respect for the tutorial process; information processing and ability to achieve learning requirements; critical analysis of the week's problem; ability to handle different learning resources; and interaction and collaboration. Group members were assessed by their peers in each category on a scale of 1 to 5, with 1 graded as very poor and 5 graded as excellent. To avoid bias, it was emphasised to participants that the outcomes of PA would be used for research purposes only and would not be taken into consideration for their assessment at the end of the experimental unit.

After participants had completed their last group member assessments with a facilitator present, they were asked to complete a modified voluntary anonymous self-administered questionnaire.[12] This questionnaire sought their opinions on changes in attitudes, learning, analytical and communication and collaborative skills as well as engagement in the learning process as a result of the PA experience. Students were given a series of statements to which they had to score their opinions on a 5-point scale, with 1 indicating strongly disagree and 5 indicating strongly agree.

A pilot study was conducted to test the appropriateness and comprehensibility of the assessment tool and perception questionnaire. Three groups of fourth-year students who were engaged in the experimental unit (n = 10 students each) were asked to read both the assessment form and the questionnaire and identify any unclear terms. No significant modifications were needed except for one unclear word which was clarified accordingly. These three groups were subsequently excluded from participation in the rest of the study.

Data were entered into a Microsoft Excel spreadsheet, Version 10 (Microsoft Corp., Redmond, Washington, USA) and analysed using simple descriptive statistics.

This study was granted ethical approval by the AGU Research & Ethics Committee. All participants were informed of the purpose and nature of the study before inclusion and were advised that their participation was anonymous and voluntary.

Results

A total of 55 medical students in six groups participated in the study (response rate: 92%); of these, 57% were female and 43% were male. The mean age of the students was 22 years old. All participants originated from one of four GCC countries (Saudi Arabia, Bahrain, Kuwait or Oman). Most students reported positive feelings towards the integration of PA in their PBL tutorials [Table 1]. Of the students, 60% either agreed or strongly agreed that their learning had improved due to PA. With regards to the perceived effect of PA on their own performance, the vast majority of respondents agreed or strongly agreed that PA had improved their self-assessment (73%).

Students reported that their engagement had improved as a result of their participation in the PA process. Most respondents agreed or strongly agreed that their attendance (67%), participation in group discussions (71%) and desire to use more resources to achieve learning needs (64%) had improved. Changes in attitudes as a response to PA were also examined. A large proportion of participants agreed or strongly agreed that their respect towards the other group members (70%) and desire to share information with them (74%) had improved. Participants also agreed or strongly agreed that they had become more dependable (75%) as a result of PA. The role of PA in the development of problem analysis skills was also investigated. A large percentage of participants agreed or strongly agreed that PA had increased their analytical skills (65%) as well as their ability to achieve their learning objectives (64%) and fulfil tasks related to the analysis of problems (72%).

Regarding the impact of PA on the development of personal and professional skills, a large percentage of respondents agreed or strongly agreed that their communication skills (71%), collaborative skills (75%) and ability to work as part of a team (69%) had improved as a result of PA.

Discussion

Assessment is a major driving force for learning, since it supports and enhances the integration of knowledge and skill acquisition within the educational process. Following the introduction of PBL in medical education, several methods of student evaluation have

Table 1: Self-reported perceptions of the effects of peer assessment among fourth-year medical students in Bahrain undergoing a problem-based learning curriculum (N = 55)

Item	n (%)				
	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
Overall					
Improved learning	14 (25)	19 (35)	15 (27)	2 (4)	4 (7)
Improved self-assessment	23 (42)	17 (31)	7 (13)	2 (4)	3 (5)
Learning and engagement					
Improved tutorial attendance	23 (42)	14 (25)	8 (15)	4 (7)	5 (9)
Improved participation in discussions	24 (44)	15 (27)	8 (15)	4 (7)	4 (7)
Began to use more resources for finding relevant information	16 (29)	19 (35)	10 (18)	4 (7)	5 (9)
Attitude					
More respectful towards group members	25 (45)	14 (25)	9 (16)	4 (7)	2 (4)
More keen to share information with group members	20 (36)	21 (38)	6 (11)	4 (7)	3 (5)
More dependable	23 (42)	18 (33)	7 (13)	5 (9)	2 (4)
Problem analysis					
Improved ability to analyse problems	15 (27)	21 (38)	10 (18)	6 (11)	3 (5)
More able to reach learning objectives	16 (29)	19 (35)	11 (20)	4 (7)	3 (5)
More able to fulfil tasks related to problem analysis	14 (25)	26 (47)	9 (16)	4 (7)	2 (4)
Communication, teamwork and collaboration					
Improved communication skills	22 (40)	17 (31)	8 (15)	4 (7)	4 (7)
Improved teamwork	23 (42)	15 (27)	8 (15)	5 (9)	3 (5)
More willing to help other group members understand difficult issues	24 (44)	17 (31)	6 (11)	4 (7)	4 (7)

evolved including tutor-, peer and self-assessment. However, as Wagner *et al.* reported, it is difficult to demonstrate the value and reliability of the latter two methods of assessment.[6] The primary aim of the current study was to examine perceptions of a four-week PA course among six groups of medical students in Bahrain. The criteria used for PA in this study focused on peer responsibility and respect as well as information processing, critical analysis and collaborative skills. Overall, and in line with previous reports, the results of the current study demonstrated that the vast majority of participating students accepted PA and perceived this method to add value to their learning, motivation and personal and professional growth.[13]

The majority of participants in the current study believed that their learning improved as a result of PA; this is in agreement with the findings of Maas *et al.*, who explored the impact of PA on the acquisition of clinical skills among students in an undergraduate physical therapy course.[14] The authors concluded that, despite the fact that participants ranked PA to be less useful than expert assessment, it was still a powerful tool in improving clinical performance.[14] The majority of pharmacy students in another study by Basheti *et al.* agreed that anonymous assessment of a peer was a useful learning experience.[15] In support of this, Garner *et al.* investigated medical students' views on PA and found that students were generally positive about the usefulness of PA for their formative learning.[16] Data from both the current study and the literature therefore clearly demonstrate that PA plays an important role in promoting self-directed learning among students.

With respect to motivation and participation in the tutorial process, most students in the current study believed that taking part in PA improved their attendance and engagement in group discussions. These findings were in line with those of Casey *et al.*, who reported that the implementation of PA in an undergraduate nursing programme promoted student engagement in the learning process.[17] In the current study, a large number of participants believed that PA made them more dependable, respectful to their colleagues and keen to share knowledge with them. In accordance with this, Nofziger *et al.* investigated the professional and personal reactions of students

towards PA and found that two-thirds reported associated changes in their awareness, attitudes or behaviours.[18] These findings demonstrated that the evaluation experience helped students to develop personally and professionally and supported their motivation and engagement.[18]

Regarding the impact of PA on critical analysis abilities, the majority of participants in the current study thought that PA helped them improve their problem analysis skills and identification of their learning needs. Moreover, most students reported improvement in their collaborative, teamwork and communication skills. Kritikos *et al*. reported that PA helped undergraduate pharmacy students to learn from each other and become more engaged, attentive, reflective, analytical, critical, confident and self-aware.[5] Ramakrishna *et al*. described significant progress in students' professionalism, collaboration, communication and group work in response to the implementation of an evaluation tool that involved PA in addition to self- and faculty assessment.[19] These findings emphasise the role of PA in the development of students' critical analysis skills and integration within their groups.

While PA has been shown to be a valuable tool for promoting student learning and professional accountability, many questions related to this evaluation strategy remain unanswered. Indeed, concerns about the reliability of PA have been raised.[20] Therefore, it is of the utmost importance that the implementation of this evaluation process be formally organised so as to maximise its benefits to students and institutions. This may include training students to increase their competence in the PA process, integrating this form of evaluation in the institution's assessment scheme and encouraging facilitators to support the use of this approach. However, further research is needed to determine whether PA has a significant impact on academic performance.

There are several limitations pertaining to this study. First, although the sample was representative of the entire student body of the university, conducting this study with a larger sample might yield more informative results. Second, the students' exposure to PA in this study occurred over a relatively short period of time and during only one unit of their course. A longitudinal study involving the utilisation of PA on multiple occasions and over several years would be potentially more enlightening. Finally, the evaluation of learning among the students was only performed at level 1 of Kirkpatrick *et al*.'s learning evaluation model and the effects of PA on future student activities and outcomes were not investigated.[21] This may be a focus of future research.

Conclusion

Among the studied group of medical students in Bahrain, PA was perceived positively and led to self-reported progress in learning and analytical skills. PA also boosted engagement and motivation in the educational process as well as students' personal and professional development. Moreover, PA was believed to have a positive impact on the students' attitudes towards other members of their group.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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