

Prioritising the key behaviours that enhance the quality of collaborative learning by medical students: A modified Delphi study

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Abstract

Introduction: Medical education has transitioned to require more active student learning, including self-directed and collaborative approaches. Although there are many advantages to collaborative small-group environments, learning in this setting is not always effective. One potential factor is that behaviours that are key to the success of small-group collaborative learning in medical education are yet to be clearly defined. In this study, we aimed to identify and prioritise behaviours that are relevant to individual students effective collaborative learning in small groups.

Method: A two-round modified-Delphi approach was used to identify student behaviours that positively influenced the success of small-group collaborative-learning environments. In Round 1, the panel members were asked to rate the impact of 15 student behaviours on two subscales: (1) enhancing the quality of learning and (2) fostering a collaborative environment. The top 10 behaviours identified were utilised for Round 2, in which the panel members were asked to rank the behaviours based on the magnitude of their positive impact on students' quality of learning.

Results: Collaborative group behaviours were prioritised in Round 2, and the top six behaviours were selected for the design of a user-friendly educational intervention for medical students. The key behaviours identified were preparation by the student, involvement in discussion, engagement in learning, listening skills, sharing views and voicing opinions, reflecting on feedback and responding appropriately.

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Conclusions: This study identified six key behaviours that influence students' learning in small-group collaborative-learning environments. These findings will inform further research at our institution into the development and evaluation of an educational intervention that aims to foster the identified behaviours in medical students.

Keywords: collaborative learning; Delphi technique; behaviours; group learning; small group teaching.

Introduction

Worldwide, medical education has evolved towards more active, self-directed and collaborative learning. This change has been underpinned by a shift from a behaviourist perspective towards a more social and cognitive perspective on learning (Davidson, Major, & Michaelsen, 2014). Learning in small groups has been reported to have many advantages, including increased motivation (Polyzois, Claffey, & Mattheos, 2010), improved team orientation (Koh, Khoo, Wong, & Koh, 2008), enhanced interpersonal and communication skills (Schmidt, van der Molen, Te Winkel, & Wijnen, 2009), promotion of deep approaches to learning (Dolmans, Loyens, Marcq, & Gijbels, 2015) and improved learning outcomes (Bate, Hommes, Duvivier, & Taylor, 2014; Davidson & Major, 2014). However, the latter point is often debated, because not all students participating in small-group learning show improvements in assessments of knowledge acquisition (Hartling, Spooner, Tjosvold, & Oswald, 2010). Also, not every small group functions as effectively as might be expected (Clancy & Tornberg, 2007; Johnson & Johnson, 2002). These findings suggest that collaborative learning cannot be considered a panacea for all higher-quality learning and that there remains potential for improving the outcomes of learning and interaction within a small-group collaborative-learning context. Moreover, students' skills in effective collaborative learning can be improved by aligning curriculum design and assessment with the original goals of the collaborative-learning approach (Skinner, Braunack-Mayer, & Winning, 2015).

In medical education, assessment is the means for providing information to students about their learning, and assessment, in turn, influences a student's learning. Emphasis has been placed on the important role of assessment in students' learning (Dochy & McDowell, 1997). In that context, interventions that assess students' performance within small-group learning activities can aid in guiding students. An exploratory study of small-group learning and assessment advocated promoting student behaviours that positively impact both learning and interaction in a small-group learning environment (Willis et al., 2002). In addition, the principles of an intervention to enhance growth and development of the learner have been described. They include formative assessment with constructive and timely feedback in addition to providing an opportunity for self-evaluation (Konopasek, Norcini, & Krupat, 2016).

The importance of developing collaborative skills early in medical education can be linked to the changing dynamics of workplace practice in medicine, which now relies more on a teamwork approach. Physicians are expected to function as effective members of multidisciplinary teams; this current focus on teamwork ideally shifts the focus of

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care from the doctor and medical issues to an entire team with a holistic patient-centred approach. According to Morrison et al. (2010), teamwork training must commence in medical school to nurture appropriate competencies in the physicians of the future. Accreditation and supervisory bodies in medical education also advocate building the teamwork capabilities of medical students (AMC, 2012; Frank, Snell, & Sherbino, 2014; General Medical Council, 2015; Liaison Committee on Medical Education, 2011). Teamwork training can be integrated within a small-group instructional approach (Kropiunigg, 2002; Kropiunigg, Pucher, & Weckenmann, 2002; Sobral, 1998).

Despite strong theoretical support for small-group collaborative approaches to learning, there are several reasons for suboptimal functioning of small groups. Firstly, there is a lack of consensus regarding factors that are important in effective small-group learning. A number of studies have emphasised the importance and desirability of interactional factors such as exploratory questioning and cumulative reasoning in collaborative learning (Visschers-Pleijers, Dolmans, De Leng, Wolfhagen, & van der Vleuten, 2006; Visschers-Pleijers, Dolmans, Wolfhagen, & van der Vleuten, 2005). Other studies suggest that the absence of these theoretically-important interactions does not seem to inhibit students' learning (De Grave, Dolmans, & van der Vleuten, 2002). Secondly, a lack of understanding by teachers and students about aspects that promote effective learning might be responsible for discrepancies between the effectiveness of collaborative learning in theory and in practice. Hmelo and Eberbach (2012) identified this issue and asserted that there is a paucity of research "on how good-quality collaboration develops and is sustained" (p. 13). According to Skinner et al. (2015), novice students need to be guided in their approach to learning in a collaborative environment. Previous studies also support this claim. Tipping, Freeman and Rachlis (1995) reported a low awareness of effective group behaviours among students and faculty involved in collaborative learning, and there was inconsistency between reported and observed behaviours. In addition, Mpofu, Das, Stewart, Dunn and Schmidt (1998) found a difference between students' and tutors' perceptions of important group behaviours. The perception of factors affecting group learning also varied for medical students according to seniority in the programme (De Grave et al., 2002). Taken together, these studies reveal a lack of consensus regarding the key behaviours that positively influence learning and interaction within small-group learning environments. This emphasises the need to understand such aspects and to develop strategies that promote effective behaviours in small-group collaborative-learning activities.

In this study, we aimed to prioritise the key and most influential behaviours that positively impact on students' learning in a small-group collaborative-learning context.

Method

A two-round modified-Delphi approach was used to rank and prioritise the key student behaviours that are most positively influential in small-group collaborative-learning environments. In a classical three-round Delphi, the first round is traditionally used to develop, suggest or clarify the statements (Jones & Hunter, 1995; Shehnaz, Premadasa, Arifulla, Sreedharan, & Gomathi, 2015). In this study, the first round was not required,

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as the collaborative-learning behaviours that were most relevant to group interaction and learning were explored and identified through qualitative studies (Iqbal, Velan, O'Sullivan, & Balasooriya, 2016; Pervaz Iqbal, Balasooriya, O'Sullivan, & Velan, 2014). Fifteen behaviours were identified through the initial qualitative research, and these behaviours were included in the Delphi study.

The invitation to participate in the Delphi study was made at the annual conference of the Australian and New Zealand Association for Health Professional Educators (ANZAHPE) in 2014 and through medical education networks across Australia. The invitation was open to all healthcare professionals with an interest in medical education and those who were involved in the design and facilitation of small-group learning activities in medical programmes. A self-administered questionnaire was distributed at the conference, and an online version of the same survey was distributed through medical education networks across Australia.

In Round 1, the panel members were asked to rate the impact of each behaviour on two subscales: (1) enhancing the quality of learning and (2) fostering a collaborative environment. Each scale consisted of 4-point Likert options: low impact, some impact, moderate impact and high impact. Panel members were also asked to suggest other behaviours that need to be included and add further comments. An important characteristic of the key behaviours that were to be prioritised in the Delphi is that such behaviours should have a positive impact on the interaction among group members as well as promote effective learning. In the analyses of the ranking, behaviours that are ranked high on both subscales would be prioritised. Basic demographic data were also collected—panel members were asked to select or specify the type of small-group activity that they were involved in, years of experience teaching and years of experience facilitating small-group collaborative-learning activities.

The individual ratings were collated for each scale, and mean scores were used to rank behaviours in terms of relative importance on each of the two subscales. In addition, the content validity index (CVI) was calculated. The CVI is an estimate of content validity based on agreement by a reference group (Polit & Beck, 2006), which in this study is the Delphi panel members. The CVI is calculated by measuring the proportion of group members who indicate that a particular item is key (Polit & Beck, 2006). A 4-point ordinal scale was selected to avoid ambivalent midpoint responses. Behaviours were then dichotomised, using the ordinal scale, into “key” and “non-key” responses for CVI measurement (Polit & Beck, 2006). In our survey, we grouped the responses as follows: low impact + some impact = “non-key” and moderate impact + high impact = “key”. Polit, Beck and Owen (2007) recommended a CVI value of 0.78 per item as good evidence of content validity for Delphi using more than three raters, irrespective of the kappa statistics (i.e., error measured due to chance). Therefore, a CVI cut off of 0.78 was used for this study. The mean rankings and the CVI provided a robust method of prioritising behaviours in the two subscales. Items with a cut off of 0.78 and behaviours that were ranked highly in both subscales were selected for Round 2 Delphi.

In Round 2 Delphi, panel members were asked to rank the behaviours in order of impact on students' quality of learning in small groups on a scale from 1 to 10

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(1 = highest impact and 10 = least impact). Participants were informed of the results of the analysis (i.e., mean rankings) from Round 1. The ranking for the second round was performed online. A text box was also included at the end of the online form to enable any further comments about the behaviours and the ranking activity. The average ranking for each behaviour (i.e., a score) was calculated to determine the preference list of priority behaviours for collaborative learning. The algorithm for the ranking analysis in SurveyMonkey (2014) was used (see Figure 1), where W = weight of rank position and X = response count for answer choice.

$$\frac{X_1W_1 + X_2W_2 + X_3W_3 \dots X_nW_n}{\text{Total}}$$

Figure 1
Algorithm for ranking analysis.

The weights are applied in reverse, i.e., the participant's most-preferred choice has the largest weight and their least-preferred choice has a weight of one. In this way, the rank of the behaviour was calculated.

The final round-two ranking was reviewed by the expert group (research team), which consisted of a medical education expert (CB), two professors in the medicine faculty (GV and AO) and a PhD scholar in medical education (MI), through two rounds of discussion. The purpose of this was to review the results of the Delphi process and identify the key behaviours for inclusion in an educational intervention.

Ethics approval for this study was obtained from the University of New South Wales Medical and Community Human Research Ethics Advisory Panel (Reference Number: 2014-7-03). Strict confidentiality and anonymity of the participants in the Delphi study was maintained.

Results

Round 1 results

A total of 54 participants from various healthcare specialities responded in the first round of the Delphi study: 44 (81%) medical education, 2 (3%) public health, 4 (7%) occupational health, 2 (3%) pharmacology, 1 (1%) veterinary science and 1 (1%) osteopathy. All participants had an academic role and were involved in small-group teaching that included design and/or facilitation of collaborative learning. Participants' mean teaching experience overall was 16.3 years (range 5 years to 50 years), and their mean teaching experience in small-group learning activities was 11.8 years (range 3 years to 48 years). Participants were asked to select the type of small-group learning activities in which they were involved. Twenty-three participants selected two or more options

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for the small-group activities that they were involved in. Hence, the distribution was as follows: 15 (27.8%) participants were involved in discipline-based tutorials, 22 (40.7%) were involved in problem-based learning, 26 (48.1%) were involved in scenario group facilitation and 17 (31.5%) were involved in other collaborative-learning activities.

Table 1 presents the results of Round 1, i.e., mean ranking for the “enhancing the quality of learning” subscale and the comparison of mean and CVI from each of the two subscales. The top 10 behaviours on the “enhancing the quality of learning” subscale with a CVI of 0.78 and above were selected for the second round.

A level of overlap was observed between ratings on the two subscales—the top 10 behaviours identified above included six behaviours that were also rated highly on the subscale “fostering a collaborative learning environment” and had a CVI cut-off value of above 0.78. However, as our aim was to prioritise the most influential behaviours for higher-quality student learning, we retained our focus on the behaviours ranked high in the scale “enhancing the quality of learning”.

Analysis of the free comments revealed the following main themes: self-regulating behaviours, respectful behaviours, enthusiasm, understanding roles, openness in debate and discussion and responsibility in learning. All of these were already well-represented in the behaviours included in the Delphi Round 1. Therefore, there were no need to change the behaviours that were currently included.

Round 2 results

A total of 23 participants completed the second round. Out of the 54 participants who had completed Round 1, nine did not include their email address and three supplied incorrect email details. Therefore, a total of 42 participants were invited to participate in the second round. Participants ranked the 10 selected behaviours in order of priority (from 1 = highest impact to 10 = least impact) based on their positive impact on individual students’ quality of learning (Table 2).

An important objective of the Delphi technique is to achieve consensus between the panel members. This is typically evaluated by reduced variance in responses in subsequent rounds (Rowe & Wright, 1999). However, the stability of responses over a series of rounds is considered a more reliable indicator of consensus than statistical measures (Hasson, Keeney, & McKenna, 2000). It is interesting that six behaviours were ranked highly twice in the Delphi study. First, for the Round I subscale “enhancing the quality of learning”, the six behaviours had a CVI cut-off value of 0.78 or above and were ranked highly according to the mean calculation. This was confirmed in Round 2, when the exact same behaviours were ranked the highest during the ranking activity. This observation of stability of responses across the two rounds provided further evidence of consensus around the top six behaviours that can positively impact the quality of learning within a collaborative-learning environment.

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Table 1
Results of Round 1: Mean Ranking in "Enhancing the Quality of Learning" Subscale and Comparison of Mean and CVI From the Two Subscales

Ranking based on Subscale 1	Student behaviour	Subscale 1: Enhancing the quality learning		Subscale 2: Fostering a collaborative learning environment	
		Mean	CVI	Mean	CVI
1	Involved in discussion and debate on different ideas	3.57	0.94	3.53	0.92
2	Is well prepared for the learning session	3.57	0.94	3.25	0.77
3	Shares information with group members and voices own opinions	3.53	0.88	3.50	0.94
4	Appears willing to work and is engaged in the learning	3.46	0.90	3.62	0.98
5	Listens to others' points of view	3.44	0.85	3.87	0.98
6	Reflects on the feedback and responds appropriately to it	3.33	0.81	3.29	0.81
7	Provides constructive feedback	3.27	0.85	3.42	0.90
8	Is self-aware of personal strengths and weaknesses	3.27	0.83	3.29	0.79
9	Asks questions during discussion	3.25	0.79	3.25	0.81
10	Shares responsibility during learning	3.24	0.75	3.53	0.94
11	Accepts roles and responsibilities (e.g., fulfils the leadership role or respects the peer in the leadership role)	3.22	0.88	3.5	0.94
12	Has a clear understanding of the group agenda/ aims/outcomes	3.03	0.74	3.4	0.88
13	Appears attentive and enthusiastic (e.g., during a discussion)	3.00	0.75	3.38	0.87
14	Encourages others to participate in the discussion	2.85	0.70	3.53	0.94
15	Respectfully assertive during the discussion	2.85	0.66	3.01	0.79

Notes:

CVI = content validity index

Ranking is based on the mean.

Items in bold were selected for Round 2.

The behaviour "Shares responsibility during learning" was not selected, although it was in rank position 10 based on the mean calculation, because the CVI of this behaviour was less than 0.78.

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Table 2

Ranking of Behaviours Based on Their Impact on Quality of Learning (1 = highest impact; 10 = least impact)

Rank	Behaviour	No. of participants ranking each behaviour as prioritised										Total	Score
		1	2	3	4	5	6	7	8	9	10		
1	Is well prepared for the learning session	6	7	4	4	0	1	0	1	0	0	23	8.30
2	Involved in discussion and debate on different ideas	5	2	6	2	3	4	0	1	0	0	23	7.43
3	Appears willing to work and is engaged in the learning	6	5	3	2	1	3	1	0	0	2	23	7.39
4	Listens to others' points of view	2	2	2	5	7	1	1	2	0	1	23	6.39
5	Shares information with group members and voices own opinions	2	3	3	5	1	2	3	2	1	1	23	6.22
6	Reflects on the feedback and responds appropriately to it	0	1	1	3	3	2	3	5	2	3	23	4.35
7	Is self-aware of personal strengths and weaknesses	1	0	2	1	2	3	4	4	5	1	23	4.30
8	Asks questions during discussion	0	2	1	0	3	5	3	3	3	3	23	4.30
9	Accepts roles and responsibilities (e.g., fulfils the leadership role or respects the peer in the leadership role)	1	1	1	1	1	1	2	0	7	8	23	3.26
10	Provides constructive feedback	0	0	0	0	2	1	6	5	5	4	23	3.04

Prioritisation of behaviours for the educational intervention

The review carried out by the expert group led to agreement that the top six behaviours prioritised across the two rounds of the Delphi approach would be most relevant for inclusion in the educational intervention. The reasons for selecting the six behaviours are described below. First, as described above, the ranking of the top six behaviours remained stable across the two rounds of the Delphi study, which reliably confirms consensus and priority (Hasson et al., 2000).

Second, the team agreed that limiting the number of behaviours included in the intervention to six would be beneficial—this was based on a trend observed in educational literature that emphasises instrument feasibility by reducing number of items in an evaluation. When considering the design of the educational intervention for collaborative learning, the acceptability and feasibility, especially in terms of the time taken to complete the evaluation, would be important. In addition, reducing the number of dimensions and focusing on key aspects in an evaluation improves inter-rater reliability and accuracy of behaviour assessment (Tavares, Ginsburg, & Eva, 2016). The literature on feasible instrument design was drawn upon to inform the optimum number of items for inclusion in the study (Haider, Johnson, Thistlethwaite, Fagan, & Bari, 2014; Hayward, Curran, Curtis, Schulz, & Murphy, 2014; Olupeliyawa, O'Sullivan, Hughes, & Balasooriya, 2014; Schönrock-Adema, Visscher, Raat, & Brand, 2015; Tan

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& Tan, 2006). These studies report on feasibility based on balancing “questionnaire fatigue” with achieving the desired outcomes. There are several questionnaires with fewer items that achieve the desired results. One recent example is the work of Kelly, Bennett, Muijtjens, O’Flynn and Dornan (2015), who compared the psychometric properties of an 8-item instrument with a well-established 50-item DREEM inventory. They reported equivalent reliability and validity of the 8-item instrument when compared to the 50-item DREEM inventory.

Third, the design focus of the educational intervention is established on several theoretical principles in learning, including the cognitive load theory (Weidman & Baker, 2015; Young, van Merriënboer, Durning, & Ten Cate, 2014). When considering the design of the educational intervention, our aim would be to optimise germane load (i.e., learning in the small-group context) by reducing extraneous load (by promoting the key collaborative-learning behaviours that are prioritised through this Delphi approach) while maintaining the intrinsic load (which is maintained and remains stable within the small-group learning activities designed by the medical programme). This theory is built on the tenets of learner’s working memory, which according to Miller’s (1956) review on human psychology can hold no more than seven, plus/minus two information elements at one time (Young et al., 2014). Based on this, the six key behaviours prioritised across the Delphi rounds were finalised to be included in the educational intervention. These six behaviours are:

1. Is well prepared for the learning session
2. Is involved in discussion and debate on different ideas
3. Appears willing to work and is engaged in the learning
4. Listens to others’ points of view
5. Shares information with group members and voices own opinions
6. Reflects on feedback and responds appropriately.

Discussion

In this study, we used a modified-Delphi technique to prioritise the key collaborative-learning behaviours in medical students. These behaviours were explored qualitatively through focus group discussion with medical students and interviews with small-group facilitators; therefore, a list of behaviours was generated prior to the Delphi (Iqbal et al., 2016). In a two-round Delphi study, ranking across the two rounds remained stable for six collaborative-learning behaviours, and these were prioritised as key collaborative behaviours in small-group learning for medical students. The relevance and importance of the identified behaviours is discussed below.

Key behaviour 1: Is well prepared for the learning session

The literature supports students’ “preparation in advance” as an important first step in collaborative learning, including team-based learning (Parmelee, Michaelsen, Cook, & Hudes, 2012). Preparatory activities can be diverse, e.g., reading recommended text,

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watching a video, completing a tutorial or attending a lecture (Parmelee et al., 2012). This creates the foundation for effective collaboration in small-group learning. One important principle in the literature suggests that deeper and higher quality learning is likely when the student is encouraged to manage, monitor and take responsibility for learning (Baeten, Dochy, Struyven, Parmentier, & Vanderbruggen, 2015), and this usually tends to take place during preparation for learning. There is also theoretical support for this behaviour. Wallace, Walker, Braseby and Sweet (2014) modified Bloom's original cognitive continuum of learning from six to three levels, i.e., know, evaluate and create. In preparation for small-group learning, the "know" occurs in the learners' own time and at their own pace, while the higher cognitive activities such as "evaluate" and "create" can take place during the collaborative in-class group interaction.

Key behaviour 2: Is involved in discussion and debate on different ideas

Learning in a small group usually takes place through discussion and debate between group members. Theoretical support for the importance of this behaviour is found in Slavin's (1996) concept of cognitive elaboration, in which the individual's thinking changes while interacting with others in a group. Interactions such as asking and answering questions, reasoning, resolving conflict, providing mutual feedback or note-taking stimulate elaboration (Dolmans & Schmidt, 2006; Norman & Schmidt, 1992; Visschers-Pleijers, Dolmans, Wolfhagen, & van der Vleuten, 2004). Slavin (1996) asserted that new information needs to merge with existing knowledge. This is achieved through encoding, activation of schemas and metacognition. Discussion and debate promotes encoding and schema activation.

Key behaviour 3: Listens to others' points of view

In the present study, listening was identified as an important behaviour that can positively impact on the listener's learning. Long-term knowledge retention is enhanced by the deep processing of information in an elaborated discussion, resulting in better retention by active contributors and active listeners (van Blankenstein, Dolmans, van der Vleuten, & Schmidt, 2011). In small-group collaborative learning, the interaction between students is a two-way process, in which the speaker and the listener play equally important roles. In an effective collaboration, both the speaker and the listener benefit. Webb (2013) described that both the speaker and listener need to internalise new information, leading to activation of previous schemas. Both must reflect on the new information, resulting in modification and adaptation. In the speaker, these steps may occur earlier, while preparing to present the idea, whereas in a listener, these can occur at the time of listening or afterwards. Therefore, in order to promote learning, listening must be active.

Key behaviour 4: Appears willing to work and is engaged in the learning

Students participating in small-group learning activities typically have a more positive attitude and are more engaged and motivated compared to students in traditional lectures or passive learning (Kilgour, Grundy, & Monrouxe, 2016). The level of student engagement is directly proportional to the level of motivation, which then influences

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the direction, intensity and persistence of student behaviours that directly relate to knowledge, understanding and emotional wellbeing (Bate et al., 2014). In addition, the motivational dimension has been shown to not only influence the cognitive aspects of learning (including interaction and elaboration) but also directly impact on group productivity (Dolmans, Wolfhagen, & van der Vleuten, 1998).

Key behaviour 5: Shares information with group members and voices own opinions

Sharing of information is important in starting small-group interactions. A previous study of effective collaborative learning acknowledged the role of asking for, as well as giving and receiving, explanations (Visschers-Pleijers, Dolmans, de Grave, et al., 2006). Additionally, it is important for students to be respectfully assertive in sharing information and voicing their opinions during group discussion. This is helpful in overcoming a pervasive communication challenge in group interaction, i.e., group conformity behaviour. This is described as peer pressure that causes the individual to change his or her own behaviour to match the responses and reactions of others in the group (Beran, Kaba, Caird, & McLaughlin, 2014).

Key behaviour 6: Reflects on feedback and responds appropriately to it

The importance of individualised feedback during small-group active learning is well-recognised in medical education (Ajajawi & Boud, 2015; Kilgour et al., 2016). It is important not only to receive feedback but also to reflect on it and respond in an appropriate manner. Therefore, from the students' perspective, it is important to proactively engage with feedback and effectively use the information for improvement (Winstone, Nash, Parker, & Rowntree, 2017). The first practical step in engaging students with feedback is to highlight its relevance to students' learning (Winstone, Nash, Rowntree, & Parker, 2017). Moreover, formative feedback on students' engagement and response to feedback can promote such engagement in learners (Carless, 2017). It is valuable to develop the skill of reflection in medical students, especially since it is strongly linked to capacity for life-long learning (Sandars, 2009). Moreover, constructive feedback is believed to enhance reflection (Sandars, 2009).

Limitations

In higher-education research, consensus methods are commonly used in decision making (Hasson et al., 2000) and also in identifying competencies, behaviours and attributes (De Villiers, De Villiers, & Kent, 2005; Gordon, Baker, Catchpole, Darbyshire, & Schocken, 2014). The Delphi process harnesses the insights of appropriate experts (Jones & Hunter, 1995; Rowe & Wright, 1999; Sunderji & Waddell, 2015) and is particularly useful if they are located across a wide geographical area. Participants for this study were invited from only one region. In addition, the voluntary nature of participation in this study could have resulted in academics taking part because of their interest in promoting collaborative learning. These aspects can limit the generalisability of these findings to other contexts. Nonetheless, the key behaviours identified have a strong theoretical basis

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and are recognised in the educational literature, which complements their importance and relevance. However, further research as suggested in the section below would add to this evidence base. While 54 participants completed Round 1, we were only able to contact 42 participants for Round 2. A challenge was that some participants did not include their contact details or an email address on the form, and for a few participants, we could not identify the correct email addresses due to illegible handwriting. In future studies, this challenge could be overcome through the distribution of questionnaire forms in an online format or by utilising the “real-time Delphi” through online software (Sunderji & Waddell, 2015). The recommended adequate panel size is 15–30 members; groups larger than 30 can become unmanageable and may not improve the outcomes (Clayton, 1997; Shehnaz et al., 2015). Our final Delphi panel had 23 members, which is well within the recommended panel size.

Implications of the findings and avenues for future research

This study is part of a wider project that focuses on developing, implementing and evaluating a complex educational intervention to promote effective collaborative learning in medical students. Collaborative learning is complex in nature, involving students’ interactions with one another and with the tutor. The proposed intervention would be based on an instrument that incorporates the six behaviours that were identified through this study. This would provide opportunities for self-evaluation and tutor evaluation of the key behaviours, feedback on observed behaviours, as well as students’ self-reflection and development of a plan of action for improvement. It is anticipated that such an intervention could enhance learning and help prepare students for clinical practice. Small-group collaborative learning is integral in the teaching and learning of medicine (Kaufman & Mann, 2014) and provides students the opportunity to experience working in teams. Although many advantages of small-group collaborative learning have been listed above, students need to be guided in their approach to maximise their learning outcomes. An in-depth analysis of medical students’ perceptions of small-group collaborative learning highlights the importance of understanding and promoting collaborative behaviours (Balasooriya et al., 2013). Students report variability in their peers’ contributions during small-group learning activities and a desire for greater understanding of important interactional skills; for this reason, students were in favour of using an instrument that could promote these skills (Balasooriya et al., 2013). An important implication of these findings is the need to support the development of skills to effectively participate in small-group learning. The six behaviours identified in this study are identified as important and influential in promoting effective collaborative learning. These behaviours have strong theoretical support from the literature and have practical implications for medical education. Future research to explore the impact of these behaviours on students’ learning outcomes would be beneficial.

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