Problem-Based versus Small Group Learning in Medical Education

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1.0. Introduction

Problem based learning (PBL) has been considered as the modern method of teaching in medical colleges that can be considered as a development or a subtype of the small group education (SGE). The latter was defined in 1987 by Fontes as a group of 5 to 9 students involved in the discussion of a single educational topic (1) and was discussed in details in the Association for Medical Education in Europe (AMEE) Guide no. 48 (2, 3). According to AMEE, interaction between the students is a prerequisite to define them as SGE, which can have various formats. PBL, likewise SGE, is based on active involvement of the student, as well as interaction with peers, faculty and patients (4). In SGE, a wide range of educational tools can be used, including quizzes, games, presentations, videos or a combination of them, according to the educational need (5). At the meantime, the problem or the vignette is the main educational tool for PBL which has been shown to enhance the application of evidence-based medicine principals in clinical practice. The group discussion and reasoning of the vignette simulate the same principals of clinical investigation, such as asking questions, acquiring the necessary information, as well as appraising this information and its application (6). At the meantime, PBL requires special training for both the tutors and the students (7, 8). PBL encourage the integration between different medical subjects but gaps in the knowledge of the students are very difficult be filled, being uncovered by the vignettes (9).

2.0. Focus of this report

In spite of various similarities between SGE and PBL regarding the strengths and challenges, the comparison between these two teaching approaches is scarce. This report discusses the shared advantages and disadvantages between the two educational systems, as well as the unique features of each of them. Reflection on these features suggested two hybrid models to make benefit of the merits of the two systems.
3.0. Analogy between SGE and PBL

In educational psychology, cooperative learning has the advantage of enhancing the students’ motivation as well as higher order thinking. This approach decreases the competitiveness atmosphere in the class and convert the student’s self-centralization to interdependence. The latter would stimulate sharing ideas and resources as well as the interaction between the students. Such collaboration grows over time and increases according to the frequency of the meeting as well as by facing common tasks and competitions with the group spirit (10). Furthermore, the groups that met frequently over relatively long duration, forms small communities which share knowledge and validate clinical experience as physicians (11). Training of the students in similar systems could enrich this collaborative culture and enhance their continuous medical education.

SGE can be considered as a more effective teaching approach, in comparison to classical didactic education. Students who followed an active SGE based system for clinical skills teaching, showed better overall score in Objective Structured Clinical Examination (OSCE) and physical examination stations, in comparison to average results of classical educational system (12). Similarly, PBL has been shown to decrease the dropout and increase the pass rate in different medical disciplines. The students’ satisfaction with PBL is usually positive and increases gradually when the students are advancing in the educational process (13). On the other hand, the variability in coverage of the scientific material can be present in both variants of education but they are more remarkable in PBL. The general atmosphere and the tutor-challenging environment in the classroom is influential for SGE but is critical for the success of PBL pedagogy. This atmosphere should be stimulating in order to accomplish the learning objectives. The interactive quality in SGE and PBL is student-centered and should lead to a positive collaborative atmosphere. Failure to preserve this atmosphere can be associated with student’s self-focus and individualism versus the collective mind spirit, which is a key success in both systems (14). In this case, the risk of having unsuccessful session will be higher with PBL than SGE. The tutor direct involvement can overcome the negative atmosphere, which can be easier done in SGE than in PBL sessions (15).

The students’ personality traits are another point of concern in group learning, which can be present in both SGE and PBL. For example, dominant student becomes more influential when play the role of chairman in PBL session, while the shy student can be more
inattentive. Ultimately, subgrouping of the class may occur, into a dynamic pole and a submissive pole. Furthermore, the two subgroups can start to have arguments following the feeling of injustice or rejection by the other party. Social acceptance of each student by the rest of the group members is critical for the integration and collaboration within the group; otherwise a failure cycle will start based on the time and effort investment versus gained benefit, in the opinion of each student (16).

Thus, SGE and PBL share many strengths and challenges and both systems are based on collective and collaborative learning.

4.0. Antagonism between PBL and SGE

4.1. Differences in tutorship

The preparation for the class is one of the most important differences between the two educational systems. SGE is mostly a structured session that has clear educational triggers and expected outcomes, which are easier to direct and to evaluate the session accordingly. The tutor role in moderation is important for the success of the session as the tutor should lead the discussion to achieve the learning objectives and enhance the cognitive skills of the students (2).

PBL session needs lots of preparation and education of the tutor for the context around the vignette, in order to be able to direct the session without direct interference. In PBL system, the tutor’s task is to maintain the flow of discussion towards the intended learning outcomes in a professional environment. In many instances, the students may not appreciate the role of the tutor. They would expect the tutor to be actively involved in the scientific explanation of the learning outcomes, which is against the self-learning and student-centered principals (17). At the meantime, PBL tutor can have an important role that particularly affect the performance of average level students. Chng et al. investigated the possible influence of the PBL tutor on the students’ accomplishment and correlated the outcome of the average-level students to the scientific and psychological support offered by the tutor (18).

4.2. Difference in the flexibility of the session format

SGE can have different pedagogical approaches, which provide flexibility for the course coordinators to tailor the session format according to the educational need of every patch.
SGE can be considered to follow the collaborative and inquiry-based pedagogical approaches with a possibility of integration and reflection. SGE can have different formats, such as seminars, workshops, syndicates, tutorials and many others (2). In one example of SGE, the educational tool was based on questions with initial individual answering, followed by group discussion. The students reported more enjoyment and motivation for learning than classical lectures. At the meantime, there was no difference in the students’ performance in the examination. Instructor found that these discussion-based sessions are longer and more challenging than classical, unidirectional lecture. On the other hand, coverage of the scientific material was variable in different groups (19). In another context, SGE was used for discussing certain topics in physiology. The outcome involved enhancement of the communication skills and interaction, as well as deeper scientific involvement through proficient use of references (20). In a different format, SGE can apply inductive teaching method that would have more involvement of the students. In these sessions, the students are informed about the topic of the day and they take turns to prepare question and answers over subsequent sessions, with minimal interference by the tutor. This format was associated with improved deep learning, as shown by significant increase in comprehension and correlation to previous knowledge, in comparison to directed SGE (21).

On the other hand, PBL has a more standardized structure with a single educational tool, which is the vignette. PBL combines the inquiry-based, integrative and collaborative pedagogical approaches. There is limited flexibility in the educational process and the students have to learn to accommodate with the system, which can be difficult or impossible for some students (22).

**4.3. Differences in the infrastructure and manpower**

In SGE, the session can be considered as the development of the classical resource sessions, with different levels of tutor contribution, readily accessible studying resources and limited number of students. The class can accommodate larger number of students than PBL class and is usually run by the subject matter expert (23).

In most of institutes, PBL has -at least- two sessions per week. The duration of each session varies in different schools with a minimum of two hours per session. The number of students per group is classically less than ten. Thus, the number of equipped, suitably
designed and well-maintained rooms, will correspond to the number of students per patch. The organization between patches, in order to avoid the overlap in the class timing and to ensure the efficient use of classrooms, is another challenge. The most important cost is reflected by the number of tutors and the amount of their working time required in the tutoring process, in addition to the preparation time as mentioned earlier (14, 24). McKendree (2010) highlighted the importance of involving the PBL tutors in curriculum planning and designing in order to understand and appreciate the role of each vignette in the program outcomes (8). While SGE can be organized within a program, unit or a department, PBL system requires a global perspective of the whole curriculum. Due to the integration of subjects in each problem, the vignette must be designed, validated and updated by a committee of subject matter experts and coordinated accordingly. The coordinators would ensure the fitness of the vignette to the student’s level as well as the integration of the problem to the curriculum, which is a time and effort consuming task (25).

4.4. Difference in the session moderation

Based on the format used in SGE, the session can be centered around the tutor, who should decide the extent of coverage of the topic, the preparation of material and learning tools. Furthermore, the tutor can actively moderate the session towards the learning outcomes (25). On the other hand, the student is the core of the educational process in PBL, including the moderation of PBL session, the vignette analysis and the extraction of learning objectives. Such role can cause a confusion in the task of the tutor in the PBL class in regards to the student’s expectations (26).

4.5. Difference in pedagogical process

In PBL pedagogy, the vignette requires intense discussion that is led by the students and directed by brainstorming, discussion, personal perspectives, previous knowledge and experience as well as the scientific achievement in the second session. The capacity of the tutor to redirect the discussion into the mainstream can be challenging due to the absence of tools, rather than reasoning and participation in discussion. The known ‘side effect’ of the PBL system is the presence of gaps in knowledge. These gaps can be also created by the inability of different vignettes to cover all the necessary topics in each subject (9). Vignettes are the educational tool used to cover all subjects in the curriculum, which has the advantage of correlating the curriculum to real life situation. The role of the tutor, in this context, is
limited to the facilitation (27). The role of the curriculum is similarly crucial in SGE. The broad learning outcomes of each course that follow SGE should match the outcomes of the program, influenced by the course team, who are usually subject matter experts. Then the content, approach and teaching tools can be adjusted according to the level of the students, as well as their interaction and feedback. Apart from vignettes, other educational tool can be used, such as an assignment, questions and answers, workshop or direct illustration, if necessary (2, 3).

PBL pedagogy has also an effect in setting up the thinking process of the students. In an interesting follow up study in Japan, female graduates of PBL and non-PBL systems were approached after their professional career to investigate if the educational system has affected their choices. PBL graduates who joined the internal medicine department showed more interest in holistic practice, such as primary health care and community medicine, rather than subspecialties, and decreased interest in basic sciences (28).

5.0 Reflection

The modern methods of education are dependent on active involvement of the students, rather than obtaining the information as passive recipients. Active participation can be through discussions, solving problems or performing certain educational tasks, which is not practical with large number of students. Thus, the idea of dividing the students into groups was logistically crucial and was associated with better achievement and satisfaction of the students. Teaching in small groups evolved in different ways, including SGE and PBL. The latter was adopted by several medical schools as the vignette or the problem could simulate clinical situations which are seen by the medical team in their daily practice. The vignettes are usually multidisciplinary and requires the integration of subjects; i.e. biochemistry, anatomy, pathology, ophthalmology, surgery,… . The coordination of the session is challenging due to the strength/weakness of the tutor in different subjects. The adoption of PBL in various medical and health institutes could be the reason beyond the rich literature about PBL and the scarce research regarding SGE (2).

On the other hand, SGE is usually conducted within a single discipline (e.g. anatomy) under the coordination and involvement of the subject matter experts. The educational tools are variable according to the best match of each intended learning outcome of the subject,
based on the overview of the curriculum. Unfortunately, most of the available studies comparing either PBL or SGE to classical didactic system. Conducting a comparative study for academic achievement and student satisfaction of cohorts educated through SGE or PBL would help to figure out the strength and weakness of both systems. Pedagogically, both PBL and SGE seem to achieve the learning outcomes with efficiency. Separate studies confirmed the superiority of one of both systems in comparison to the classical didactic teaching. PBL system has been shown to enhance the critical thinking of the students and create the logical association between different medical subjects. At the meantime, the students can suffer from gaps in knowledge and the system needs infrastructure and human resources to be implemented. Thus, several institutes are using PBL for the final years or only in clinical training programs. The rational is that the student can build a solid background in basic medical sciences through classical teaching, then applying this knowledge in the PBL context during the clinical studies. From these institutes perspective, the integration of basic with clinical sciences and acquiring problem solving skills should take place at a later stage when the students have sufficient education (11, 29).

In Germany, an interesting study compared a special format of SGE, which is serious gaming, with PBL (30). In their setting, 25 students were included in a computer lab with one tutor. The used software allows interaction with virtual patients and use different skills for investigation and treatment, in a gaming setting. The students received help from the tutor during the game, a digital feedback from the software at the end of each game as well as the recommendation of an experienced physician. While this artificial intelligence group used the allocated sessions to complete 40 cases, PBL group studied 5 cases. In the final evaluation, serious gaming group scored significantly higher than the PBL group. This study reflects the flexibility of development in SGE, including the use of customized modern tools, such as artificial intelligence.

Based on the aforementioned, a mixture of PBL with SGE can be suggested to combine the merits of both systems. Hybrid systems were gaining increasing popularity in medical schools (31, 32). The classical example of a hybrid system is a mixture of PBL classes with parallel didactic course(s). In this system, two workflows were suggested; the first considered PBL as a learning tool among other tools involved in each module. The second is to consider PBL as a hub that joins each two subsequent modules (33). These
workflows may create confusion for the students, especially in the first years, as they are usually looking at PBL as time-consuming and difficult to understand. Meanwhile, the topics introduced by classical teaching would suffer from the same limitations which are counteracted by PBL, including the cognitive and analytical skills.

Therefore, two suggested hybrid systems can be recommended, both combine SGE and PBL. The first system will be based on SGE in streams or modules, while few topics are covered by PBL. These topics will be carefully chosen to serve as an exercise for the students in order to apply the acquired knowledge in an integrated session through analytical thinking. The design of SGE sessions has to keep the interactive challenging spirit and not to be developed into didactic teaching. The educational tools should trigger the thinking process of the students with possible integration of a very few number of subjects whenever appropriate. The classical division of the curricula into units or body systems can still be followed, with independent stream of each subject within the unit. Tutors involved in teaching SGE can be responsible for PBL sessions within the same module, which is most likely to be their subspecialty. PBL, in this case, would provide the link between different subjects, achieving the principal of integration between subjects. For example, the renal unit can include separate SGE modules to teach anatomy of the urinary tract, physiology and biochemistry of water and electrolyte balance, renal functions and so on. At a midpoint, a problem can be designed, such as chronic renal failure, to apply the acquired knowledge and introduce the pathology and pharmacology learning objectives. Similarly, another problem can be designed at the end of the unit to cover more advanced domain, such as renal tumors. Pedagogically, this system will help to fill in the gaps of knowledge that are present in classical PBL system, while keeping the integrated, student-centered and interactive culture of education. As another suggestion, the hybrid system could be based on PBL with intercalating SGE courses in the subjects or topics that are difficult to be covered in PBL, such as introductory courses in biochemistry, embryology, cell biology, etc. The coordination between PBL and SGE would be very important in this case, for the course success. The percentage of SGE can be higher in the first years and decrease as the students approach the end of the clinical phase.

In conclusion, the suggested PBL-SGE hybrid system can provide solutions for the current challenges without sacrificing the merits of both systems and help the students to achieve the learning outcomes of the program with confidence.
6.0. References


