Active Learning Classes in a Preclinical Year May Help Improving Some Soft Skills of Medical Students

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ABSTRACT

Objective: Active learning methods are an effective way to improve essential soft skills, such as critical thinking and social skills, and so medical educators frequently implement active learning approaches as a means to improve the soft skills of medical students. This study reports an improvement in the soft skills of medical students after the implementation of an active learning curriculum.

Methods: More active learning activities were implemented in 2016 in the 3rd year medical class, involving 330 students. Overall, the number of hours devoted to active learning classes was increased from 340 hours (38.2%) in 2015 to 481 hours (59.98%) in 2016. To evaluate whether this led to any improvements in the soft skills of medical students, students undertaking the 3rd year course in the 2015 and 2016 academic years were asked to complete questionnaires to evaluate themselves (self-evaluation) as well as four other students in their same study group (peer-evaluation) at the end of the academic year. The questionnaire responses from the 2015 and the 2016 groups were compared.

Results: Most students believed there was no improvement in most of the evaluated soft skills during the year. However, students in the 2016 class showed improvements in eleven outcomes in the peer-evaluation: presentation, information, technology, creativity, communication, leadership, life planning, adaptability, self-sufficiency, courtesy, and punctuality ($p < 0.05$). The differences were not due to the students' different background skills as the initial scores of most outcomes were identical between the two student groups ($p > 0.05$).

Conclusion: Even without a proper design for teaching soft skills, active learning classes in a preclinical year of the medical curriculum may help improve some of the essential soft skills that medical practitioners need and, therefore, should be implemented in the medical curriculum.

Keywords: Active learning; small group discussion; medical curriculum; preclinical teaching; soft skills (Siriraj Med J 2020; 72: 415-423)

INTRODUCTION

In order to be fully prepared for the medical profession, medical students must acquire knowledge in medicine and master essential procedural skills, for which they must engage in a long period of extensive higher level learning.[1] But besides medical knowledge and procedural skills, medical students also need to possess other essential skills to function as medical professionals, including critical thinking and communication skills, teamwork and collaboration skills, information assessment skills, and other life skills.[2] These skills are collectively termed 'soft skills.' However, in contrast to medical knowledge

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and procedural skills, soft skills are hardly directly taught or evaluated in the 6-year medical curriculum taught in Thai medical schools.[3]

The preclinical curriculum comprises the second and third year of the medical curriculum. Traditionally, the preclinical curriculum in Thailand is based on large-group teaching with occasional laboratory classes. Large-group teaching, such as lectures, are considered appropriate for the delivery of a large amount of knowledge from the lecturer to the students in a limited time.[4,5] However, in this approach students passively take in knowledge with little or no class participation, and as such, they hardly develop any high-level learning or essential soft skills during the process.[1,6] In order for high-level learning to be achieved and soft skills to be taught, other teaching methods are needed. We hypothesized that active learning classes might have some effects on soft skills development or improvement in medical students.

Active learning is defined as "a teaching method that involves students' active participation in class." In this approach, instead of receiving one-way information from lecturers, the students contribute and gain knowledge through taking part in various activities, such as group discussions, debates, and presentations.[7] Active learning has been proven to improve students' academic performance and satisfaction.[8,9] Also, as students get to communicate in class and express their ideas, active learning also improves students' team cooperation, critical thinking, and presentation skills, all of which are essential soft skills.[10]

This study tested whether there was an improvement in the soft skills outcomes of medical students after the implementation of an active learning curriculum, using self- and peer-evaluation questionnaires to gather the research data.[11,12] Although the number of hours devoted to active learning activities was increased, the activities were not specifically designed to teach such skills. We evaluated improvements in 14 expected soft skills outcomes based on 4 essential skills, namely medical professionalism, learning and innovation skills, life and career skills, and information literacy. We gathered data from students in the modified class in 2016, which included a higher number of hours devoted to active learning, and from students who took the traditional class in 2015 before the curriculum changes, and compared their results.

MATERIALS AND METHODS

Structure of the medical curriculum

Our medical curriculum structure has been described previously in the literature.[13] Briefly, Thai medical students enter medical school promptly after finishing high school and then follow a 6-year medical curriculum. The second and third years of the curriculum, termed the "preclinical years," focus on the teaching of basic medical sciences related to the normality and abnormality of human bodies, respectively. Both preclinical years are divided into two parts: 'general concepts' and 'organ systems.' The general concepts and organ system parts focus on introductory subjects and the applications of those introductory subjects to human organ systems, respectively. No real patients are involved in these preclinical years. The expected knowledge outcomes of both parts of the training are based on the Medical Competency Assessment Criteria for National License 2012 established by the Medical Council of Thailand.[14]

Implementation of more active learning hours in the medical curriculum

In 2016, a change was made to the third-year medical curriculum structure taught at the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand, to include various active learning methods in the medical curriculum, including both large- and small-group teaching, as shown in Table 1. Team-based learning[15], flipped classrooms[16], and formative evaluations were also introduced.

Creation of a tool for evaluating the soft skills outcomes

As part of the new curriculum evaluation and development, an online questionnaire was created to assess selected soft skills outcomes based on the "21st-century skills" needed by modern medical practitioners[17], including medical professionalism, learning and innovation skills, life and career skills, and information literacy. The online questionnaire was critically amended and finally approved by the medical education expert committee of the Undergraduate Education Division, Faculty of Medicine Siriraj Hospital. Table 2 presents an example of the questionnaire used to evaluate 14 soft skills outcomes of the medical students in 4 main categories: (1) information literacy (presentation, information, and technology), (2) learning and innovation skills (creativity and communication), (3) life and career skills (leadership, life planning, adaptability, and self-sufficiency) and (4) medical professionalism (courtesy, responsibility, punctuality, kindness, and honesty).

Comparison of soft skills outcomes

A total of 234 third-year medical students in the class of 2015 (before the curriculum change, thus representing a traditional learning group) and 294 third-year medical students in the class of 2016 (first year of the change,

TABLE 1. Comparison of the teaching hours in the traditional (2015) and active (2016) learning curricula.

Teaching methods	Description	Teaching hours (%) 2015	2016
Total number of classes		**890 (100)**	**802 (100)**
Large-group teaching (330 students per class with 1–5 instructors per class)		**550 (61.80)**	**409 (51.00)**
Traditional lectures	- Passive one-way lectures - Giving basic knowledge of the designated knowledge outcomes	430 (48.31)	170 (21.20)
Case-based lectures	- Passive one-way lectures - Giving applications of basic knowledge based on simple clinical cases	120 (13.48)	151 (18.83)
Large active-learning*	- Interactive lectures with quizzes and instructors' feedback - Giving applications of basic knowledge based on simple clinical cases	0 (0.00)	88 (10.97)
Small-group teaching (5 small-groups of 5-6 students per room facilitated by 1–3 instructors and a total of 12 rooms were run simultaneously)		**340 (38.20)**	**393 (49.00)**
Traditional group discussions*	- Group discussions based on assigned worksheets of selected topics - Giving basic knowledge of the designated knowledge outcomes - Students' reflections and instructors' feedback	24 (2.70)	14 (1.75)
Case-based group discussions*	- Group discussions based on assigned worksheets of clinical cases - Giving applications of basic knowledge based on simple clinical cases - Students' reflections and instructors' feedback	180 (20.22)	223 (27.81)
Laboratory skills*	- Hands-on laboratory practice - Students' reflections and instructors' feedback	45 (5.06)	28 (3.49)
Demonstrative laboratory*	- Demonstration of laboratory results, followed by - Students' reflections and instructor feedback	91 (10.22)	46 (5.74)
Flipped classroom*	- Pre-class assignments given 1 week in advance, followed by - In-class students' reflections and instructor feedback	0 (0.00)	26 (3.24)
Team-based learning*	- Individual readiness assurance test (iRAT), followed by - Group RAT (gRAT), then instructor feedback, followed by - Application exercises on clinical cases, followed by - Students' reflections and instructors' feedback	0 (0.00)	26 (3.24)
Formative evaluations*	- MCQs or short answer questions at the end of each study section - Students' reflections and instructors' feedback	0 (0.00)	27 (3.37)
Project-based learning*	- A project is chosen based on student–instructor discussions - Students conduct the project over a period of 1–2 months - Students' reflections and instructors' feedback during the activity	0 (0.00)	3 (0.37)

*Active learning classes

TABLE 2. Example of the questionnaire used to evaluate the 14 soft skill outcomes.

Give scores representing your ability or behavior in the following aspects **5 = very good; 4 = good; 3 = neutral; 2 = bad; 1 = very bad**										
Soft skills outcomes	**Yourself**		**Lab Partner 1**		**Lab partner 2**		**Lab partner 3**		**Lab partner 4**	
	At present	**1st day of year 3**	**At present**	**1st day of year 3**	**At present**	**1st day of year 3**	**At present**	**1st day of year 3**	**At present**	**1st day of year 3**
Information literacy										
1. Presentation										
2. Information										
3. Technology										
Learning and innovation skills										
4. Creativity										
5. Communication										
Life and career skills										
6. Leadership										
7. Life planning										
8. Adaptability										
9. Self-sufficiency										
Medical professionalism										
10. Courtesy										
11. Responsibility										
12. Punctuality										
13. Kindness										
14. Honesty										

thus representing an active learning group) were asked to complete the web-based questionnaire at the end of their respective academic year. Briefly, each student received a username and password to log in to the questionnaire. Each student was then asked to score him or herself (self-evaluation) and to score other four members of his/her study group (peer-evaluation) according to the list of soft skills (Table 2). The students were asked to score by using a Likert scale ranging from 1 (very bad) to 5 (very good) at two time points: at the beginning of the academic year and at the end of the academic year. After excluding controversial results, including partially filled questionnaires and questionnaires with the same scores for all the responses, the results for each question scored at the beginning and at the end of the academic year were compared. To eliminate response bias in the use of the Likert scale, the results were only categorized as either an improvement (positive change) or no improvement (no change). It was noteworthy, however, that a negative change was not found in this study.

Statistical analysis

The improvement rate of each outcome was evaluated using the chi-square test. Scores at the beginning of the academic year were compared between the two groups using the Mann–Whitney U test. All the analyses were performed using Statistical Package for the Social Sciences (SPSS®) for Windows 18.0. Statistical significance was achieved at $p < 0.05$.

RESULTS

The number of hours involving active learning was markedly increased in the active learning group (2016)

All the active learning classes were mainly designed for teaching medical knowledge or procedural skills. None of them were specifically designed for teaching soft skills. Overall, the number of hours devoted to active learning was increased in the active learning group (2016; 481 hours, 59.98%) compared to the traditional learning group (2015; 340 hours, 38.2%). Also, the amount of hours devoted to large-group teaching decreased (550 hours to 409 hours) while small-group teaching increased (340 hours to 393 hours). For the large-group teaching, the traditional lecture classes decreased (430 hours to 170 hours) while the time devoted to case-based lecture classes increased (120 hours to 151 hours) and more large active-learning-activities classes were introduced (88 hours). For the small-group teaching, the number of hours devoted to traditional group discussion classes decreased (24 hours to 14 hours) while case-based group discussion classes increased (180 hours to 223 hours). However, the time devoted to both hands-on and demonstrative laboratory classes decreased (45 and 91 hours to 28 and 46 hours, respectively).

Students in the 2016 group reported more improvement in most soft skills outcomes in the peer-evaluation

After excluding the controversial results, there were 119 and 187 self-evaluation responses and 527 and 820 peer-evaluation responses returned from the 2015 and 2016 groups, respectively. According to the self-evaluation results (Table 3), most students (58-100%) in both 2015 and 2016 groups believed there was no improvement in each of their soft skill outcomes. The number of those who believed there was an improvement of these skills were not statistically different comparing between the two groups. Similarly found in the peer-evaluation results (Table 4), as most students in both groups (65-100%) believed there was no improvement in each soft skill outcomes of their peers. However, there were significantly higher numbers of the students in the 2016 group who believed there was an improvement in these skills of their peers. Specifically, the improvement was detected in 11 outcomes (presentation, information, technology, creativity, communication, leadership, life planning, adaptability, self-sufficiency, courtesy, and punctuality). Both student groups had similar improvement rates in terms of responsibility and kindness. There was no improvement in the honesty outcome in both groups.

Students in both the traditional (2015) and active learning groups (2016) had similar initial scores in most outcomes

One possible reason for the higher improvements of the students in the 2016 group in 11 out of the 14 soft skills outcomes evaluated may be that the 2016 class might have started with lower rating scores at the beginning of the academic year, or initial scores, which would then have allowed more room for improvement when compared to the 2015 group. Therefore, we tested if this was such a case. The initial scores of the 11 soft skills outcomes between the two academic years were compared. The initial scores of nine outcomes were similar in both academic years (Table 5). The initial score for punctuality of the 2016 class was not lower, but the initial scores for the presentation skills of the 2016 class were significantly lower. Interestingly, the initial scores of the three outcomes with similar improvements between the two groups (namely, responsibility, kindness, and honesty) of the 2016 class were significantly higher in both the self- and peer-evaluations.

TABLE 3. Number of students showing improvements in soft skills outcomes as evaluated by self-evaluation.

Outcomes	Groups	No improvement (%)	Improvement (%)	*P*-value
Presentation	2015	69 (58%)	50 (42%)	0.740
	2016	112 (60%)	75 (40%)	
Information	2015	80 (67%)	39 (33%)	0.196
	2016	111 (60%)	75 (40%)	
Technology	2015	84 (71%)	35 (29%)	0.150
	2016	117 (63%)	70 (37%)	
Creativity	2015	82 (69%)	37 (31%)	0.448
	2016	121 (65%)	66 (35%)	
Communication	2015	78 (66%)	41 (34%)	0.597
	2016	117 (63%)	70 (37%)	
Leadership	2015	79 (66%)	40 (34%)	0.338
	2016	114 (61%)	73 (39%)	
Life planning	2015	86 (72%)	33 (28%)	0.168
	2016	121 (65%)	66 (35%)	
Adaptability	2015	91 (76%)	28 (24%)	0.088
	2016	126 (67%)	61 (33%)	
Self-sufficiency	2015	99 (83%)	20 (17%)	0.325
	2016	147 (79%)	40 (21%)	
Courtesy	2015	89 (75%)	30 (25%)	0.198
	2016	127 (68%)	60 (32%)	
Responsibility	2015	82 (69%)	37 (31%)	0.344
	2016	119 (63%)	68 (37%)	
Punctuality	2015	94 (79%)	25 (21%)	0.125
	2016	133 (71%)	54 (29%)	
Kindness	2015	92 (77%)	27 (23%)	0.789
	2016	147 (79%)	40 (21%)	
Honesty	2015	119 (100%)	0 (0%)	U
	2016	187 (100%)	0 (0%)	

Note: U = incalculable by Chi-square test; p-value calculated by Chi-square test.

TABLE 4. Number of students showing improvements in soft skills outcomes as evaluated by peer-evaluation.

Outcomes	Groups	No improvement (%)	Improvement (%)	*P*-value
Presentation*	2015	383 (73%)	144 (27%)	0.004
	2016	534 (65%)	286 (35%)	
Information*	2015	421 (80%)	106 (20%)	< 0.001
	2016	530 (65%)	290 (35%)	
Technology*	2015	421 (80%)	106 (20%)	< 0.001
	2016	574 (70%)	246 (30%)	
Creativity*	2015	415 (79%)	112 (21%)	0.02
	2016	600 (73%)	220 (27%)	
Communication*	2015	417 (79%)	110 (21%)	0.004
	2016	592 (72%)	228 (28%)	
Leadership*	2015	424 (80%)	103 (20%)	< 0.001
	2016	546 (67%)	274 (33%)	
Life planning*	2015	413 (78%)	114 (22%)	0.002
	2016	579 (71%)	241 (29%)	
Adaptability*	2015	429 (81%)	98 (19%)	< 0.001
	2016	591 (72%)	229 (28%)	
Self-sufficiency*	2015	452 (86%)	75 (14%)	0.045
	2016	669 (82%)	151 (18%)	
Courtesy*	2015	418 (79%)	109 (21%)	0.001
	2016	587 (72%)	233 (28%)	
Responsibility	2015	401 (76%)	126 (24%)	0.251
	2016	601 (73%)	219 (27%)	
Punctuality*	2015	431 (82%)	96 (18%)	< 0.001
	2016	588 (72%)	232 (28%)	
Kindness	2015	438 (83%)	89 (17%)	0.702
	2016	688 (84%)	132 (16%)	
Honesty	2015	527 (100%)	0 (0%)	U
	2016	820 (100%)	0 (0%)	

*Statistically significant; U = incalculable by Chi-square test; p values were calculated by Chi-square test.

TABLE 5. Comparison of the average initial scores between the traditional (2015) and active learning (2016) groups.

Outcomes	Self-evaluation			Peer-evaluation		
	2015	2016	*P*-value	2015	2016	*P*-value
Presentation*	3.96	3.88	0.268	4.19	4.12	0.030
Information	4.18	4.18	0.751	4.35	4.29	0.053
Technology	4.21	4.26	0.692	4.41	4.43	0.381
Creativity	4.04	4.12	0.469	4.26	4.25	0.511
Communication	4.15	4.19	0.760	4.36	4.37	0.550
Leadership	3.90	3.87	0.656	4.06	4.02	0.199
Life planning	4.18	4.22	0.977	4.38	4.37	0.832
Adaptability	4.24	4.36	0.236	4.39	4.39	0.909
Self-sufficiency	4.31	4.42	0.263	4.49	4.50	0.547
Courtesy	4.08	4.21	0.177	4.27	4.35	0.052
Responsibility**	3.98	4.26	0.001	4.30	4.48	< 0.001
Punctuality*	4.34	4.43	0.169	4.34	4.41	0.029
Kindness**	4.38	4.60	0.014	4.49	4.68	< 0.001
Honesty**	4.75	4.84	0.031	4.72	4.83	< 0.001

*Statistical significance for the peer evaluation; **Statistical significance for both the self- and peer-evaluation; p-values were calculated by Mann–Whitney U test.

DISCUSSION

The active learning method was implemented in the third-year medical curriculum in 2016 for teaching medical students at the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand, as it has been proven to enhance academic performance and independent learning.[8,9] It has also been reported to improve many essential soft skills.[10] Despite the lack of a specific design for teaching soft skills, students in the active learning group (the 2016 group) had higher improvement rates in 11 out of the 14 soft skills outcomes evaluated based on peer-evaluation compared to the traditional group, namely students in the 2015 class prior to the curriculum change. This implies that the active learning method is potentially superior to the traditional learning method in developing some soft skill outcomes. This result is similar to that reported in a recent systematic review of problem-based learning in China, which reported that such improvement came from the nature of group discussion, where students need to express their ideas and exchange their opinions with their peers.[10]

It should be first noted that despite some statistical difference in the peer-evaluation outcomes, most of the students in both groups believe there was no difference in the performances both of themselves and of their peers. This is likely due to the short study duration as these soft skills need to be developed over a longer period of time. A follow-up study at the end of the 6-year curriculum may be useful to clarify this point.

The similar initial scores of nine of the outcomes in both groups justified the higher improvement rates of those soft skills. The 2016 class even had a higher initial score for punctuality, in which they also showed greater improvements. The lower initial score for presentation skills was very minimal (4.19 vs. 4.12). However, whether the higher initial scores in the 2016 group for responsibility and kindness would result in the no difference in improvement between the two groups is controversial and requires further study. Finally, no improvement was detected in the honesty outcome. Among the tested outcomes, the honesty outcome had the highest initial scores in both student groups (4.72 and

4.84 in the 2015 and 2016 classes, respectively), leaving only a small gap for improvement. To further evaluate the honesty outcome, a study with higher discriminatory power is needed.

It should be noted that there was no significant difference in improvement rates of any of the tested outcomes observed in the self-evaluation responses. It is possible that the small sample size could account for the insignificant results from the self-evaluation questionnaires. However, other possible factors should also be considered. For instance, self-evaluation questionnaires are potentially subject to bias, which may lead to obscure data, especially in non-grade-associated outcomes, such as soft skills.[18] Moreover, one study reported that only peer-evaluation had a significant correlation with educator evaluation.[19]

There were two major limitations to this study. Firstly, there were higher proportions of relevant responses from both self- and peer- evaluation in the 2016 group which might have skewed the results. Secondly, all students were asked to complete the questionnaire at the end of their academic years and, therefore, had to recall their performances at the beginning of the year. This might lead to somewhat over- or underestimate of the performances. However, as the two groups were treated in the same manner, we believe these biases would be minimal.

CONCLUSION

In conclusion, even without applying a specific design for teaching soft skill outcomes, the active learning classes in a preclinical year of the medical curriculum may help improve some of the soft skills of medical students. However, as self- and peer-evaluation could be subject to bias and the Hawthorne effect, a standard in-depth method for the measurement of the quality of each soft skill is needed. Additionally, further study may include the study of number of time comsuming (in hours) outside the classroom in order to prepare for the active learning classes.

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