Co-teaching Model Promotes True Integration for Integrated Curriculum of Urology

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Abstract

Background

Currently, the integrated curriculum of urology is still on the road of complete integration. Co-teaching, an existing concept in education, however, may be used to promote the integration of urology. Therefore, the present study was designed to explore the effect of co-teaching method compare with the traditional teaching method.

Methods

Co-teaching and traditional teaching in the topics hematuria and acute kidney injure (AKI) were prepared and validated. 98 undergraduate medical students of Tongji University were randomly assigned to groups A and B. Group A was taught hematuria by Co-teaching (CT) and AKI by traditional teaching (TT) and Group B was taught hematuria by TT and AKI by CT. A knowledge assessment tool of 20 multiple choice items was administered to assess the pre, post and retention knowledge scores. Change between knowledge scores was analyzed using inferential statistics. One students' questionnaire and one tutors' questionnaire were designed and used to investigate the perception on teaching-learning experience.

Results

Both traditional teaching and co-teaching were significantly effective in increasing the knowledge scores with no significant difference in learning outcomes between these two methods. However, co-teaching showed better knowledge retention compared to conventional teaching. At the same time, the feedback from students' questionnaire showed co-teaching method better than traditional teaching; otherwise, the feedback from tutors' questionnaire showed it needs more time and cooperation for the co-teaching.

Conclusions

Co-teaching can promote the curriculum to be deeply integrated, achieve comparatively better retention of knowledge and improve the teaching effect as revealed by the findings.

Background

Due to historical reasons, the subject teaching has still been taught in isolation according to discipline in China. This model emphasizes to teach the systematic knowledge in their discipline, which is easy to be prepared and performed for clinical teachers. But the disadvantages are also very obvious. There is no cross-fusion between various disciplines, which is not consistent to the truly clinical practice. Considering of the shortages of the traditional teaching model, integrated medicine based on organ systems becomes gradually the mainstream of medical education(1). It meets the view of integration of human body, and can make students more conducive to understand the integration of medicine as a whole. Since the start of integrated curriculum construction in Tongji University from 2010, urology and nephrology began to jointly carry out curriculum reform and constructed integrated urological curriculum based on the

problem-based learning like other reports(1, 2) in order to break down the barriers among discipline. However, with the practice of course, we also gradually found that the integrated course of urology is not complete. It integrated only disciplines but not teachers, only forms but not content. Nephrological diseases are taught by teachers of nephrology, and urological diseases are taught by teachers of urology. The content of nephrology and urology is not really integrated into one course, and the interdisciplinary fusion did not come true. Therefore, it is imperative to deconstruct the original curriculum system, jump out of the restrictions among disciplines, and carry out deep integration of urinary system diseases.

The concept of team teaching/co-teaching however, exists in education which has been found to be an innovative teaching-learning methodology with many advantages in its own way (3, 4). This study was an attempt to explore the possibility and effectiveness of co-teaching integrated nephrologist and urologist in the urological integrated curriculum, and to clarify what and how we should do in terms of preparation before teaching, cooperation in the teaching, knowledge reserve if co-teaching is required in the integrated curriculum.

Methods

This study took place in the fall of 2018 and 2019 within the fourth-year undergraduate integrated urology course. After a focused group discussion among the faculty members coming from the departments of teaching office, nephrology and urology, hematuria and acute kidney injure (AKI) were selected for teaching. The undergraduate students came from the class of Shanghai Tenth People’s Hospital of Tongji University, who consented to participate in this study, and were divided into two groups: co-teaching (CT) group and traditional teaching (TT) group. 96 students who consented to be part of the study were randomly divided into two groups of 48 students in each group. A knowledge questionnaire consisting of 20 items of multiple choices (single best response type) was made and validated by experts for assessment of knowledge before and after the teachings. All questions were based on the specific learning objectives of the topics to be covered in the teaching sessions. All the questionnaires and design of study were approved by the Institutional Ethical Committee of Shanghai Tenth People’s Hospital of Tongji University.

The knowledge questionnaire was administered prior to the teachings to have a baseline knowledge score to serve as a pre-test score. The teaching was carried out as planned according to the teaching schedule (Table 1).

Table 1
Teaching schedule

	1st topic	2nd topic
Group A	Co-teaching: hematuria	Traditional teaching: acute kidney injury and renal trauma
Group B	Traditional teaching: hematuria	Co-teaching: acute kidney injury and renal trauma

A post-test was conducted for both the groups for each of the two topics using the same knowledge questionnaire as used in the pre-test. At the end of exposure of both types of teaching modalities, a 5-item anonymous investigative questionnaire was administered to obtain the students' perception on teaching-learning experience. These questions included (☒) interest in the subject; (☒) understanding of the concept; (☒) achieving learning objectives; (☒) enthusiasm for learning more and (☒) application of knowledge in clinical situation. Another 5-item investigative questionnaire was administered to obtain the tutors' perception on (☒) preparative time for teaching, (☒) aspects which facilitated their teaching, (☒) degree of coordination, (☒) teaching fluency in classroom, and (☒) anxious degree for teaching. Four weeks from the post-test, the same knowledge questionnaires for both topics were administered to both groups to determine the retention of knowledge.

Statistical analysis

Paired t-test was used to compare the mean pre-, post- and retention test knowledge scores of group A and group B (intragroup analysis) for both the topics. Mean improved knowledge scores of every topic were compared between co-teaching and traditional teaching method using t-test. Mean knowledge retention scores for every topic were also compared between co-teaching and traditional teaching method using t-test. The results of students' and tutors' questionnaires for co-teaching model and traditional teaching model were evaluated in the form of percentage and compared using Chi-square test.

Results

The mean pre- and post-test knowledge scores in the TT and CT groups for hematuria content were 9.61 ± 2.65 , 17.46 ± 1.91 , 15.32 ± 2.33 and 9.67 ± 2.69 , 17.72 ± 2.43 , 16.08 ± 2.42 , respectively. In addition, the mean pre- and post-test knowledge scores in the TT and CT groups for AKI content were 8.26 ± 2.15 , 16.42 ± 1.89 , 13.62 ± 2.36 and 8.17 ± 2.27 , 16.58 ± 2.03 , 14.47 ± 2.18 , respectively (Table 2, Table 4). The mean pre-test scores of whether hematuria content or AKI content were not significant difference between TT group and CT group. The knowledge scores of the two groups were significantly improved by both teaching methods as reflected by paired t-test analysis ($p < 0.05$). Both teaching methods (TT and CT) all could significantly improve score compared to pre-teaching (hematuria content by TT 7.85 ± 1.62 and by CT 8.05 ± 1.73 ; AKI by TT 8.16 ± 1.31 and by CT 8.41 ± 1.96), which was significant difference. However, the score of improvement between TT and CT was not significantly different whether in hematuria content or in AKI content (Table 3).

Table 2
Comparison between mean pre- and post-test knowledge scores of CT and TT respectively

Topic/method	Pre-test score(mean ± SD)	Post-test score(mean ± SD)	p-value
Hematuria/TT	9.61 ± 2.65	17.46 ± 1.91	< 0.05
Hematuria/CT	9.67 ± 2.69	17.72 ± 2.43	< 0.05
AKI/TT	8.26 ± 2.15	16.42 ± 1.89	< 0.05
AKI/CT	8.17 ± 2.27	16.58 ± 2.03	< 0.05
AKI: acute kidney injury and renal trauma; TT: traditional teaching; CT: co-teaching; SD: standard deviation; p-value < 0.05 is considered significant.			

Table 3
Comparison of scores' change (post minus pre-test score) between CT and TT for hematuria and AKI

Topic	TT(mean ± SD)	CT(mean ± SD)	p-value
Hematuria	7.85 ± 1.62	8.05 ± 1.73	0.56
AKI	8.16 ± 1.31	8.41 ± 1.96	0.46
AKI: acute kidney injury and renal trauma; TT: traditional teaching; CT: co-teaching; SD: standard deviation; p-value < 0.05 is considered significant.			

Although retention score of the hematuria topic and AKI topic showed significantly decreased compared to post-score in both teaching, knowledge retention scores of the hematuria topic and AKI topic still kept higher level compared to pre-learning score in both TT (15.32 ± 2.33) and CT (16.08 ± 2.42). However, comparing to post-score, the knowledge retention score of hematuria topic decreased lowlier than AKI using TT or CT(Table 5). Furthermore, for any topic, CT method could prevent knowledge retention score decrease compared TT method (CT method 1.64 ± 0.62 vs TT method 2.14 ± 0.73 in hematuria topic; CT method 2.11 ± 0.92 vs TT 2.80 ± 0.83 in AKI topic; $p < 0.05$) (Table 5).

Table 4
Comparison between mean retention and post-test knowledge scores of CT and TT respectively

Topic/method	Retention test score(mean ± SD)	Post-test score(mean ± SD)	p-value
Hematuria/TT	15.32 ± 2.33	17.46 ± 1.91	< 0.05
Hematuria/CT	16.08 ± 2.42	17.72 ± 2.43	< 0.05
AKI/TT	13.62 ± 2.36	16.42 ± 1.89	< 0.05
AKI/CT	14.47 ± 2.18	16.58 ± 2.03	< 0.05
AKI: acute kidney injury and renal trauma; TT: traditional teaching; CT: co-teaching; SD: standard deviation; p-value < 0.05 is considered significant.			

Table 5

Comparison of scores' change (retention minus post-test score) between CT and TT groups for hematuria and AKI

Topic	TT(mean $\pm$ SD)	CT(mean $\pm$ SD)	p-value
Hematuria	2.14 $\pm$ 0.73	1.64 $\pm$ 0.62	< 0.05
AKI	2.80 $\pm$ 0.83	2.11 $\pm$ 0.92	< 0.05
AKI: acute kidney injury and renal trauma; TT: traditional teaching; CT: co-teaching; SD: standard deviation; p-value < 0.05 is considered significant.			

Results based on feedback questionnaire

Regardless of the topics taught, students expressed their preference for co-teaching over traditional teaching as a whole (showed in Table 6). But for the tutors, as showed in Table 7, they needed longer preparative time, higher demand for performing their teaching, higher degree of coordination, more devour for fluency in classroom and felt more anxious of teaching.

Table 6

The perception of students on co-teaching and traditional teaching

Items	CT	TT	p-value
(☒) interest in the subject	46	36	< 0.05
(☒) understanding of the concept	45	32	< 0.05
(☒) achieving learning objectives	37	31	< 0.05
(☒) enthusiasm for learning more	48	36	< 0.05
(☒) application of knowledge in clinical situation	45	33	< 0.05
CT: co-teaching; TT: traditional teaching			

Table 7

The perception of tutors on co-teaching and traditional teaching

Items	CT	TT	p-value
(☒) longer preparative time for teaching	44	5	< 0.05
(☒) higher demand for performing their teaching	46	8	< 0.05
(☒) higher degree of coordination	47	0	< 0.05
(☒) more devour for fluency in classroom	43	16	< 0.05
(☒) more anxious degree for teaching	41	13	< 0.05
CT: co-teaching; TT: traditional teaching			

Discussion

Presently, the medical curriculum is compartmentalized and the subject teaching is conducted in isolation in China, which leaves students little scope to correlate and integrate the medical knowledge during the clinical practice and fails to transfer the subject to its applied clinical aspects(5). Isolation among subjects leads to rarely generate the expected level of interest and curiosity in the students(6). In an attempt to enhance meaningful learning, integrated curriculum has been proposed to be incorporated in the medical education system(7–9). Tongji University promoted integrated curriculum in 2010. Integrated urological curriculum was founded based on problem-based learning as a pilot of Tongji University teaching reformation.

With the performance of integrated urological curriculum, it showed meaningful teaching-learning processes which may be more appealing to the learners as it may connect the theoretical knowledge with clinical applications. However, due to the traditional effect, very few medical schools in China could impart integrated teaching methods which made integrated curriculum incompletely be integrated. Integrated teaching conception and method lacked in the teaching reformation. So the integrated curriculum was taught in isolation by the tutors coming from different disciplines. In order to break the barrier among the disciplines and set up a truly integrated urological curriculum, we introduced the co-teaching method into integrated curriculum.

The concept of team teaching/co-teaching however, exists in education which has been found to be an innovative teaching-learning methodology with many advantages in its own way(3, 4, 10). Co-teaching includes five models: team teaching, parallel teaching, one teach one support, alternative teaching and station teaching(3).

This study was an attempt to explore the efficacy and potential benefits of integration in teaching of urology with nephrology in a co-teaching model. The teachers coming from urology and nephrology in the class may be of help not only in focusing on the essential and vital subject contents but also in making up for the deficient knowledge of the other discipline. The co-teaching emphasized that both tutors integrated into one teaching process, and as substitute of the other in terms of discipline knowledge gained and retained by the students(11). There was a significant increase in post-test knowledge scores of students as compared to pre-test knowledge scores irrespective of the teaching methodology used. And in each topic, there was a significant decrease in knowledge retention compared to post-test score by both the teaching methodologies. However, the co-teaching method showed the advantage in terms of long teaching effect compared to traditional teaching method. In the two topics, the knowledge retention score significantly decreased compared to post-test knowledge by the traditional teaching but not so in the case of co-teaching, indicating superiority of co-teaching over the traditional teaching. Therefore, this finding suggested that co-teaching was more fruitful in focusing on the relations and hence leading to better long term retention.

Many studies have been reported on integrated teaching at different levels of medical curriculum and have shown positive results(1). Co-teaching has the added advantage of letting the two teachers co-plan

and divide the lecture content into two inter dependent segments. Each teacher is responsible for presenting a specific segment at the right juncture(12). In present case, the urology teacher took the lead while teaching urological knowledge of the topic being taught whereas the nephrology teacher intervened to discuss the nephrological aspects, which may be reduce the anxiety out of deficiency other disciplines as we found in this study. Presence of two teachers reinforces the key points of the lecture through repetition or restatement which helps in clarifying concepts and favors long term retention.

It may be beneficial in helping students make connections and retrieve any missed out information. Students remain alert and attention owing to presence of two teachers as one of them teaches and the other observes. The integrated lectures may help the students to put together the learnt facts so as to get the whole picture and adopt a holistic approach while applying them to clinical practice(13).

Moreover, the students have favored co-teaching as revealed through the answers to the feedback questionnaire. Feedback regarding interest in the subject, understanding of the concept, achieving learning objectives and enthusiasm for learning more, all were significantly preferred by co-teaching method. The students opined that co-teaching also helps in better application of theory in clinical situation.

Co-teaching was accepted by most students, but as showed in Table 7, there are more demands for tutors, owing to the need of teachers' joint efforts of urology and nephrology disciplines. They need more time to prepare teaching, and design integrated modules for coordination, which needs get both subjects experts at one place to discuss and organize learning objectives, flow of contents, their clinical relevance and applications as would be presented by them(10). Traditional teaching, on the other hand, requires comparatively less efforts as it is executed in isolation.

Nonetheless, co-teaching is an innovative way which is effective in generating interest among the students and thereby facilitating better understanding of the subject(4), and helpful to give students a complete picture to bridge the gap between knowledge and its application in clinical settings.

Limitations

It is not comprehensive to use test scores to represent teaching effects because the practical or clinical application of the learned concepts is very crucial in medical education, so this was only a preliminary trial to test the co-teaching effect. Hence, we sincerely hope that efficacy of co-teaching could also be further tested with different topics of other subjects and a wider sample.

Abbreviations

AKI

acute kidney injury and renal trauma; TT:traditional teaching; CT:co-teaching; SD:standard deviation.

Declarations

Ethics approval and consent to participate

All the questionnaires and design of study were approved by the Institutional Ethical Committee of Shanghai Tenth People's Hospital of Tongji University.

Consent for publication

All the participants gave consent for direct quotes from their interviews to be published in this manuscript.

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

This study was largely conceptualized by XDY and ZY, though all authors participated in the design of the questionnaire and study methodology. AHM and FW performed survey with questionnaire; LW, JW and WYG were responsible for data process, HMZ drafted the manuscript. All authors contributed to revisions of the manuscript and provided final approval prior to its submission.

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