

Effects on applying Micro-Film Case-Based Learning model in pediatrics education

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Abstract

Background: By establishing an innovative teaching model, teachers and students can optimize the education outcome. Lecture-Based Learning (LBL) model has long been widely used as main teaching method in medical course in Chinese culture with a positive result of grades, however, negative of practice. Case-Based Learning (CBL) model modified it by focusing on clinical case study, yet with its limitations. The aim of our study is to discuss the effect of applying a comprehensive renewal CBL model: Micro-Film Case Based Learning (MF+CBL) Model, in pediatrics theoretical course in senior year students under Chinese culture.

Methods: Experimental research was conducted by parallel group control study. The total sample was 104 senior year students (Chinese) majoring in clinical medicine from Guangxi Medical University. The experimental group was intervened by MF+CBL model, while the control group by LBL model. Both process and result were assessed after 8-week courses, by questionnaires of Student Self-Assessment, Satisfaction Survey and Final examination.

Results: The outcome of experimental group generally surpassed control group in Student Self-Assessment, Satisfaction Survey, and Final examination. The open question at the end of the questionnaire yet unfolded a fact that a small number of students were not used to the MF+CBL model due to its time and energy consuming feature.

Conclusions: MF+CBL model was an innovative teaching method, compared with LBL, with a better contribution of comprehensive quality development which offered an alternative model to optimize the capacity of future pediatrics doctors.

1 Background

The shortage of pediatricians in China is warning. According to statistics from *Pediatrics* in 2019, China has about 135 thousand pediatricians, who are struggling in a severe service gap between 1 pediatrician and 2500 children (1:2500). The situation will be worse by the increasing dropping rate about 12.6% [1]. Thus, Pediatrics is trapped in an undesirable situation for medical students.

In consideration of the harsh reality of Chinese pediatricians confronting, such as, lower salaries but heavier workloads, pressure from high expectation of patient's family members, and greater occupational risks on medical disputes, compared with other specialists [2] Pediatric education is facing the challenge of cultivating competent successors with knowledge, resilience and believes [3].

Pediatrics is a course that can offer the first impression to pediatric medical students, playing a crucial role both in training talents and changing the barren situation of children health care service. Therefore, it shoulders the mission of attracting talents, imparting knowledge, developing competence and improving scenario coping to take the challenge of complex physical-psycho-social problems [4] [5, 6].

Higher requirements to the medical education system and greater challenge to medical educators has been raised through the rapid development of health care needs and the relative lag of comprehensive teaching mode. Previous studies has revealed the limitation of traditional LBL model on problem-solving, collaborate learning, and lifelong learning strategies, as well as the side effect of decreased motivation, self-study ability, practical application and critical thinking abilities [7–9].

Contemporary medical education applies problem-based Learning (PBL) model and case-based Learning (CBL) model as innovative teaching strategies, featured by small-group, case-based discussion [10], which have been proved to be more effective in improving student/faculty satisfaction, encourage lifelong learning and curiosity, clinical and critical thinking, and problem-solving ability [11]. But in contrast, CBL model surpasses PBL model in target-orientation and effective in-depth learning by its advance preparation, and guiding clarification [12].

Although the CBL model is proved to be helpful in promote profession competence by creating a chance to handle medical case situation [13] aiming at facilitating knowledge assimilation and forming critical thinking [14], scenario teaching filled with humanities [15] and social medicine elements are not sufficient [16, 17]. Besides, the number and diversity of cases is limited [18], which astricts student's learning interest [19].

The innovative model of blending Micro-Film technique with CBL model (MF + CBL) can be an attempt to solve the above problems, by establishing a sustainable learning mechanism including four important elements in education: interests (attraction), knowledge application [20], competency, and scenario coping skills. Micro-film blending teaching model has been widely used in the field of Humanities and social sciences teaching. Being an artistic teaching form, micro-film can be helpful to case-creation, and unfold social factors within scenarios, such as interpersonal interaction, sense of values and so on. It embraces the expression advantages of a film, while much shorter, entertaining and interactive [21]. The features of low cost, time-efficient production cycle and low cost ensure the feasibility of collecting typical case videos in daily clinical work. Moreover, the case-creation with video fragments protects infants and children from risk of re-direct exposure.

In addition to CBL model, MF + CBL model unfolds a case through storytelling technique [22], within a specific socio-cultural background, which can create a chance for medical students to see things in a different way by seeking meaning through the application of knowledge, and deeply understand the wisdom of "To Cure Sometimes, to Relieve Often, to Comfort Always." Nevertheless, there is little study about the application of MF + CBL model in pediatrics teaching. Thus, this paper will demonstrate the effect of MF + CBL model by comparing the traditional LBL model and innovative MF + CBL model in students' capacity development.

2 Methods

2.1 *Participants*

The study population comprised 104 undergraduates (Chinese) in the senior year from the major of clinical medicine of Guangxi Medical University, including 42 male and 62 female, age from 25–27 year-old. All the participants were divided into two parallel groups (52 students per group) by random sampling with a random number generator. The group which was intervened by MF + CBL model, named experimental group, while the other group by LBL model, name control group. There is no statistical difference between the two groups on gender ($P = 0.842$), age ($P = 0.253$) and academic record ($P = 0.347$) (Appendix 1).

2.2 Design

2.2.1 General curriculum arrangement

The unified textbook was Pediatrics (Wang WP, 2018, People's Medical Publishing House, Ninth Edition), based on which teachers can arrange power-point as supplementary. Pneumonia, Asthma, Hyaline membrane disease and Meconium aspiration syndrome were the 4 chosen chapters for this study, highlighting pathogenesis, diagnosis and treatment. Each chapter cost 6 class hours, lasted for 2 weeks; in total 24 class hours, lasted for 8 weeks.

2.2.2 Experimental group (MF + CBL model) design

Based on task-oriented model, the whole experimental group was divided into four sub-groups according to the four chosen chapters. Each sub-group was responsible for a micro-film making, with the help of teacher's advanced work of taping case videos of children's symptoms, for example, pneumonia fever, cough, wheezing, cyanosis and dyspnea, etc. The whole 8-week MF + CBL process was divided into 2 periods.

Period 1 was characterized by teacher-oriented CBL focus group discussion [23], while period 2 was chaired by student-oriented micro-film presentation, followed by expert comments and conclusion (Fig. 1). In period 1, teacher played as a leader to explain the experimental curriculum and requirements, clarified knowledge key points, demonstrated clinical observation and reasoning in wards, and assisted groups in information analysis with in focus group discussion. The requirement for micro-film making was to present a case story containing both clinical factors, such as pathogenesis, diagnosis, treatment, and related social medicine factors, such as poverty and humanism, sexual discrimination, doctor-patient relationship. Students were encouraged to discuss those factors in a focus group under CBL structured questioning guideline set by the teacher [24].

In Period 2, student played a center role for micro-film presentation, while teacher shifted to an organizer to arrange class discussion and expert comment. Experts invited including clinician, doctor-patient relation coordinator, social health management professor, media and film industry.

Photographic equipment: Iphone X, 2017, Apple Inc. Video editing software: Videoleap Pro, 2017 Lightricks Ltd, download from App Store.

2.2.3 Control group (LBL model) design

The whole teaching process was divided into 4 period abided by the chosen chapters, which were offered by teacher-centered lectures with the help of power-point and some required pictures and videos as usual, yet no media as micro-film. Teacher's predominant role stayed unchanged from beginning to the end (Fig. 1).

Crucial potential confounding variables were controlled, including classroom site, overall teaching period, basic teaching materials (text book, power-point, pictures, audio/video assistance, extra reading materials and etc). There were no differences between the experimental and control group in these variables.

2.3 Evaluation method

In order to reach a comprehensive evaluation, both process assessment and result assessment were applied during this research. Student self-assessment questionnaire and satisfaction survey were referred for process assessment (Appendix 2), simultaneously, scores of final closed-book examination for result assessment.

Student self-assessment questionnaire evaluated abilities including: fundamental knowledge, clinical thinking, situation coping, critical thinking, and learning creativity. Satisfaction survey evaluated the arrangement of lecture context, teaching method and student's self-efficacy [25]. Final closed-book examination was designed and checked by all the teachers involved in the 8-week teaching experiment. Teachers signed confidentiality agreement, and the test papers were checked in anonymous way.

2.4 Statistical analysis

All statistical analyses were analyzed by SPSS software (version 24.0). The measurement data were expressed in the form of $\bar{x} \pm s$. Significance was assessed from independent sample t-test. The categorical data were analyzed by the chi-square test, Comparison of teaching effect between two groups. $p < 0.05$ set as statistically significant.

3 Results

3.1 Comparison of self-assessment between experimental group and control group

The result of self-assessment questionnaire revealed that amongst all the participants, the experimental group surpassed the control group in terms of fundamental knowledge ($P = 0.010$), clinical thinking ($P = 0.038$), situation coping ($P = 0.000$), critical thinking ($P = 0.000$), and learning creativity ($P = 0.000$) (Table 1). The open question at the end of the questionnaire yet unfolded a fact that a small number of students were not used to the MF + CBL model due to its time and energy consuming feature, compared with self-study.

3.2 Comparison of final examination results between experimental group and control group

The final examination scores indicated that amongst all the participants, the experimental group surpassed the control group in aggregate score (80.02 ± 3.77 vs 73.65 ± 3.69 , $P = 0.000$), especially in fundamental knowledge (39.44 ± 2.65 vs 37.12 ± 2.24 , $P = 0.000$) and case study (40.58 ± 1.97 vs 36.53 ± 2.54 , $P = 0.000$) (Table 2).

3.3 Comparison of satisfactory survey results between experimental group and control group

The result of satisfactory survey of experimental group demonstrated a more pleased status in the matter of lecture content ($P = 0.002$), teaching method ($P = 0.000$) and student's self-efficacy ($P = 0.000$) (Table 3).

4 Discussion

In order to fulfill the ever-changing challenge facing by medical education, this research aimed to establish a sustainable learning mechanism including interests (attraction), knowledge application, competency, and scenario coping skills. During this immersive learning process, students were required to intensively throw themselves into case observation, analytical discussion and summarization, guided by the teacher. The teaching quality was depended on the functional roles of teacher and student in a loop of mutual reinforcement, and evaluated by designed assessments individually and mutually to students and teachers (Fig. 2). Thus, the effect of advanced teaching mode by blending CBL with micro-film technique would be discussed below based on the results of all measurements.

First, MF + CBL model was more attractive to students than LBL model, which could be testified by the statistics of satisfaction survey in three dimensions of course content, teaching method and student's self-efficacy. Since the course content was the control variable, teaching method and the learning process, as well as student's feeling of rewarding were more likely influenced the satisfaction level. The reason analysis probably was: first, in micro-film stories, CBL model was updated to live-CBL or e-CBL [26], which was more vivid than test book lines; second, micro-film was an aesthetic fruit based on medical student's interdisciplinary hard working, and the presentation was a stimulation of their inner potential on teamwork, case-reasoning and scaffolding for case representations [27]; third, CBL model with its structured question technique could better lead students to apply fundamental knowledge to practical clinic situations, narrows the gap between knowledge and usage [28], which may increase the feel of self-efficacy and then motivates the learning initiative and creativity [29].

Second, MF + CBL model was more effective towards knowledge application than LBL model. The objective result of closed book examination revealed a general higher score status in terms of fundamental knowledge and case analysis from experimental group to control group (Table 2). The reason analysis probably was: first, traditional LBL model was characterized by its teacher-center efficiency in a cramming system, where students could only seize fragments of knowledge by rote [30],

whereas MF + CBL increase student's automatic processing in cognition by providing abundant opportunities to experiential practice [31]; second, micro-film told a case story based on the development of illness, which followed the nature law of medical field and knowledge assimilation process; third, MF + CBL model encouraged case study under situational affection, within which students could realize knowledge application by the mutual reinforcing of learning and using.

Third, MF + CBL model could better develop student's learning capacity than LBL model. Learning capacity could be evaluated by the ability of critical thinking and learning creativity [30]. With the requirement of vast stores of knowledge, mastery of complex clinical situation and incorporate frontier learning, medical education not only focused on the right answer, but on the right way which can be paved by developing critical thinking based on a solid foundation of knowledge. Simultaneously, learning creativity could help students persist to learn by motivate their initiative thinking and inquiry. The reasons that "critical thinking" and "learning creativity" performed higher score in the experimental group might be: first, micro-film was an video expression technique, which allowed information explosion. Students in the experimental group were encouraged to scan the available information, for instance, some important yet subtle clue functioning at enhancing visual cue interpretation [31], some deviant behaviors that covered by dramatic plots helping to trigger critical thinking; second, MF + CBL model was a creative learning method that could be assimilated during the improvement of practical, medical humanities and evidence-based medicine abilities by students. Teaching was not ended at the time of knowledge assimilation, instead, it continued in the construction of student's learning model. Individual established his learning model by acquisition [30], and further influenced others.

Fourth, MF + CBL model could better promote student's situation understanding and coping than LBL model. The social issues related to the patient or illness that reflected by MF + CBL model could expand students' case discussion to the bio-psycho-social system of the patient [32]. Themes of social medical triggers, values affected health service offering, doctor-patient relationship and etc, could be revealed by structure guiding questions from the teacher in MF + CBL focus group. For example, "How to design a family rehabilitation plan for the patient?", "What's the risk factors between doctor-patient relationship in pediatrics? How to improve the relationship?", "In medical field, how to help a children with special needs in a sustainable way?" and etc. Therefore, the learning procedure was also the progress to practicing in scenarios [22]. Therefore, students were required brought not only questions, but also solutions to the case scenario. In addition, during the shooting process, students needed to interview hospital staffs, patients and their families, and media staffs, which deepened the comprehend of clinical practice and dilemma and social stress facing by medical care, resulted in the improvement of situational coping skills.

In fact, MF + CBL model had its limitation as a demanding teaching method for both students and teachers, in terms of student's willingness of self-study, creative thinking, expression, and teacher's capacity of handling innovative technique, group discussion leading and conclusion [33]. In addition, initial planning and extracurricular activities were important parts of MF + CBL model, no wonder some students—in the experimental group—expressed their oppose opinion about this innovative trial. We did

not deny that honest-to-goodness cramming could lead to a better grade on an exam in current Chinese education system, since the way a student obtained knowledge was not inherent, but acquired dependent on the learning context or environmental influence. Nevertheless, the seemingly superior efficiency of knowledge imparting was outweighed by the disadvantage of lack of critical thinking, which might limit student's capacity development in the path of mechanical memorization. MF + CBL model was comparatively time-consuming in reaching a fine grade, but useful in developing student's deep learning approach [30], which changed the destination of learning from scores to strength.

5 Limitations

This study has several limitations. First, teachers were different in the LBL course and the CBL course, though all the teachers involved in this study were above average appraisal previously. Thus, we might have a biased sample of educators. Second, the study sample was within one institute, and the process took place over only 8 weeks on 4 chapters, which might not be wide and long enough to foresee a stable change on medical student's education outcome.

6 Conclusions

The result indicated an advantaged status of MF + CBL model compared with traditional LBL model. MF + CBL model was preferred and broadly beneficial to both teachers and students in the 8-week teaching experiment. The ever-changing demands of health care system has been pushing doctors to a higher level of capacity, such as deeper thinking and critical analysis during unforeseen and unfamiliar situations or in research. It is timely to explore further how educators can improve and alter clinical teaching methods with MF + CBL model to optimize students' learning effectively, and to encourage a shift towards capacity building. Our findings call for a long-term research covered university educational and hospital clinical practice period of the effect of curricular interventions on pediatrics to guide teaching innovation in medical education.

Abbreviations

LBL

Lecture-Based Learning

CBL

Case-Based Learning

MF + CBL

Micro-Film Case Based Learning

Declarations

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Authors' contributions

Pan Y, Chen X and Zhao JM were involved in the conception and design of the study. Pan Y designed the framework and research methods under theoretical guidance of Zhao JM and the clinical guidance of Chen X. Pan Y, Chen XQ and Chen X were involved in experiment implementation. All authors (Pan Y, Chen XQ, Wei QW, Zhao JM and Chen X) contributed to the further analysis and interpretation of the data. Pan Y wrote the first draft of the paper. All authors contributed to the critical revision of the paper and approved the final manuscript for publication.

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Availability of data and materials

All the cases and video materials were informed and obtained patients' statutory guardians' consent for medical educational usage. All student-participants were voluntary and signed declaration of informed consent before participating in the study. The micro-film making procedure strictly followed the medical ethics of patient-priority, respect and impartial. Infant model (KM/TY4, Shanghai Kangmu Science and Technology Co. Ltd, China) was used in necessary extra video shooting to avoid any harmfulness to patients.

Ethics approval and consent to participate

This study was ethically approved by Guangxi Medical University's Ethics Committee (Appendix 3).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix 1: Demographic data.

Appendix 2: Questionnaire for self-assessment and satisfaction survey.

Appendix 3: GUANGXI MEDICAL UNIVERSITY ETHICAL REVIEW COMMITTEE Approval Notice.

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Tables

Table 1. Comparison of self-assessment between experimental group and control group

Group	MF + CBL (n = 52)		LBL (n = 52)		X ²	P
	Yes	No	Yes	No		
Self - assessment						
Fundamental knowledge	40	12	29	23	4.306	0.038
Clinical thinking	43	9	30	22	6.618	0.010
Situation coping	50	2	18	34	40.827	0.000
Critical thinking	46	6	20	32	25.917	0.000
Learning creativity	40	12	18	34	17.190	0.000

Table 2. Comparison of final examination results between experimental group and control group (scores, $\bar{X} \pm s$)

Group	MF + CBL (n=52)	LBL (n=52)	T value	P value
Fundamental knowledge	39.44 ± 2.65	37.12 ± 2.24	4.835	0.000
Case study	40.58 ± 1.97	36.53 ± 2.54	9.054	0.000
Total score	80.02 ± 3.77	73.65 ± 3.69	8.703	0.000

Table 3. Comparison of satisfactory survey results between experimental group and control group

Group	MF + CBL (n = 52)				LBL (n = 52)				X ² value	P value
	Yes	General	No	Degree	Yes	General	No	Degree		
Lecture content	31	15	6	46 (88.46%)	15	19	18	34 (65.38%)	12.43	0.002
Teaching method	35	8	9	43 (82.69%)	14	18	20	32 (61.54%)	17.524	0.000
Self-efficacy	34	10	8	44 (84.62%)	11	22	19	33 (63.46%)	21.556	0.000

Figures

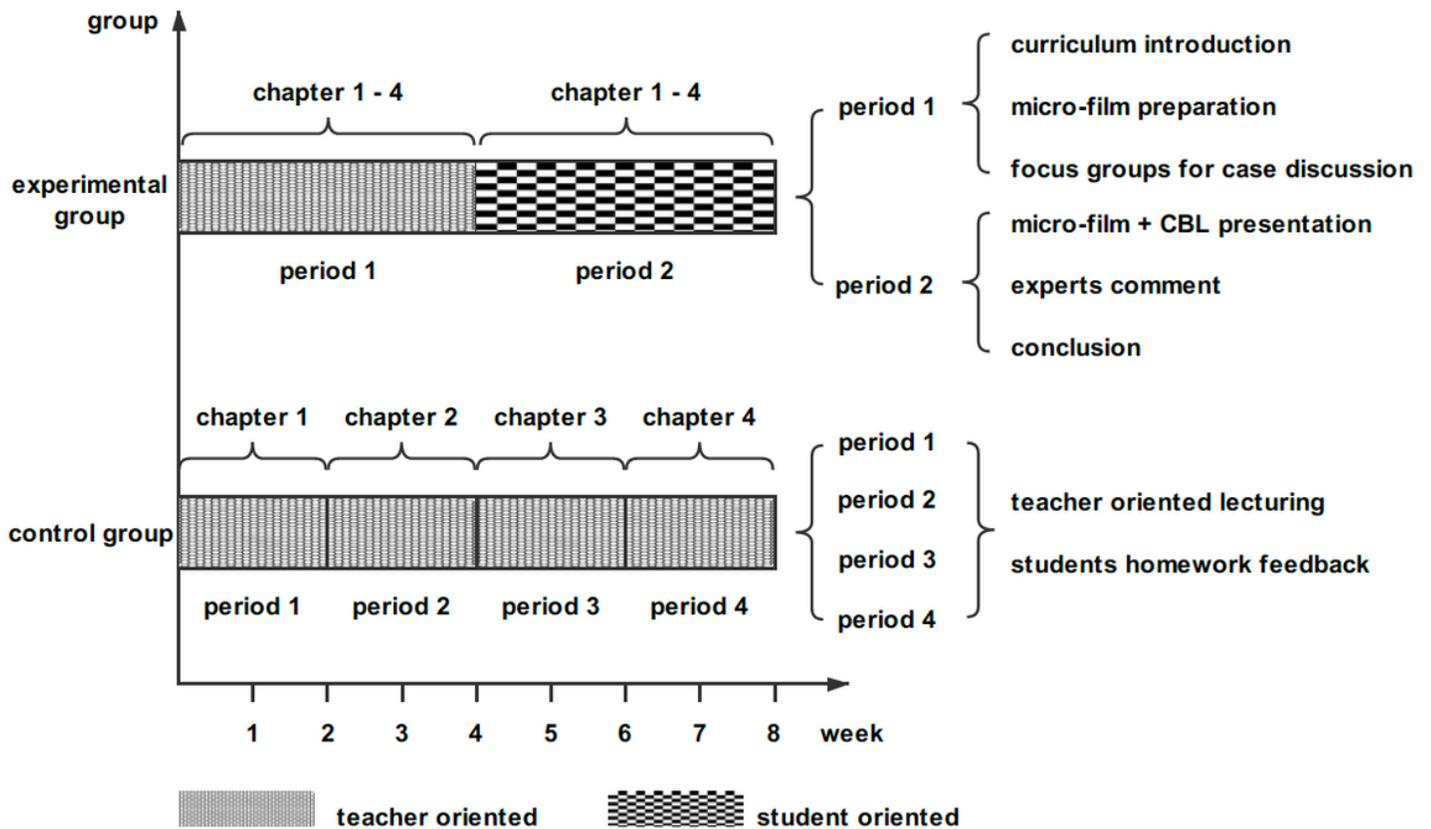


Figure 1

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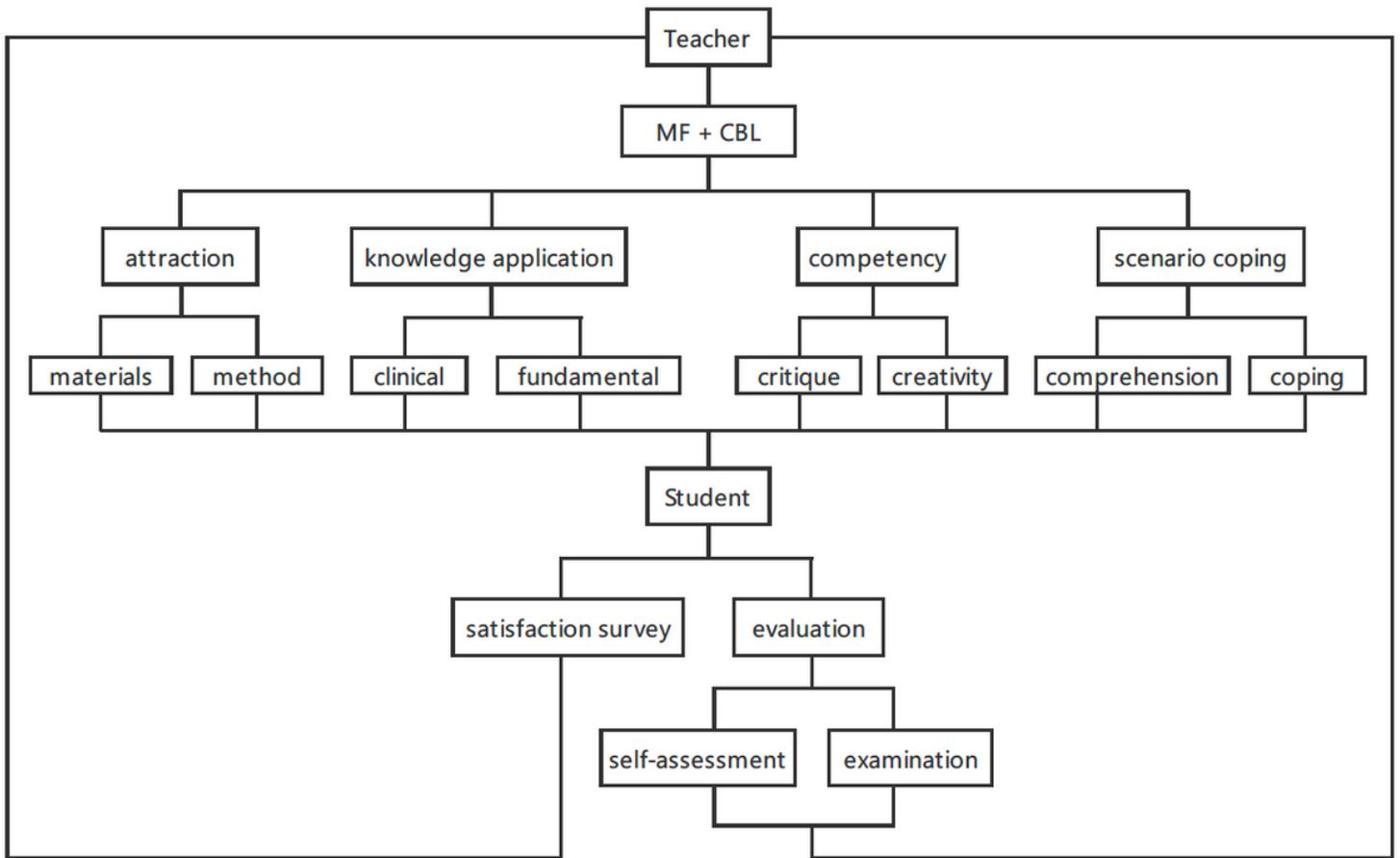


Figure 2

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