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Reform and Practice of Medical Fundamental Curriculum System Based on "Three-Early Education": A Case Study on Youjiang Medical University for Nationalities Located in the Minority Areas of Southwest China

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Abstract

Objective: "Three-early Education" for undergraduate majored in medicine aims to providing them with the opportunities to participate in clinical practice, research, and social practice at the first and second year of their college life. It is the key demand of Accreditation Standards for Basic Medical Education in China—Clinical Medicine, and is of vital importance to medical students from medical college in minority areas to enhance their clinical thinking ability, scientific literacy, communication ability, self-motivated and lifelong learning ability, professional literacy, and to get qualified for serving the strategy of Great Healthy China. The majority of the clinical medicine students at Youjiang Medical University for Nationalities (YMUN), a school from the minority areas of southwest China, are from rural countryside, with minority students accounting for 70%. At enrollment, their basic knowledge was not solid enough, and their abilities in communication, autonomous learning, critical thinking and practical skills were also weak. **Method:** School of Fundamental Medical Sciences of YMUN constructs "three-early education" system through a series of training on updating teaching philosophy and improving teaching skills, revised undergraduate program including integrated courses and reformed teaching mode, and reinforced administration. Specifically, our final goal is to promote the student to be qualified for being a clinical doctor, through an establishment of comprehensive education system

integrated with advanced teaching mode as well as efficient evaluation and motivation system, upholding the philosophy which inherit the communist tradition, focus on morality education, and build a solid foundation of basic medical theory, knowledge and skills. **Result:** In this way, the minority students who are at a disadvantage can catch up with their peers and be eligible for the clinical doctors. In this study, implications for course reform and practice in other medical colleges with similar background were provided, based on the case study on the improved medical basic curriculum system built upon "three-early education" at YMUN.

Keywords

Human Anatomy, Physiology, Pathology, Integrated Courses, All-Around Abilities Cultivation

1. Introduction

"Three-early Education" refers to providing junior medical students with the opportunities to participate in clinical practice, research, and social practice so that they will be well-trained at school in terms of position competency, innovation ability and sense of social responsibility (Pomerantz, 2019; Steiner, 1996). This concept was first put forward by Professor Wang TH from Zhongshan Medical School of Sun Yat-sen University (Wang et al., 2004), and it has been put into practice there from then on. Now various reforms and practices of medical education based on "Three-early Education" are carried out in other medical schools in China as well (Yang et al., 2019; Xu & Xu, 2010). Although the reform implementations in every school are slightly different, they all play a significant role in cultivating the qualities of medical students. In this study, implications for course reform and practice in other medical colleges with similar background were provided, based on the case study on the improved medical basic curriculum system built upon "Three-early education" at Youjiang Medical University for Nationalities (YMUN) in recent five years.

2. Methods and Analysis

YMUN constructs "three-early education" system through a series of training on updating teaching philosophy and improving teaching skills, revised undergraduate program including integrated courses and reformed teaching mode, and reinforced administration. Specifically, there are the following 6 points (**Figure 1**).

2.1. Amendment of Talent Cultivation Plans to Ensure Constant "Three-Early Education" Since Freshman Year

Talent cultivation plans have been amended, requiring explicitly that the following curricula are supposed to be set (**Table 1**): Recognition of Occupation and Post (Term 1), Course Arrangements and Guidance (Term 1 - 8), An Introduction to

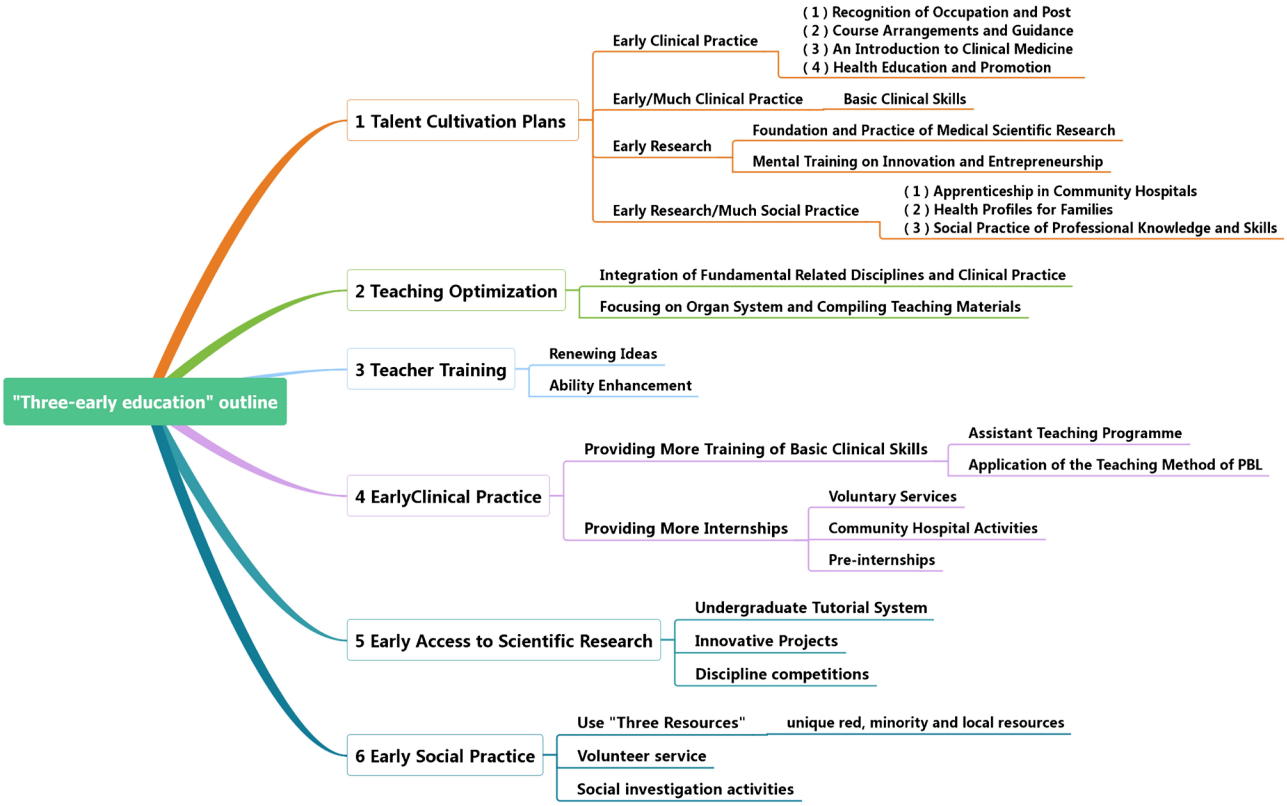

Figure 1. Three-early Education outline.

Table 1. "Three-early Education" module setting in the clinical medicine professional talent cultivation plans.

Curriculum or Internship Course	School Hours	Terms	Module
Recognition of Occupation and Post	8	1	Early Clinical Practice
Course Arrangements and Guidance	2 × 18 = 16	1 - 8	Early Clinical Practice
An Introduction to Clinical Medicine	27	1	Early Clinical Practice
Health Education and Promotion	9	2	Early Clinical Practice
Basic Clinical Skills	6 + 9 + 42 + 36 + 12 + 6 + 60 = 171	2 - 8	Early/Much Clinical Practice
Foundation and Practice of Medical Scientific Research	12 + 15 + 27 = 54	1, 3, 7	Early Research
Mental Training on Innovation and Entrepreneurship	32	4	Early Research
Apprenticeship in Community Hospitals	8W	1 - 8	Early Research/Much Social Practice
Health Profiles for Families	/	1 - 8	Early Research/Much Social Practice
Social Practice of Professional Knowledge and Skills	6 × 6 = 36	3 - 8	Early Research/Much Social Practice

Clinical Medicine (Term 1), Health Education and Promotion (Term 2), Basic Clinical Skills (Term 2 - 8), Foundation and Practice of Medical Scientific Research (Term 1, 3, 7), Mental Training on Innovation and Entrepreneurship (Term 4). Also, from the first vocation, students are required to start off as an apprentice in community hospitals for 1 - 2 weeks when available, writing reports and sharing experience on it, to build health profiles for families, focusing on their health guidance and so forth; from the third term, students are required

to be short-term clinical trainees during the summer holidays, and Social Practice of Professional Knowledge and Skills (Clinic) is set to ensure that the "Three-early Education" is put into practice.

2.2. Teaching Optimization via Integration of Fundamental Related Disciplines and Clinical Practice, Focusing on Organ System and Compiling Teaching Materials

Related disciplines, including Human Anatomy, Histology and Embryology, Cytobiology, Physiology, Biochemistry, Microbiology, Immunology, Parasitology, Pathophysiology, Pathology and so forth, have been integrated based on the current outline of the national medical practitioner qualification examination and the postgraduate entrance examination, following the principle of being "useful, adequate and effective", and focusing on the logic line of "molecular-cell-organ system" reorganized from both the normal and abnormal aspects. Also, the integrated courses are modified based on principles of the "three basic" (basic theory, basic knowledge and basic skills) and "five properties" (thoughtful, scientific, advanced, inspiring and applicable), closely connected to the training objectives for 5-year clinical medicine majors (Table 2). What's more, the

Table 2. Integration of foundation on organ system and clinical practice and semester schedule.

Integrated ideas	Integrated courses	Integrated results	Semesters	Modules
Horizontal integration of fundamental related disciplines, focusing on the logic line of "molecular-cell-organ system" reorganized from both the normal and abnormal aspects	Human Anatomy Histology and Embryology Cytobiology Physiology Biochemistry Microbiology Immunology Parasitology Pathophysiology Pathology	*Fundamental Medicine* (*Book* 1) Introduction *Fundamental Medicine* (*Book* 2) Body systems and organs *Fundamental Medicine* (*Book* 3) Basic body physiological and pathological processes *Fundamental Medicine* (*Book* 4) Pathogens	2 - 4	Early clinical practice (cultivate clinical systematic thinking)
Vertical integration of foundation and clinical practice, focusing on the logic line of "molecular-cell-organ system" reorganized from both the normal and abnormal aspects	Internal Medicine Chirurgery Obstetrics and Gynecology Pediatrics Lemology Neuropathy and Pathergasiology Otolaryngology Ophthalmology Stomatology Dermatology and Venereology Emergency and Disaster Medicine	An Introduction to Clinical Medicine Fundamental Skeletal Motor System and Clinic Fundamental Respiratory System and Clinic Fundamental Circulatory System and Clinic Fundamental Digestive System and Clinic Fundamental Nervous System and Clinic Fundamental Genital System and Clinic Fundamental Blood System and Clinic Fundamental Urinary System and Clinic Fundamental Rheumatic Immune System and Clinic Pediatrics Infectious Diseases Dermatology and Venereology Otolaryngology Stomatology Ophthalmology Psychiatry Emergency and Disaster Medicine	2 - 7	Do clinical practice frequently and repeatedly (cultivate clinical systematic thinking)

teaching contents have been optimized and condensed according to the requirement of "participating in clinical practice early, frequently and repeatedly" so as to be more suitable for the comprehensive reform of clinical medical education based on "5 + 3" and the training of excellent clinicians. Hence, this integrated curriculum is one of the core courses for the cultivation of clinical medical talents, and suitable for five-year undergraduate students of clinical medicine in medical colleges.

2.3. Concentration on Teacher Training about Renewing Ideas for Ability Enhancement

It is hoped that a team of professional teachers of clinical medicine who can meet the standard of integrated curriculum of organ system will be built by two ways. The first is to improve the team quality via intensifying the introduction and cultivation of all teachers involved; the second is to enhance the teaching ability of the team via providing young tutors for students to resort to, organizing teachers to study various subjects, hosting competitions for teaching research and encouraging the teaching team to prepare lessons and to research teaching collectively. Also, the transformation of teaching and learning concepts between teachers and students is supposed to be promoted. Hence, training teachers' teaching ability, organizing collective lesson preparation and student symposium regularly every semester are suggested, which helps the establishment of appropriate teaching and learning viewpoint and modern teacher-student relationship between teachers and students. For instance, 86 teachers have been trained in terms of designing micro-lectures, 89 in terms of studying and reporting in American seminars, 78 in terms of learning basic "Flipped Classroom" mode, 24 in terms of applying the teaching method of PBL, CBL and Sandwich at symposiums and 80 in terms of studying formative evaluation and putting it into practice. Meanwhile, teaching salons are regularly held, where the normalization of mutual communication and development between teachers can be achieved.

2.4. Let Students Participate in Clinical Practice Early via Providing More Training of Basic Clinical Skills and Internships

2.4.1. Assistant Teaching Programme "Early Clinical Practice" Made to Enhance Basic Skills of Clinical Practice

Letting students participate in clinical practice early or simply "Early Clinical Practice" is a multi-staged teaching programme, where detailed teaching plans are made, appropriate teaching contents and teachers are assigned and different clinical skills are taught at different learning stages.

When students are learning basic medical courses, they are requested to do clinical practice on Pathology in terms of inflammation and tumor, Pathophysiology in terms of edema, stress and shock, and Microbiology in terms of viral hepatitis. Participating in noviciate early and translating theory to practice, students can feel the usefulness and effectiveness of basic medical skills as early as possible.

2.4.2. Application of the Teaching Method of PBL on "Early Clinical Practice"

The teaching method of problem-based learning (PBL) is applied on "Early Clinic" via teacher's asking students a series of questions on a certain studying topic, inspiring them to think about and to try to solve the problems and analyzing and answering these questions step by step (Dolmans et al., 2015; Park et al., 2010). For instance, when teaching the morphology of bones, teachers can present a case of fracture and require the study groups to raise questions on this case and to find the answers via consulting literature. A group may ask: What is the classification basis of fracture? What kind of orthopedic patients does the clinical orthopedics department mainly deal with? What is its therapy? The process of raising, analyzing and solving problems related to clinical knowledge points gradually not only arouses students' learning interest but also prompts them to search related materials, look for the answers and understand the knowledge points better (Wang et al., 2018).

2.4.3. Voluntary Services of "Early Clinical Practice"

Students are provided the opportunities to participate in clinical practice from freshman year. At this stage, students are asked to contact clinical diagnosis and treatment, going to the hospital as volunteers and accompanying the patients and so forth. During their contact with patients, students can learn various symptoms directly and understand patients' pain more deeply (Castro et al., 2019), thus realizing the significance and difficulty of the communication between patients and medical staff, sparing no efforts to bridge the gap between doctors and patients, speaking for the patients and serving them. This kind of cultivation can stimulate students' initiative to study.

2.4.4. Community Hospital Activities of "Early Clinical Practice"

The community hospital serves as a major place for teaching and students are requested to take part in community clinical practice based on learning the experience from clinical practice in traditional hospitals. The teaching objectives are to improve students' professional attitude, communicative skills, ability to cooperate, learning ability and critical thinking, and it is hoped that a multi-level, multi-module, progressive and coherent curriculum system can be established, including medical humanistic practice, clinical practice on operating skills, preventive medicine and general family medicine and so on. The teaching mode of community clinical practice "Early Clinical Practice" (Smith & Branstetter, 2016), which combines "education, practice and service" differs from the classroom teaching concentrated on cognitive learning in that the idea of educating "knowledge, passion, affection and behaviour", benefiting the cultivation of medical students' correct values and core competence. The role of national medical education of practice training bases is played via national medical clinic. The medicine curriculum system for racial minorities such as rehabilitation medicine of the Zhuang nationality is being constructed actively. To be specific, related and characteristic teaching materials are written, teaching contents and

methods are explored such as Rehabilitation Medicine of Zhuang Nationality, the personnel training mode for rehabilitation medicine of the Zhuang nationality is innovated, researches have been done in terms of practical teaching mode and method and the characteristic and excellent course, Rehabilitation Medicine of Zhuang Nationality, is set up; the demonstrative base of rehabilitation medicine of the Zhuang nationality for all undergraduates is constructed, which helps to improve students' ability of clinical practice, provide better conditions for students to take an active part in extracurricular activities of science and technology and to enhance their innovative ability, promote constructing the technical personnel team of Youjiang Medical University For Nationalities in terms of researches and experiments, and train medical talents for the society better.

2.4.5. Pre-Internships of "Early Clinical Practice"

Pre-internships of "Early Clinical Practice" are introduced based on students' clinic noviciate and pre-graduation practice (Steiner, 1996). Generally speaking, pre-internships are arranged in summer and winter vacation, that is, 6 pre-internships are arranged in 6 holidays in the first 3 academic years after enrollment (in principle, 10 days are arranged for each winter vacation and 15 days for each summer vacation). Students can contact the pre-internship unit, teachers and arrange time independently. Students are required to choose the pre-practice place around home, including hospitals at all levels (Melnick et al., 2017), community clinics, individual clinics (Adam & Aliferis, 2020) and other medical sites, and conduct pre-practice via learning from teachers, offering voluntary services, doing observation and investigation and so forth. The pre-internship enables students to know the general situation of hospital management, medical laws and regulations and sanitation situation of primary care, get familiar with the basic process of hospital work, diagnosis and treatment, the basic knowledge of reception and treatment, and the doctor-patient communicative skills as well. Moreover, it further consolidates students' professional thoughts and enhances their practical ability so that the "Early Clinical Practice" and pre-graduation practice are connected seamlessly.

2.5. Early Access to Scientific Research via Undergraduate Tutorial System, Innovative Projects and Discipline Competitions

2.5.1. Undergraduate Tutorial System

The undergraduate tutorial system is insisted. Excellent instructors are selected and focus on cultivating medical students' scientific research ability (Lü & Song, 2019) from the following aspects: selection of scientific research topic, scientific research literature retrieval, scientific research design, experiment, statistical analysis, and paper writing. At the same time, students are trained and guided in early scientific research in a variety of ways. For example, the "ternary" experimental teaching mode is implemented for a long time in the experiments of functional science, which is applied to the cultivation of medical students' innovative ability. See **Table 3** for the main contents of "ternary" experimental teaching

Table 3. "Ternary" experimental teaching mode in experiments of functional science.

Level	Cultivation Measures	School hours	Terms	Module
Unitary	Exploratory or designed experimental teaching methods adopted for all undergraduate students of related majors	12	4 - 5	Early scientific research
Binary	Training activities of the tutorial system adopted for outstanding students	Extracurricular time, depending on the needs of research projects	5 - 7	
Ternary	Laboratories or teachers' scientific research activities opening for students interested in scientific research			

mode. The undergraduate tutorial system is characterized by the introduction of scientific research into the classroom, cultivation of both the students' generality and differences, emphasis on the students' status and teachers' dominance, stimulation of students' enthusiasm and initiative in learning, improvement of students' practical ability, and cultivation of students' innovative consciousness, thinking and ability.

2.5.2. Innovation Training Program for College Students

Participating in the innovation and entrepreneurship plan for college students is an important way to get in touch with scientific research early. Tutors provide scientific guidance and training (Gray, Kitson-Reynolds, & Cummins, 2019; Fastring et al., 2018) at all levels for their students in paper reading, summary writing, raising scientific hypothesis, project selection, design of experiments, preliminary experiment and writing skills of declaration and so on, paving the foundation for students' obtaining national or regional university students innovation project funding, experiencing the whole process of scientific research through the implementation of the project. Meanwhile, undergraduates are guided and organized to participate in national discipline competitions. The training of students' innovative experimental skills and scientific research thinking is strengthened, and the scientific research process is deepened through preparation for competitions. The program has created a national and even international communication platform for students where they can compete with medical undergraduates in national medical colleges and universities and listen to experts' comments. At present, our college has guided and organized students to participate in the first "National Undergraduates' Innovation Forum & Experimental Design Contest in Basic Medical Sciences", competed with 475 teams from 108 universities including Peking University, Fudan University, Zhejiang University, Sun Yat-sen University, Central South University and Shanghai Jiao Tong University and won the third prize.

2.6. Use "Three Resources" to Inspire Students' "Three Gains" Thought, Make Students Contact Society via Social Practice of "Serving the Country People in Three Aspects" and Other Activities

By making use of the unique red, minority and local resources in Baise and its surrounding areas, "Serving the Country People in Three Aspects" in summer

vacation, volunteer service and social investigation activities are organized to promote students' early contact with the society. And students' clinical consciousness, fundamental service awareness and their various abilities are enhanced obviously such as doing independent study, practice, innovation, scientific research and so forth. Using the research base of Ethnic Anthropology, the students are guided to carry out scientific research and get in touch with the society. The subject direction of Human Anatomy and Histology and Embryology successively set up 12 research and teaching base in Baise, Longlin, Lingyun, Bama, Fuchuan and other cities and counties of Guangxi Province from January, 2012 to December, 2015, and respectively went to places inhabited by minorities in compact communities of Guangxi, including primary and secondary schools, colleges and universities, communities, counties, villages, towns and the surrounding areas of Baise, to do activities such as research on Physical Anthropology, free medical treatment for bone health and so on. During the annual program serving the country people in summer vocation, and at every World AIDS Day and World Tuberculosis Day, students are instructed to carry out the a series of social activities on "Prevention and Resistance of AIDS", "Prevention and Control of Tuberculosis in Accordance with the Law", visit local schools, communities, stations, plazas, construction sites and so forth, promote the prevention of AIDS and Tuberculosis and provide relevant free medical treatment for the masses in the forms of exhibition boards, teach-ins, questionnaires, knowledge contests, banners to sign and art shows. The health of the people in the country's important aluminum industrial base are protected through investigation of the background of aluminum mining areas and related basic researches, invention patents and transformed achievements. The students were also instructed to set up 15 monitoring stations for high aluminum exposure in Pingguo, Debao, Tianyang, Jingxi and other counties in the main producing areas of aluminum mines, to monitor the three waste emissions of aluminum plants built and operated in the mining areas, to supervise the discharge of wastes from factories and mines, and to provide the local masses with knowledge on the prevention of related diseases.

3. Conclusion

In this study, a set of textbooks that integrate the "molecule-cell-organ system" as the mainline was constructed. At the same time, it was oriented to the clinician's job competence as a guide and the hospital's characteristic brand activities as a carrier, which effectively made up a system for the national medical university for developing students' inadequate qualities. This research has formed a diversified teaching model and evaluation incentive mechanism to cultivate students' clinical thinking ability. After years of practical exploration, the following problems have been successfully solved: traditional basic medical courses are being relatively independent with each other, lacking interconnection and cross-integration, overall thinking and comprehensive application training, and

the foundation and clinical practice are separated, theory and practice are disconnected. What's more, students of medical universities and colleges for nationalities have little contact with scientific research, low scientific literacy and weak sense of innovation and creativity. In addition, they have little contact with society, poor communication and expression skills, and weak humanistic and professional quality. Happily, the problem of lacking connection between disciplines has been solved effectively, and students' problem-solving, practical, scientific research and innovative abilities have been improved. More than 130 innovation and entrepreneurship training projects above the district level have been set up under the guidance of the successful team, and nearly 200 scientific research papers have been published by students in the past five years. Meanwhile, the construction of teaching platform, curriculum construction and teachers' level of development have been improved, and more than 20 teaching reform papers have been published. The 4 teaching platforms constructed are available to all teachers and students through the Internet at any time, and have achieved remarkable results in assisting students to study independently and teachers to prepare lessons. The 5 textbooks published have been applied and promoted in our school and some other colleges and universities in and outside the district, and have been praised by experts in the related field. Youjiang Medical University for Nationalities has been awarded one key laboratory and one excellent teaching team at the university level in Guangxi, two demonstrative centers for autonomous experimental teaching, one advanced individual in education and scientific research in Guangxi and one excellent teacher in China, and won two first prizes and three-second prizes of teaching achievement awards at the autonomous region level. There have been gains and results in the reform, but they cannot be achieved once and for all. Faced with students from ethnic minority areas or similar students with "weak foundation", the higher education workers in the front-line still need to make unremitting efforts to make up for students' "congenital malnutrition, insufficient confidence" and other disadvantages as soon as possible, so that these students can catch up and create the bright future.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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