

## **Research-oriented English teaching of engineering majors at regional Chinese engineering colleges based on the idea of steps**

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**ABSTRACT:** Regional Chinese engineering colleges face a serious challenge in regard to English teaching, including teaching modes, faculty preparation, teaching resources, curriculum design and methods. This challenge needs to be urgently addressed and steps-mode classroom teaching is one of the possible solutions. Steps-mode research-oriented classroom teaching is focused on the student with the teacher acting as a guide in problem-based tasks. In order to enhance students' learning enthusiasm, initiative and creativity, this teaching mode puts great emphasis on the research process of questions and answers, which cultivates students' divergent thinking, and assists in self-regulated learning and passionate exploration. Due to a more meaningful and deeper involvement of teachers and students, and the application of new methods and tools, this mode has been helpful in improving English learning and teaching quality in engineering majors at local engineering colleges.

### **INTRODUCTION**

Regional engineering colleges are an important force in higher education in China and attract large cohorts of students. They are closely related to local economies, and further their development through new ideas and objectives, thereby, meeting the social requirements of the region. [1]. As a mandatory course in engineering majors at regional engineering colleges, English teaching plays a huge role in talent training. However, statistics indicate that there exist numerous problems in the curriculum, contents, methods and the evaluation of college English teaching [2]. Therefore, the current situation needs to be urgently addressed and new teaching modes explored. Many colleges have already begun to reform English teaching and some have introduced research-oriented teaching.

Research-oriented classroom teaching refers to a teaching method in which students, with the help of the teacher, use the inquiry method to learn new knowledge and apply that knowledge to solve problems in the classroom. This method puts more emphasis on the learning process in which problems are taken as the carrier. By creating a context, which is similar to a scientific research, but whose content and rules are not known by students, the teacher can stimulate students' interest in learning, encourage them to question or do some independent research and, thereby, the students can find out the rules and acquire knowledge. Only in this way, students can learn how to collect, analyse, judge and solve problems which enhances their ability for self-study and innovation.

At present, there are numerous difficulties in English teaching of engineering majors in regional engineering colleges. Hence, the research-based classroom teaching reform, which favours a holistic education and all-round educated students is needed in China. More traditional research-based classroom teaching puts more emphasis on teachers' guidance rather than their centrality, on students' initiative, problem-based knowledge acquisition and enhancement of student capabilities.

Some aspects of research-based teaching have been investigated, especially in relation to the subject being taught, content, methods and the target of research-based teaching; and the results of these investigations have impacted on the teaching process and often improved it. However, there are still some aspects that require further study, including quality assurance, performance requirements by both teachers and students, and the evaluation of classroom teaching from the teachers' perspective in research-oriented classroom teaching.

### **UNDERSTANDING STEPS-MODE RESEARCH-ORIENTED CLASSROOM TEACHING**

The steps-mode research-oriented classroom teaching has been introduced to make up for the shortcomings in the more traditional research-oriented teaching approach. The steps-mode pays special attention to the understanding and interpretation of the subject's value, student behaviour and to the significance of the teaching practice. The focus of the

mode is to reveal the meaning of research-oriented classroom teaching from the perspective of teaching principles, classroom management, teaching process, teaching method and teaching goals. The word *steps* could also mean *procedures*, *paces* or *walk*, all of which connote action, energy and possibly enthusiasm that could morph into the spirit of innovation. It is supposed to be an imaginative illustration of the relationship between people and the teaching practice. Each letter in the word *steps* bears some significance when analysed in the context of the actual teaching process, as shown in Table 1:

Table 1: *Steps* analysis.

Word	Letters	Steps stand for	Understanding of <i>steps</i>
steps	s	Student-centred principle	Students play the main role in the classroom
	t	Teacher-assisted management	Teachers guide and evaluate the students
	e	Exploration-based process	Exploration is the main teaching process
	p	Problem-based approach	Understanding problems and finding solutions are the teaching methods
	s	Sustainability-oriented target	Promoting students' all-round development

It is important to emphasise that the steps-mode is a student-centred approach in research-oriented classroom teaching, which pays more attention to the procedure of presenting the teaching content and underlines the guidance of teachers. The enthusiasm, initiative and creativity of students to participate in knowledge acquisition could be enhanced by way of questing, problem-solving, brain-storming, independent learning and exploration. The essence of such a teaching mode is to observe and reflect on modern classroom teaching from a future perspective, trying to develop the potential of an active classroom, which could be unique and creative, but that needs to be uncovered. With the application of the steps mode, the classroom could be a platform for students and teachers to interact, communicate and conduct research, a place for students to study and explore independently, achieving the goal of holistic development, and also a stage for teachers to show their knowledge, wisdom and personalities, and to enhance their teaching abilities.

#### CONSTRUCTION OF STEPS-MODE RESEARCH-BASED CLASSROOM TEACHING OF AN ENGLISH COURSE FOR ENGINEERING MAJORS AT REGIONAL ENGLINEERING COLLEGES

##### Student-centric Learning System with the Teacher as the Guide

The ultimate task of higher education is to cultivate talent. Research-oriented classroom teaching of engineering majors at regional Chinese engineering colleges is a crucial way of cultivating talent in higher education, which takes the people as the foremost component making students the centre point during the classroom teaching process.

Constructivism theories also emphasise the central status of students arguing that students should play a principal role in their own study, cognition and information processing, as well as in the construction of the meaning of knowledge [3]. This idea provides a theoretical foundation for steps-mode teaching.

The traditional teaching process places the teacher at the centre of the classroom and it gives them the leading role. Teachers attempt to instil knowledge in students and, thereby, perform their duty, sticking to the dull teaching task of propagating the dogma, imparting professional knowledge and resolving doubts.

The classroom teaching pattern based on the teacher's instruction and ignoring students' active learning has severely impacted on student engagement and learning outcomes. Also, it has hampered the cultivation of students' innovative spirit and practical abilities. During the classroom teaching process based on the steps-mode, students take over the principal role, while the teacher just guides them. As the most active element during the teaching process, students can carry out a complex discussion based on questions proposed by the teacher and, thereby, discover, analyse and solve problems all by themselves. Books are just tools for students and teachers in problem-solving, while the questions are the carrier of the classroom activity. During the class, the teacher is able to monitor, evaluate and guide, while students can doubt, explore and create. This mode of research-oriented classroom teaching fully manifests the higher education value of placing the talent and ability foremost, and it refers also to the quality of teaching. The steps-mode, combining study and research, focuses on reversing the roles of students and teachers during the teaching activities. As a result, the teacher's role is changed from a knowledge presenter/giver to a guide, while the student is transformed from a passive knowledge receiver to a positive constructor. Therefore, the mode utilises the teacher's guiding and motivational ability, as well as creating a natural platform for the mutual communication between the teacher and students, and among the students.

##### *With Questions as the Carrier and Exploration as the Research Process*

In the 20th Century, the international education community began to investigate the research-oriented classroom approach, and several researchers advanced this, and related topics, including John Dewey, Donald Kirkpatrick Jerome Bruner or Joseph Schwab. In more recent times, this approach has been introduced into university teaching at several West European countries and followed by a number of Asian countries. Problem-based learning in Sweden, projects-

oriented learning in Germany, projects teaching in Denmark, Japan and Korea, all of which have gone through research-based teaching and student projects to foster students' abilities in problem recognition, self-regulated innovative thinking and problem-solving ability. These initiatives have further improved research-oriented classroom teaching and shifted it from a theoretical study to a very practical approach.

Research-oriented classroom teaching implies that *a problem* is at its core and, therefore, it would be futile to organise the learning process without questions. Further in-depth studies and explorations of this teaching approach were investigation-oriented and relied on questions, which stimulated educators to design teaching curricula including discussion, and research curricula that encouraged students to participate in research projects cultivating their abilities of self-regulated exploration, innovation and introspection. The main part of steps-mode research-oriented teaching is based in the classroom, where the teaching methods are question-based and by way of creating a specific context for learning and research students' enthusiasm is stimulated. Students start asking question initiatively, learn autonomously, discover the rules and acquire knowledge and, finally, solve the problems. The ultimate goal of the steps-mode is to foster students' understanding of problems, improve their practical and innovative abilities.

Steps-mode research-oriented classroom teaching is an open-style teaching based on the subject content aligned with students' actual demand for knowledge. It can be put into practice by two methods of *questions exploration* and *classroom exploration*. During the teaching process, questions, tasks and projects are treated as the entry point of classroom teaching. Knowledge accumulation, methods acquisition and the ability for continuous improvement are melted into the process of research-oriented teaching, which enables students explore, question, think creatively and design. *The consciousness of questions* helps students to integrate the acquired knowledge and practical experience, thereby, cultivating high-quality innovative talents.

#### With Students' Education for Sustainable Development as a Teaching Goal

The graduates of engineering majors at regional engineering colleges are *the new blood* for the construction and further development of Chinese society. Their quality and capacity for sustainable development has a direct influence on social growth and stability. Thus, the cultivation of their quality and capacity is an important goal of higher education. Modern college students' development capacity can be regarded as the ability to keep learning, trying, exploring and innovating, as well as maintaining a positive attitude towards the sustainable development [4]. A research-oriented classroom with the steps-mode in English teaching of engineering majors contributes to the overall development of the country, and has the following teaching goals:

1. Learning how to learn: no teaching process can be implemented without the support of learners' self-consciousness and learning capacity. Classroom teaching activities involve mainly interactions between the teacher and students. During the teaching process, the teacher should not only make sure that students can use the teaching materials properly and master the basic knowledge in books, but also let them build knowledge by themselves.
2. Learning how to use: in the classroom, guided by the teacher, students are supposed to raise questions and conduct research on their own. The teacher should help students take in new knowledge. And, what is more important is that the teacher should allow them to develop various kinds of abilities, including how to think, how to express one's ideas and, especially, how to apply theory into practice and how to be innovative.
3. Learning how to be: classroom teaching plays a big part in college education. Research-oriented teaching should also create a classroom environment that can raise students' ethical awareness and collective consciousness, and enhance teamwork spirit and organisational skills.

The application of steps-mode to research-oriented classroom teaching of an English course for engineering majors aims to put strong emphasis on the cultivation of students' inquisitiveness in knowledge and creativity. It is a dynamic process, in which the English teacher can influence, facilitate, support and guide students' research-oriented learning activities. By this teaching and learning process, students of engineering majors will improve their critical thinking ability and ability to reflect and improve and, ultimately, fit better into society.

#### IMPLEMENTATION OF STEPS-MODE RESEARCH-BASED CLASSROOM TEACHING INTO ENGINEERING MAJORS AT REGIONAL ENGLINEERING COLLEGES

Steps-mode research-oriented classroom teaching is one of the reforms that can yield positive outcomes at regional engineering colleges. It is not only an effective way to elevate the level of research and to increase competitiveness, but also an important channel of promoting students' all-round development.

#### An Implementation Route from the Perspective of Teachers

1. *Teachers' competency*: compared with traditional classroom teaching and other research-oriented teaching models, steps-mode research-based teaching imposes substantially more requirements on teachers. As this approach

requires a more active classroom and makes students leading actors in learning, it imposes at least the following requirements on teachers: a) students need to be motivated, curious about the subject, have a great research interest, inquiry awareness and a strong desire for good performance; b) students need to be guided to learn in a critical way, to identify problems keenly and to put forwards questions verbally; c) students are led to develop rich imagination, exercise self-reliant judgment, as well as quick critical thinking in learning; and d) students need to be facilitated to strengthen learning willpower, learning perseverance, persistent inquiry and problem-solving ability. Based on these abilities, teachers, as designers, organisers, instructors, participants or evaluators in research-oriented classroom, should be armed with a perfect knowledge system, solid research methodology and ability to conduct research, open mind and determination or perseverance to carry out research-oriented classroom teaching. With all of that in place, the smooth implementation of research-oriented classroom teaching can be almost taken for granted.

2. *Teachers' behaviour*: carrying out research-based teaching in the classroom, the teacher should not only have well developed research capability, but also pre-arrange a set of practical processes, which will guide students to question, monitor their inquiry process, organise classroom teaching and allow teacher supervision of the class. Before the class, the teacher, taking students' actual demands into consideration, should analyse each step of the teaching process, and design detailed teaching schemes in accordance with the course characteristics and teaching aims. Also, prior to the teaching process, the teacher, already familiar with the core knowledge of a given subject and the corresponding textbooks, should refine that knowledge as part of the preparation and design questions, tasks and references to material to enable students to actively construct their own knowledge base during the class. After the task assignment, the students are asked to think over the questions and learn on their own. When they work out some initial ideas, the teacher should encourage them to exchange thoughts in small groups or by other ways to further their inquiry, and later ask them to present verbal or written conclusions of their deliberation in the class. It is necessary for the teacher to allocate and monitor time intervals for each specific activity, including the initial development of ideas, exchanges and discussions, presentations, evaluation and conclusions.

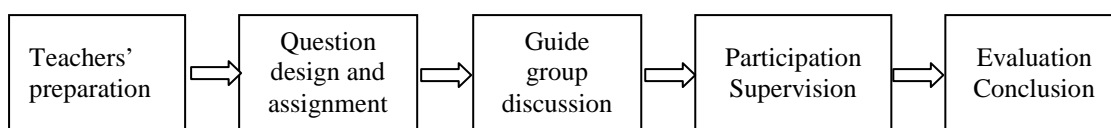


Figure 1: Steps-mode operating route for teachers in English teaching of engineering majors.

The above diagram broadly depicts the process; however, the design and arrangements regarding specific parts and their implementation may vary, due to such factors as: discipline and commitment, knowledge of the teaching content, teaching objects or teaching environment. The process is both flexible and dynamic, so the teacher depending on the circumstances may adjust it to trigger positive outcomes, and also guide, inspire or provide counselling as needed.

#### An Implementation Route from the Perspective of Students

1. *Students' competency*: constructivism holds that learning is not the simple accumulation of information, but the learners' active construction of their own knowledge; the methods of construction are mainly embodied in the interaction between the old and new knowledge and the interaction between the learners and the learning environment [5]. This theory focuses on learners' self-knowledge construction and emphasises that the teaching process is about presenting and resolving a particular problem, for which the teacher provides the theory, so that students can take the initiative to explore the problem. Compared with middle school students in China, regional engineering college students' knowledge improves gradually and dynamically. Their cognitive awareness is increasingly intense and their desire for self-expression is stronger. All that lays a solid foundation for their independent thinking in the classroom, for their courage to challenge authority and their self-independent learning. Research-oriented classroom is in need of students with such abilities. The essence of this classroom is the research, in which confusion, puzzle, curiosity, interest are major factors, and where communication and cooperation between students and students, teachers and students is essential for exploring problems, seeking answers, finding solutions and creating new knowledge. In an open class environment, students can question authority-based knowledge and give full play to their own initiative.
2. *Students' behaviour*: nowadays, there is a whole volume of literature on research-oriented classroom teaching and related topics. Most of them pay more attention to the teacher's role and implementation strategies. Research on students' behaviour and their requirements appear to be limited. However, in the process of research-oriented teaching, the proportion of students' performance can never be less important than that of the teacher. In addition to making pre-class preparations, especially obtaining information from textbooks and additional materials, students have to exercise independent thinking and form their own opinions according to their individual ways of thinking. Then, they also have to try different methods to resolve the assigned problems, choose the optimal method, self-judge and share the results with peers and teachers by writing reports, verbally presentations or in pictures.

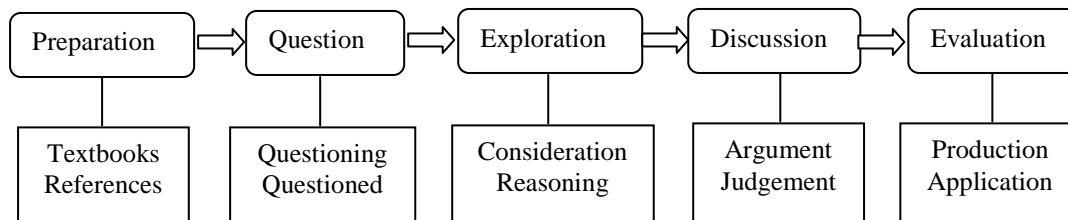


Figure 2: Steps-mode operating route for students in English teaching of engineering majors.

Understanding is a mark of the modern humanistic spirit [6]. Steps-mode research-oriented classroom teaching focuses on the interpretation of values, behaviours and their significance. In the classroom, by students' preparation - questioning - exploration - discussion - evaluation route, as well as their all-round development goal, the route can also reflect students' uniqueness, autonomy and creativity, their innate ability to understand. It could also be viewed that with the steps-mode, students play the main part, while teachers still have the leading role. Students' operating route and teachers' behaviours are complementary and inseparable. The stronger students' subjectivity is, the greater the guiding role of teachers. Harmonious interaction and trust between teachers and students can have a great effect on the outcomes of research-oriented classroom teaching.

#### Evaluation of Steps-mode Research-based Classroom Teaching

The application of the research-oriented classroom teaching has to be followed by the evaluation of its teaching effects. Traditional evaluation tends to focus on students' acquisition of knowledge rather than their capabilities. So, a different evaluation method has to be applied to properly assess the outcomes against the goals of research-based training. Compared with the traditional one, this evaluation tends to more systematic and objective as throughout the evaluation process, the concept of research-orientation has to be applied. However, even newer evaluation methods tend to overlook the emotions and attitudes of students, and the teacher's role in that, thus, not providing a multi-aspect examination of this type of teaching.

An evaluation from the perspective of the steps-mode could be a remedy for the insufficiencies of the more traditional evaluation of the research-oriented part.

First, the steps-mode evaluates the teaching effect from a variety of aspects, for example, students as the principal part in learning and teachers are leaders in teaching, but both sides should be taken into consideration in the evaluation of the teaching effect. As for students, the evaluation should involve students' interest, motives, self-study ability, research awareness and creativity. Teachers are the motivator in students' learning, so as for teachers, the evaluation should be carried out on the basis of their teaching approach, enrichment of their knowledge, improvement in their research ability and ability to guide the research-oriented classroom, as well as on enhancement of their abilities to design research-oriented courses, to cooperate, coordinate and renew. Only when both teachers and students are judged from different aspects, can the teaching effect of research-oriented classroom be fully and objectively evaluated.

Second, the steps-mode's evaluation is dynamic. Research begins with problem recognition, as does research-orientation teaching with its focus on problem awareness and critical thinking. Therefore, the evaluation of classroom-teaching effect should concentrate on the process more than the result, and should place more emphasis on engagement, process discovery and innovation. On the one hand, students can evaluate themselves in the open, autonomous classroom discussion. On the other hand, the formularisation and standardisation of the traditional evaluation of teachers should be abandoned, while personalised and humanistic dimensions should be adopted in evaluation. Furthermore, the steps-mode's evaluation is also expandable. Although the teaching process is carried out in the classroom, its effects do not turn out immediately. The evaluation of the steps-mode could be applied to the whole research-oriented teaching process, or even to graduates' professional careers.

#### CONCLUSIONS AND SUGGESTIONS

The knowledge economy needs a lot of high-calibre, innovative and talented graduates, whose education requires *active promotion of research-oriented teaching* in higher education [7]. Colleges and universities bear the responsibility to realise the aim of research-oriented teaching. The steps-mode puts students at the centre, places stress on teachers' leading role, reinforces the importance of problem awareness, stimulates the pursuit of knowledge and explorative endeavours, and it raises self-study and innovative abilities in English teaching of engineering majors at regional engineering colleges in China.

It is a dynamic teaching mode in the constant process of refinement, renewal and enrichment. It revives classroom teaching and is a key to creative education. College and university teachers should be encouraged to implement research-oriented classroom teaching more widely and also to search for other effective teaching methods. Only in these ways, can more excellent, talented graduates whose knowledge, skills and capabilities satisfy the demands of this age be trained.

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