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# A Holistic Active Learning Framework

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**Abstract.** We introduces the application and effect of a holistic active learning to allow students' explorations of their own attitudes and values. Our four year practice has proved that this teaching method can inspire students' interest, deepen their understanding, improve their engineering ability, and nurture innovative thinking. Furthermore, it develops a positive effect on teaching and assessment reform for all programs.

**Keywords:** Active learning, Assessment model, Practice teaching, teaching reform.

**PACS:**

## INTRODUCTION

Compared with traditional learning, active learning focuses more on developing skills than on transmitting information, as an effective way of nurturing talent for meeting the needs of society. Based on the idea that class time will be spent directly engaged with learning, active learning pedagogies, many of which are highly structured, includes team-based learning [1], process-oriented guided inquiry learning [2], peer-led team learning, and problem-based learning [3]. In this work we propose an holistic active learning approach, working together with staff, students and administrations to improve the quality of teaching and personnel training as the core task of education reform and development, which consequently elevates the standard of scientific research in subject of electronic engineering discipline.

## METHOD AND MATERIALS

The University of Electronic Science and Technology in China and the University of Glasgow in United Kingdom have started a transnational education project since 2013 for the degree of Electronic Information Engineering, named as Glasgow College, UESTC. The enhanced active learning on a "student-centered" curriculum attaches great importance to evaluate various assessment methods in this joined transnational program. The assessment methods of the course include oral examinations, group discussion, class participation, a mid-term test and a final exam. In accordance with these distributed assessment plans, the variety of assessment method includes simulation scenarios, case studies and lab demonstration.

Through a rigorous process management, our teaching program changes the orientation of one-sided

evaluation, using only exams, into a series of phased assessments. Students are encouraged to pay more attention to the whole process of experiments and experimental methods.

Our college actively encourages teaching construction, by forming the establishment of an effective monitoring mechanism and establishing a scientific and reasonable teaching evaluation as part of incentive measures. These holistic active learning methods create a positive work environment, and guide staff members to devote more effort to improve the diversified curriculum exam and provide strong support using a three-fold method.

### 1. Perfect system guarantee

Staff members follow the learning process and evaluate their respective learning effects. The functional management team should provide macro guidance and management, ensuring the validity and quality of the curriculum reform direction and the fairness of assessment work. The teaching management system and regulations (including performance calculation, student status management, and examination management) are coordinated and docked in the actual management and operation process. Our college has developed a handbook for students in electronic information engineering and a staff manual; the two manuals cover the relevant systems and regulations for academic advancement, degree awarding and academic integrity. At the same time, in order to implement the orderly monitoring of all aspects of teaching quality, the Glasgow College lecture system, teaching reform and research implementation plan, evaluation standards, student evaluation system, and teacher-student joint meeting system are all formulated.

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Treating students as the center of learning, our college places great emphasis on the learning experience of students and the achievement of learning goals [4-8]. A multi-channel, all-round information collection and feedback mechanism, information collection and feedback channels are established through academic committees, examination committees, staff-student associations, staff members, and students' symposiums and special seminars. Those channels ensure information collection is not only focused on the current student but also on each students' further studies and respective employers, to ensure that the revision of the syllabus will have a better goal of cultivating innovative talent.

## 2. Faculty development

The teaching staff is required to be transformed from traditional infusion teaching methods to heuristic, seminar-based teaching and active learning methods, giving full play to subjective initiative and mobilizing the interest of students in learning. Encouraging students to independently discover and solve problems based on their existing knowledge level and ability level, members of staff will encourage students to self-reflect through targeted questioning and guide students to explore creatively. Secondly, with sufficient postgraduate teaching assistants, the experimental course for 40 students may be equipped with 2 to 3 teaching assistants. The comprehensive experiment in most professional courses of the college requires students to spend a lot of time to complete the task. For these special comprehensive design experiments with certain difficulty, the teaching assistant's time schedule is flexible. Students who have questions can contact the teaching assistant at any time.

## 3. Convenient resource platform

In order to ensure the smooth implementation of teaching and oversight of effective independent learning, the college promotes the construction of online curriculum resources, specialized laboratories and the opening lab. Making full use of online interactive learning platforms, all staff members are required to upload the teaching objectives and methods of course assessments in the on-line system, and publish specifications, related course materials and post-class review advice. In addition, many courses also implement online job submission, online quizzes, online course forum. At the same time, in order to ensure independent experimentation and study, some lab sessions provide convenient experimental conditions, with the tools and software used in experiments that are designed to be as close as possible to those used in industry. One open management system includes the establishment of an information-based access control management system

using registration card systems. Open experiment and personalized learning programs provide a convenient environment for innovative practices, providing support for the implementation of diverse curriculum assessment.

By deploying active learning at a programming level, assessment and teaching can be carried out simultaneously, which is a process of assessment while teaching, such as found in the "Embedded Processors" course (see Table 1 ): for example, in the 9th week, each group will meet with the teacher for 30 minutes. In the 11th week, the teacher will make an appointment for teams that have underperformed, according to the layout of the PCB layout submitted by the students, and then will give an evaluation according to the situation completed by the students. Each team member give 2 minutes of a presentation, followed by a questioning (Q&A) session, an experimental notes display session, and a demonstration of experimental work. In general, students will be examined in their understanding of foundation knowledge, but the emphasis will be placed on the practical ability of students, and the ability to understand, debate and problem-solve.

In the consecutive year, students will already have a certain professional foundation, and the practical course will require members to work together to complete a project in a project-driven course "Team Design Project (TDPS), with the course expanded to include project development steps and electronic design theory as teaching orders. Then it develop into the process of student-centered projects in order to guide students to learn by active, hands-on participation.

After these various methods of assessment, students will no longer blindly regurgitate theory and memorized knowledge, but will have the skills allowing the combination what they see, hear and do to facilitate thinking, problem-solving, the enhancement of confidence, enthusiasm for learning, and practical skills. The role of staff members in project-based teaching is to provide counseling and support, imbuing students with the necessary information and methodology to enable students to think and solve problems. When arranging course tasks, the curriculum arrangement will be made succinct and transparent, with assessment criteria and evaluation systems distributed widely so that students can understand the training objectives and main investigation capabilities that are to be achieved. Assessing the different roles and work done by each member of group during the evaluation of the progress is generally to be completed by the teacher or by peer-review, rewarding outstanding students and highlighting underachieving students or groups. The

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assessment of the course adopts a two-level evaluation system, which is to determine the course results by means of internal group evaluation and competition between groups. This not only promotes healthy competition amongst students, but also enhances the

enthusiasm and self-motivation of students participating in the group. At the same time, it also improves the sense of cooperation among students and also reflects the fairness of the assessment.

**TABLE 1. course evaluation trace node**

Stage task	Deadline	Assessment	Assessment Method
Analog/digital circuit design section	April	System function block diagram, schematic, simulation, project budget	On-line quiz
Board design	May	System design and report on the simulation	On-line questions
System design	June	Software development, demo	demonstration

## EVALUATION

Through this form of holistic active learning, student interest can be maximized, increasing levels of engagement and thus opportunity for learning, with collaboration, communication and verbal expression at its central ethos. In last year's 3rd year cohort, TDPS assessment include 20% test (read 2 typical scientific papers, respectively give abstracts and paper conclusions), 30% assignments (15% individual review report and experimental record, 15% team review report), and 50% project design (25% mid-term and final project evaluation, 25% individual and team design reports, and project reporting).

We conducted a survey regarding our approach: 85% of students agree that the forms of assessment have been diversified, commenting that the assessment time is full, the assessment content is scientific, and the assessment information is transparent. Students believe that these approaches allow the application of theory to practical uses and stimulate innovation in students, improving attainment even in the final exam. In short, the introduction of the concept of process management into the design process of the experimental course management is an important manifestation of our integration approach, which focuses on the management of the teaching process, thus urging the students to pay more attention to the whole process of the experiment and the experimental method. We noted that this is an evaluation method that emphasizes process assessment, requiring a lot of time and effort from the teacher; however, the supportive atmosphere for implementing active learning process management is formed throughout the school using assessment management - people-oriented, scientific management to support an atmosphere of active learning.

## CONCLUSION

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Assessment methods or open-book examination papers usually do not allow students to study for transfer skills, which can instill an institutionalized attribute of poor attitude. Exploring active learning in a holistic way has provided a platform to cultivate the spirit of exploration, innovation and practical talent in students, using the "baton" of the examination to play a crucial role in the cultivation and enrichment of academic achievement. The implementation of this diversified curriculum and evaluation system allows students to discover their usual learning problems and shortcomings, and through active learning aims to solve problems and alleviate insufficiencies: the average pass rate of last four years has increased from 85% to 90%, with 99% of 2019's graduates finding employment in graduate jobs, evidence that active learning approaches help students learn more effectively than traditional approaches.

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