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A Win-Win Undergraduate Graduation Design Model for Students, Teachers, and Training Platforms

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Abstract: Undergraduate graduation design is an important link in the process of undergraduate training, and university platforms have invested a lot of manpower and material resources for this purpose. However, while carrying out student training, it has gradually become the consensus of most university platforms to achieve a win-win situation for teachers and training platforms in order to achieve optimization of resource allocation and motivation of student training. After discussion and practice, this paper proposes a set of undergraduate graduation design training concepts and training modes with a win-win situation for students, teachers, and training platforms.

Keywords: Graduation design; Thesis; Undergraduate teaching; Research project; Platform construction

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1. Introduction

Graduation design is an important learning and practice process for students in higher undergraduate colleges and universities, and it is an essential link that all undergraduates and most grassroots teachers must experience. Graduation design is not only an important way for undergraduates to achieve personal competence improvement but also may become a critical resource for instructors and training platforms. It has been pointed out that the integrated education of teaching and research has the characteristics of "cultivating high-level talents, engaging in high-level research, and integrating talent training and scientific research simultaneously" [1]. Therefore, the win-win model for students, teachers, and training platforms is a high-yield training model expected by all undergraduate training systems. However, in the reality of talent training in colleges and universities, several issues persist. For instance, students are frequently assigned low-skilled and simplistic tasks when emphasis is placed on efficient benefit acquisition by teachers and platforms. Additionally, students may overutilize the resources of teachers or development platforms when there is a focus on comprehensive student cultivation. In this regard, we have initiated a discussion on the model of undergraduate graduation design, collected the demands of students and instructors, formulated a win-win scheme for students, teachers, and training platforms, and carried out the

discussion and trial implementation of the scheme, which has achieved good practical results.

This graduation design model takes the graduation design of undergraduates in the field of life sciences as an example. Starting from the needs of teachers' research projects and platform construction, the model adopts the concepts of "tailoring to local conditions" and "tailoring to the needs of individual students," and comprehensively cultivates students' scientific research skills, innovation ability, and interest in scientific research. This training mode is mainly applicable to experimental platforms in universities with demand for research projects and platform construction, but relatively short of postgraduate human resources. The training ideas and processes are described as follows.

2. Understanding students' demands and guiding their interests

In the traditional graduation design training mode, due to the majority of undergraduate students having little understanding of laboratory work, scientific research is still stuck in the lower stage of understanding, students often cannot quickly put forward the feasibility and research value of the topic. When students are pressured to select their own topics under these conditions, their choices are frequently influenced by superficial "interest" rather than genuine research potential [2]. Practice has also proved that the scientific research value and practical feasibility of students' completely independent design of the topic are generally low, and it is difficult to achieve the real purpose of personnel training, and even kills the students' interest in scientific research.

The cultivation of students' innovation ability should be based on a certain amount of practical experience, a kind of spontaneous exploration combined with the existing objective conditions. Therefore, we do not recommend overly requiring students to be "innovative" before they have really established enough "practical experience." When students first enter the lab, we can take into account students' future plans and set the initial training direction. At the same time, we actively collect feedback from students to understand the role they can play in research projects and platform construction, and make positive guidance.

3. Cultivating students' basic skills in the context of platform construction

Relevant researchers have pointed out that scientific research topics should be combined with scientific research and laboratory construction, and efforts should be made to do real work in order to mobilize teachers' enthusiasm for guidance and strengthen students' sense of responsibility and problem-solving skills [3]. However, due to the different experimental designs of students, instructors often need to carry out a lot of repetitive training, which is time-consuming and labor-intensive.

For the above problems, we try to modularize the commonly used techniques of the platform. In the process of capacity development, undergraduate students adopt assembly-line operation, which accumulates a large amount of basic research materials for the experimental platform in a short period of time. At the same time, due to the high-density repetition of a single experimental technique, students quickly become "experts" in the corresponding technology. Some excellent students even optimized the experimental operation scheme independently on the basis of a large number of modular works, which improved the experimental efficiency, reduced the experimental cost, and greatly promoted the construction of the experimental platform. On the whole, this modular training method, with high efficiency, has made students integrate into the laboratory, get used to the working rhythm of the laboratory, and cultivate practical problem-solving skills while mastering a basic experimental technique, thus realizing the efficient enhancement of students' basic scientific research skills.

4. Topic selection and competence strengthening in conjunction with research projects

After completing the modular skills training of a group of undergraduates, the topic selection can be carried out for students. The selection of topics is a prerequisite for students to complete their graduation design with high quality, which needs to be strictly controlled by instructors. The mode of topic selection with the general direction of the scientific research project that the instructor is currently presiding over or participating in has been verified by educators through a lot of practice [4-6]. This method has a number of practical advantages for both teachers and students: (1) it can greatly improve teachers' motivation to supervise because it involves the smooth progress of the supervising teacher's scientific research project; (2) the consumption of reagents and consumables can be converted into real and useful experimental data with different efficiencies, which saves a large amount of non-scientific value of the funds for undergraduate training; (3) the experimental data can become a part of the scientific research results, which can be reflected in students' curriculum vita, and this has a great effect on their motivation.

After selecting the topic, teachers need to assist students in the preliminary development of specific experimental programs. Since the specific experimental techniques have already been optimized in the modular training process, they can be completed by the students through mutual learning and assistance, so that they can learn more experimental techniques in a shorter period of time. In addition, this method also avoids the duplication of training of different students by instructors and saves the training energy of instructors; the effective guidance of students to their peers also improves the self-efficacy of students, which greatly improves the sense of cooperation and the effect of comprehensive training of students.

In addition, in the work of topic selection, we should reasonably view the phenomenon of "many people working on one topic" [7]. Undergraduates should manage their expectations, as excessive experimental challenges can significantly diminish their enthusiasm for research. Having similar experimental research programs for the same group of students can foster mutual discussion and encourage independent problem-solving. However, it is crucial to ensure that the selected topics are only "similar" and not identical and to avoid overly similar experimental designs, in order to prevent the issue of students merely replicating each other's work.

5. Free exploration oriented to the cultivation of innovation ability

It has been pointed out in the literature that at present, China's college students have generally weak concepts of innovation and desire for innovation, and even if there is innovation, they often lack the corresponding innovation skills [8]. In practice, we also found that after students complete the main body of the graduation design work, they no longer independently carry out in-depth exploration of the subject. After research, the main reasons for undergraduate students' difficulty in taking the initiative to carry out innovative exploration are as follows: (1) Poor foundation: With an insufficient reading of relevant literature, they do not know how to design a practical research program; (2) Insufficient motivation: After having completed the graduation requirements, they do not know the practical significance of continuing exploration, thus resulting in a reduction of subjective initiative; (3) Insufficient time and energy: Colleges and universities usually start the graduation design at the end of the first semester of the fourth year [9], at this time, students are mostly looking for a job, preparing for graduate school, etc., so it is more difficult to allocate adequate energy to the innovative exploration that requires a lot of energy.

In view of the above problems, we put forward the following suggestions to solve them: (1) Integrating the cultivation of comprehensive scientific research skills and innovation ability into the whole training process of undergraduates. Undergraduates can be invited to participate in the work report of postgraduates; when postgraduates report the literature, undergraduates can also participate in the scientific research literature reporting activities in groups; (2) The motivation for innovation and exploration can be solved by conversation in general.

It is recommended that instructors guide from the perspective of talent training and encourage students to learn more and do more, so as to accumulate more experience for future scientific research; (3) For the issue of students' schedules, there are generally no mandatory work requirements. However, in order to ensure the quality and quantity of the completion of the graduation design, the graduation design content still needs to be arranged as early as possible, and students are actively encouraged to rationally arrange their time and energy.

The difficulty of completing the free exploration phase is relatively high, and it is important to acknowledge students' tendency to seek refuge during the process of developing their innovation skills. Since undergraduates are still maturing, they often lack patience for experiments that do not yield immediate results and are prone to giving up easily. Therefore, teachers must play a crucial role as gatekeepers in students' innovative design projects, actively guiding them to learn independently to maximize the success rate of their projects. Teachers themselves need to maintain patience and confidence, engage in discussions with students to refine their projects, and help students reflect on their experiences to sustain their enthusiasm for scientific research.

6. Conclusion and reflection

In this paper, through the real practice exploration of undergraduate graduation design combined with scientific research projects and platform construction, a set of undergraduate graduation design programs for students, teachers, and training platforms with the demand for scientific research and platform construction has been concluded as a win-win situation for students, teachers, and training platforms. The program starts with repetitive basic experimental techniques, which helps undergraduates to integrate into the laboratory efficiently and build their research confidence quickly; the combination of the project design and research projects enhances the teachers' motivation to guide and students' motivation to explore. Through this program, students can accumulate experimental experience, improve their problem-solving skills, and exercise their scientific research quality and innovative consciousness more efficiently; the instructors can promote the progress of their own scientific research projects faster and better; and the experimental platform can accumulate a large amount of basic materials needed for the subsequent research in this way.

One of the most important constraints to the promotion of the program is the limitation of the progress and efficiency of undergraduate graduation design to the platform construction and the progress of instructors' projects. Therefore, the program also requires a higher sense of responsibility on the part of the instructors. The "sense of responsibility" not only represents the teachers' attitude towards scientific research but also represents the high standard and strict control in the process of supervising graduation design [10]. In the whole process of graduation design training, teachers should pay attention to students, communicate well with the subject, and listen to students' opinions regularly. For the difficulties and setbacks faced by students, timely adjustment of the subject design is necessary, providing more positive guidance for students. In addition, when the innovative design of students is beyond the scope of the instructor's scientific research projects, the instructor can also actively listen to students' ideas, encourage students to consult the literature, and provide some financial support when necessary. The instructor must also act as a gatekeeper to prevent students from becoming too diffuse in their thinking. Teacher-student communication is a crucial component in developing students' scientific research skills. Teachers' attention and support serve as a direct motivation for students to engage in research and pursue their scientific inquiries.

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