



## Reform and Practice of Whole Process Management for Undergraduate Thesis (Design) Based on OBE Concept

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**Abstract:** The undergraduate thesis stage plays a vital role in realizing talent cultivation goals, serving as an indispensable requirement for students to graduate and be awarded their bachelor's degrees. Moreover, it provides crucial support for meeting graduation requirements. This article presents a comprehensive approach to process management for undergraduate thesis (design) based on the Outcome-Based Education (OBE) concept. The OBE concept emphasizes enhancing students' goal achievement abilities by strengthening the monitoring of task completion quality and evaluating goal attainment at each stage. The approach encompasses four key stages: topic selection, guidance process, evaluation methods, and thesis defense. Lastly, the effectiveness of this approach will be discussed. It has been observed that the implementation of the OBE concept has yielded favorable outcomes in practical work.

**Keywords:** *OBE Concept, Undergraduate Thesis (Design), Whole Process Management, Measures.*

### 1. Introduction

The undergraduate graduation thesis is a critical component of achieving the goals of talent cultivation. It is a requirement for students to graduate and be awarded a bachelor's degree. It also

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serves as a significant support for assessing the achievement of graduation requirements. The undergraduate graduation thesis (design) represents the comprehensive academic achievements of students at the undergraduate level, reflecting their theoretical knowledge and practical abilities in their respective majors. The quality of the graduation thesis significantly demonstrates the quality of talent cultivation.

In 2018 and 2019, the Ministry of Education held a National Conference on the Work of Undergraduate Education in Higher Education Institutions in the New Era and issued several vital documents on undergraduate thesis [1-4]. Among them, the "Opinions of the Ministry of Education on Accelerating the Construction of High-Level Undergraduate Education and Improving the Ability to Cultivate Talents" [3] clearly stated the need to strengthen the entire process management of the selection, opening, defense, and other links of graduation thesis (design), and to improve the form, content. Strictly monitor the difficulty level and improve the quality of graduation thesis (design). Literature [4] once again emphasized the importance of "scientifically and reasonably formulating requirements for undergraduate graduation thesis (design), strictly managing the entire process, and seriously handling various academic misconduct". To implement the "Overall Plan for Deepening the Reform of Education Evaluation in the New Era" and the "Opinions on Deepening the Reform of the Education Supervision System and Mechanism in the New Era", strengthen and improve the evaluation and monitoring of education supervision, and ensure the basic quality of undergraduate talent cultivation, the "Sampling Method for Undergraduate Graduation Thesis (Design) (Trial)" [5] will be implemented from January 1, 2021, this measure imposes strict requirements, particularly on the sampling inspection of graduation theses, which can prompt universities to innovate their undergraduate education concepts and practices timely.

Implementing the OBE concept [6] aims to cultivate students' spirit of independent thinking, the pursuit of truth, and innovation, enhance their ability to apply foundational theories and professional knowledge to solve real-world problems and develop their practical and scientific research abilities. To achieve these teaching objectives and ensure the quality of talent cultivation, active exploration and practice of reforming the full-process management of graduation theses (designs) have been carried out, yielding certain results in relevant majors within the college. Since OBE's appearance, it has been applied to various course designs (including graduation thesis (design)). Most research is mainly focused on two aspects: one is the Construction of a Practical Teaching System [9,11,12,13], and the other is the teaching reform of a related postgraduation thesis (design) based on OBE concept [7,8,10,14,15,16,17,18]. As thesis management is an essential process for improving and ensuring the quality of talent cultivation, it is necessary to investigate the reform of the thesis's entire process management based on the OBE concept.

## **2. Existing issues**

In recent years, through participating in the management, evaluation, and defense of undergraduate graduation theses, the following problems have been identified:

**1. Lack of standardized thesis topics:** In the past, thesis topics were mainly centered around the research areas and issues of the advisors, and many of them were self-proposed without standardized criteria. The topics completely disregarded the desired learning outcomes for the discipline and were often disconnected from societal and practical production needs.

**2. Low level of importance attached:** Many students do not attach sufficient importance to their graduation theses, lacking motivation and adopting a mentality that they can graduate regardless of the quality of their work. They fail to properly consider the relationship between their graduation theses and their future employment, which leads to poor time management and a superficial attitude toward their theses. Some advisors also lack a sense of responsibility and fail to provide adequate guidance, resulting in poor outcomes in the final graduation theses.

**3. Limited evaluation methods for graduation theses:** The evaluation is primarily based on the weighted scores of the advisors, reviewers, and defense committees. The process lacks detailed formative assessment criteria, and there is a need for further refinement in assessing students' non-professional abilities.

**4. Inadequate process management and quality control:** The entire process of a graduation thesis, from topic selection to defense, is a complete system. However, the process management system is not effectively implemented, making it difficult to obtain timely information about students' progress at each stage and the guidance provided by advisors. Quality control lacks specificity.

### **3. OBE-guided management model for the entire process of graduation thesis (design)**

"OBE emphasizes outcome-based backward design, student-centered teaching methods, and periodic evaluation. The entire graduation thesis (innovation) process forms a complete system, from topic selection to research to evaluation. Implementing the graduation thesis (design) fully embodies the concept of outcome-based education (OBE). It centers around students and effectively evaluates their achievements in various aspects of the graduation thesis (design). By adjusting the formulation of course objectives based on students' achievements, the OBE concept can be integrated into the entire process of the graduation thesis (design) and promotes continuous problem discovery and improvement by teachers and students during the implementation of the graduation thesis (design), thereby enhancing the quality of the graduation thesis (design) and promoting the overall quality of higher education.

Following the requirements of the Ministry of Education for graduation thesis (design) and the "Sampling Method for Undergraduate Graduation Thesis (Design)" which evaluates the elements of

undergraduate graduation thesis (design), as well as the existing issues in graduation thesis (design), the OBE concept is applied to reform and practice the management of the entire process of graduation thesis (design). This management model deeply integrates the OBE concept into the graduation thesis (design) implementation. The process management mainly includes four parts: (1) Goal setting, determining the learning outcomes students are expected to achieve; (2) Topic review, explaining the reasons for students to achieve these learning outcomes; (3) Process evaluation, effectively assisting students in achieving these learning outcomes; (4) Result feedback: assessing whether students have achieved these learning outcomes. The entire management process of the undergraduate graduation thesis (design) is shown in Figure 1, which is highly rigorous, with strict reviews at each stage, especially during the topic proposal stage, to ensure effective management from the source.

To comprehensively implement the fundamental task of moral education and stimulate students' interest and potential in learning, it is necessary to deepen the teaching reform of the graduation thesis (design) section, strengthen the overall process management of topic selection, proposal, and defense, strictly monitor the format, content, and difficulty, and improve the quality of graduation thesis (design) and ensure that our undergraduate graduation thesis (design) meets the requirements of the "National Standards for Teaching Quality of Undergraduate Programs in Regular Higher Education Institutions" and professional accreditation, effectively achieving the needs of professional training objectives. The standardization is carried out in the following four aspects."

First. Topic selection for graduation thesis (design). The proposed topics must be based on the objectives of the graduation design course. During the topic proposal stage, the supervising teacher needs to understand the supportive role of graduation design in the overall talent cultivation system of the relevant field. When proposing topics for graduation design, the topics should be based on the required abilities that students should achieve. Each course objective should be accompanied by corresponding graduation thesis (design) tasks and requirements that support the course objectives. It is important to avoid simply selecting topics from research projects or randomly creating topics. The supervising teacher must provide complex problems rather than simple validation tasks. Additionally, the content of the graduation thesis (design) should reflect the principles of integrating teaching with practical education, production, scientific research, culture, and economy. While meeting the quality standards of graduation thesis (design), it should closely align with practical education, scientific research, modern culture, economic development, and new technologies in the field. The graduation thesis (design) should reflect the level of development in modern science and technology and encourage the cross-pollination of knowledge from different disciplines. Finally, the proposed topics need to undergo a hierarchical review process involving the supervising teacher, the

department, the program director, and the college. The review focuses on engineering feasibility, complexity, advancement, and alignment with societal development trends. A certain proportion of topics (not less than 50%) are encouraged to come from practical internships to ensure that the thesis topics are practical. External thesis advisors, such as research personnel or engineering and technical professionals from companies, as well as educational internship supervisors, should be invited to guide the graduation thesis (design) outside the university.

Second. The guidance for graduation thesis (design). The process guidance is more scientific. The process guidance for graduation thesis (design) is divided into six parts: task assignment, proposal stage, regular assessments, mid-term review, thesis evaluation, and oral defense. Each part has quantifiable indicators for evaluation. For example, in regular checks, the student and the supervising teacher should meet at least weekly. Every two weeks, the student must submit a written report on the progress of the graduation design. The supervising teacher evaluates these reports and assigns scores accordingly. There is also a feedback process to improve subsequent guidance for the graduation thesis (design). The mid-term review evaluates students based on their performance, design (development) abilities, literature review, foreign language translation, and overall progress.

The final grade for the graduation thesis (design) is calculated based on the scores of the supervising teacher, the thesis evaluator, and the oral defense committee, each with their respective weight coefficients. The weight coefficients are determined scientifically and reasonably based on the requirements of each field. The supervising teacher's score is determined by attendance, attitude towards learning and work, research skills, independent work abilities, task completion, research or experimental skills, analysis and research or engineering design skills, and data processing abilities. It is recommended to assess the student's performance, proposal report, mid-term review, and thesis quality in proportion when assigning scores. The thesis evaluator's score is based on factors such as the student's research and argumentation, foundational theory and professional knowledge, technical skills and practical abilities, workload, accuracy of calculations, advancement of the proposal, logical reasoning, accuracy and reliability of data, quality of drawings, and research results. The oral defense committee evaluates the student's thesis quality, group acceptance, and the completeness of the oral defense report within the specified time. The passing criteria for the final evaluation of the graduation thesis (design) are a score of 60 or above for both the thesis evaluation and the oral defense. Students with scores above 60 but relatively low scores in the oral defense will be re-evaluated and have a second defense. The supervising teacher and the thesis evaluator provide advisory scores, and after the oral defense, the oral defense committee determines the final score. The professional defense committee ensures the balance of the overall graduation thesis (design) scores, with the proportion of excellent grades not exceeding 20% and the proportion of good grades not exceeding 50%.

Except for the regular assessment, which the supervising teacher evaluates, all other stages involve cross-evaluation and ensure a fair and impartial oral defense process. Therefore, the student's thesis grade is determined based on the actual situation of the thesis (design) and its authenticity.

Third. Refine and optimize the diversified assessment methods for the graduation thesis (design). According to the "Evaluation Criteria for Undergraduate Graduation Design (Thesis) at Neijiang Normal University," the thesis grade is jointly determined by the supervising teacher, thesis evaluator, and defense committee—the sub-scores of each component account for a certain percentage of the overall evaluation grade. After the defense, students are required to submit their completed graduation thesis (design) and related materials to their supervising teacher. Those who meet the criteria can apply for inclusion in the compilation of "Outstanding Graduation Theses (Design) by Neijiang Normal University Undergraduates." The materials must be revised according to the requirements of the "Writing Standards for Outstanding Graduation Theses (Design) by Neijiang Normal University Undergraduates" and submitted to the Academic Affairs Office within the specified time for compilation. The college should submit the students' graduation thesis (design) grades to the Academic Affairs Office within the specified time. After the grades are reviewed and confirmed to meet the school's requirements, the information will be recorded in the students' academic records. After the defense, the university will conduct random plagiarism checks on a sample of students, with a target of 10% of each class, using computer-generated random selection. Handling plagiarism check results will follow the "Implementation Rules for Dealing with Academic Misconduct in Degree (Graduation) Theses at Neijiang Normal University" guidelines. After completing the graduation thesis (design) work, each college and major should conduct a thorough summary. The supervising teachers are required to analyze the achievement of course objectives in the graduation thesis (design) teaching syllabus for their respective majors. Additionally, each major should analyze the achievement of course objectives for their field's graduation thesis (design).

Fourth. Some works after the defense. (1) Students should organize and submit their graduation thesis (design) outcomes and materials to their supervising teacher. Those who meet the criteria can apply for inclusion in the compilation of "Outstanding Graduation Theses (Design) by Neijiang Normal University Undergraduates" and revise their materials according to the requirements of the "Writing Standards for Outstanding Graduation Theses (Design) by Neijiang Normal University Undergraduates." These revised materials should be submitted to the Academic Affairs Office within the specified time for compilation. (2) The college should submit the students' graduation thesis (design) grades to the Academic Affairs Office within the specified time. After the grades are reviewed and confirmed to meet the school's requirements, they will be recorded in the students'

academic records. (3) After the defense, the university will conduct random plagiarism checks on a sample of students. The list of students subject to plagiarism checks will be generated from those who participated in the graduation defense that year. In principle, a random sample of 10% of each class will be selected using computer-generated random selection. Handling plagiarism check results will follow the "Implementation Measures for Dealing with Academic Misconduct in Degree (Graduation) Theses at Neijiang Normal University" guidelines. (4) After completing the graduation thesis (design) work, each college and major should conduct a thorough summary. The supervising teachers must analyze the achievement of course objectives in their respective majors' graduation thesis (design) teaching outline. Additionally, each major should analyze the achievement of course objectives in the graduation thesis (design) specific to their field.

Fifth. Establishing standardized mechanisms guides the responsibilities of college leaders, teachers, and students in implementing undergraduate graduation theses.

Requirements for colleges: Each department should regularly organize inspections of the major stages of graduation theses: (1) Proposal stage: Focus on whether the principle of "one person, one topic" is implemented, the arrangement of topics, the completion of task sheets, and the progress of proposal reports. (2) Mid-term check stage: Focus on students' learning attitudes, work progress, the guidance provided by advisors, and issues in the graduation thesis work. Improvement requirements should be issued for students who have not met the progress and quality requirements or have violated relevant regulations. (3) Defense qualification review stage: Organize defense committees and advisors to strictly review the process management, academic standards, and quality of students' graduation theses and provide review comments.

Requirements for majors: (1) Organize the mobilization of graduation thesis work and review the appropriateness of thesis topics based on the objectives of professional training and the requirements of the graduation thesis teaching outline. Topics that do not meet the criteria should be revised or not adopted and reported to the department's graduation thesis working group. (2) Under the department's arrangement, organize students' topic selection work, complete it before the formal start of the graduation thesis, and report the topic selection situation to the college. (3) Check the completion of task sheets for graduation theses. (4) Conduct inspections at various stages of graduation theses, promptly address issues that arise during the teaching process, and conduct research. (5) Assess the work of advisors. (6) Randomly check the "Formatting Guidelines for Undergraduate Graduation Theses at Neijiang Normal University" implementation in the major. (7) Review students' eligibility for graduation thesis defense. (8) Organize graduation thesis defense and evaluation. (9) Select outstanding graduation theses in the major. (10) Conduct a comprehensive summary of the graduation thesis work in the major and evaluate the achievement of course objectives based on the teaching outline for the graduation thesis in the major.

Requirements for advisors: Advisors should adhere to the "student-centered, strict requirements" principle and focus on inspiring students' thinking and mobilizing their initiative and creativity. Specific responsibilities include: (1) Develop graduation thesis topics according to the objectives of professional training and the requirements of the graduation thesis teaching outline. Carefully fill out the graduation thesis task sheet and distribute it to students before the start of the graduation thesis. Prepare for the early teaching work guiding graduation theses, such as research, literature materials, books, tools, experimental equipment, etc. Develop a detailed schedule and work plan for the graduation thesis (guidance time, location), task sheet, and work procedures. (2) Guide students to understand the thesis's tasks, objectives, requirements, and all work content. Develop a work plan and guide students in preparing the proposal report. Conduct necessary reviews of students' overall plan design, experimental or survey plans, data processing, and theoretical or experimental analysis, and provide careful guidance. (3) For topics undertaken by multiple students, students should participate in the overall plan demonstration and independently complete the required workload. (4) Provide guidance and answer questions to students at least once a week. Check the progress and quality of students' graduation theses and conduct mid-term checks, pointing out issues and providing improvement suggestions. Fill out the "Record of Guidance for Undergraduate Graduation Theses at Neijiang Normal University." (5) Review and provide feedback on each graduation thesis (including translation of foreign literature) according to the requirements of the task sheet and the "Formatting Guidelines for Undergraduate Graduation Theses at Neijiang Normal University." (6) Review students' eligibility for graduation thesis defense. (7) Provide a course achievement evaluation form for each student based on the teaching outline for the graduation thesis in the major.

Requirements for students: (1) Carefully read and understand the tasks and requirements specified in the "Task Sheet for Undergraduate Graduation Theses at Neijiang Normal University." Under the guidance of teachers, develop a schedule and make necessary preparations. (2) Follow the schedule, write the design report (thesis) according to the "Formatting Guidelines for Undergraduate Graduation Theses at Neijiang Normal University," and ensure the completion of the graduation thesis on time, with quality and quantity. (3) Respect and cooperate with teachers and relevant external advisors, and listen carefully to their guidance. (4) Strictly abide by discipline and conduct graduation thesis work at designated locations. Follow the procedures to ensure personal safety and the safety of equipment. (5) Maintain a scientific attitude, adhere to academic ethics, and avoid plagiarism and falsification, including downloading other people's theses from the internet. (6) Keep complete records of guidance for the progress of the graduation thesis, conduct periodic summaries, and regularly report the progress of the thesis to the advisor (at least once a week). Every two weeks, students should submit a written report on the progress of their graduation thesis.



Advisors should provide face-to-face guidance to students at least once every two weeks. (7) Students should complete the work of the proposal report, including literature review, translation of foreign literature, proposal report, overall plan, and schedule for the graduation thesis. Students should read at least two professional foreign literature materials related to the thesis topic, which should also be included in the references of the graduation thesis. The content should be combined with the graduation thesis topic, and a literature review should be written. (8) Graduation theses should have clear viewpoints, well-founded arguments, scientific analysis, reliable results, clear logic, and fluent writing. Engineering graduation theses should have accurately drawn design drawings, well-prepared design reports, correct and clear drawings, reasonable and economical designs, concise and coherent reports, neat writing, and accurate calculations.

#### **4. Effectiveness of reform implementation**

Guided by the OBE concept, since 2021, the graduation thesis (design) course of mathematics and Applied mathematics has been taken as the pilot teaching reform, and the practical teaching management mode and assessment system have been improved while implementing, which has been successfully applied to the quality control management of graduation thesis (design). To give full play to the exemplary and leading role of outstanding students in the process of graduation thesis (design), the quality of graduation thesis of mathematics and Applied mathematics majors has gradually improved, and the excellent rate of the thesis has increased from 12% to 22% in 2020. A batch of high-quality, excellent graduation thesis (design) has stood out, playing a leading and reference role in controlling the quality of graduation thesis (design) of other majors in the college. The assessment and evaluation system based on the OBE concept is based on the idea of goal orientation and process control, which decomposes assessment indicators into various stages of graduation design and implements phased quality monitoring. According to the characteristics of undergraduate theses in mathematics majors, at different stages of graduation thesis design, qualitative assessment should be transformed into quantitative evaluations as much as possible, and corresponding assessment standards and weights should be formulated for each assessment content. From the implementation effect of the 2022 and 2023 Mathematics and Applied mathematics graduates, the purpose of improving the quality of the graduation thesis (design) has been achieved.

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