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Analysis of the Logic and Problems in Course Objective Design under Engineering Education Accreditation: A Qualitative Research Perspective

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Abstract*—Under the background of engineering education accreditation, the design of course objectives is crucial for achieving graduation requirements and cultivating students' ability to solve complex engineering problems. However, many university teachers face difficulties in designing logical, measurable, and outcome-oriented course objectives. This paper, based on the theoretical framework of metacognition, adopts a qualitative research method and conducts in-depth interviews with eight university teachers (including master teachers, experienced teachers, and novice teachers) to explore their cognitive processes, emotional experiences, and reflective monitoring in designing course objectives. The study reveals common problems: copying objectives from high-level universities, lack of alignment with graduation requirements, vague and unmeasurable descriptions, and confusion between teaching content and student outcomes. The findings provide practical insights for improving course objective design in computer science education.*

***Keywords*—** *Course Objective Design; Engineering Education Accreditation; Qualitative Research; Outcome-based Education; Metacognition.*

I. INTRODUCTION

Engineering education accreditation, based on the Washington Accord, requires that all course objectives must support the achievement of graduation requirements, with a clear focus on student outcomes (Outcome-Based Education, OBE) [1, 2]. The core of accreditation is to ensure that students graduating from engineering programs possess the ability to solve complex engineering problems. Course objectives serve as the bridge between graduation requirements and classroom teaching. They must be specific, measurable, achievable, and clearly linked to the competencies that students are expected to demonstrate [3, 4].

However, many engineering teachers still experience difficulties in translating abstract graduation requirements into assessable learning outcomes., especially in designing logical and effective course objectives. Common problems include: copying course objectives from textbooks or high-level universities without adaptation, writing objectives that are too vague to measure, confusing knowledge-based goals with competence-based outcomes, and failing to align objectives with graduation requirements. These problems directly affect the quality of teaching and the effectiveness of outcome-based education. Existing studies mainly focus on curriculum systems and accreditation standards, while teachers' cognitive processes and reflective experiences in objective design remain insufficiently explored. This paper uses qualitative research to answer two questions: (1) How do university teachers perceive and understand the logic of course objective design under engineering education accreditation? (2) What are the typical problems and challenges teachers face in designing course objectives, and how do their metacognitive processes influence their design practices?

II. RESEARCH METHODOLOGY

This study focuses on university teachers' metacognitive processes in designing course objectives for computer science programs. Following the qualitative research paradigm, we adopted semi-structured interviews and textual analysis of teaching syllabi. A participatory study was conducted over six months with nearly 22 teachers from Anqing Normal University and other programming courses in Anhui Province. Based on preliminary observations, we selected eight representative teachers for in-depth interviews. The selection covered three types: master teachers (recognized for teaching excellence), experienced teachers (more than 10 years of teaching), and novice teachers (less than 5 years). The specific information is shown in Table I.

TABLE I. Information about the teacher interviewed.

Teacher	Gender	Years of Teaching	Title	Type of Teacher
A	Male	18	Professor	Master teacher
B	Male	22	Associate Professor	Experienced
C	Female	12	Associate Professor	Experienced
D	Male	8	Lecturer	Experienced
E	Male	3	Lecturer	Novice
F	Female	2	Lecturer	Novice
G	Female	20	Professor	Master teacher
H	Male	5	Lecturer	Novice

Each interview lasted 40- 60 minutes. Teachers were asked to provide their course syllabi and explain how they designed the course objectives, how they linked them to graduation requirements, and what difficulties they encountered. To improve the trustworthiness of the findings, all interview data were transcribed verbatim and repeatedly reviewed during thematic coding. The coding categories were continuously refined through comparative analysis among the researchers. Through iterative comparison and discussion, the researchers

gradually established the three-dimensional analytical framework of metacognitive knowledge, metacognitive experience, and metacognitive monitoring.

A. Metacognitive Knowledge about Course Objective Design

Metacognitive knowledge refers to teachers' understanding of the principles, standards, and expectations for course objective design. The interviews revealed that most teachers had only a superficial understanding of the requirements of engineering education accreditation regarding course objectives.

Teacher A (master teacher): "I know that course objectives should support graduation requirements, but honestly, the graduation requirements are written in very broad terms. I just try to match my course content to some of the indicators. The connection is often intuitive rather than systematic."

Teacher B (experienced): "Our school organized training on OBE, but I still find it difficult to translate abstract graduation requirements into concrete course objectives. I usually look at what other universities have done and modify them slightly."

Teacher C (experienced): "I think the most important thing is that students learn the knowledge. The course objectives are just formalities for accreditation. As long as I cover the key topics, the objectives are automatically achieved."

Teacher E (novice): "I really struggle with writing measurable objectives. I don't know what 'analyze' or 'evaluate' really mean in terms of assessment. I often end up using verbs like 'understand' and 'master' because they feel safer."

Teacher G (master teacher): " The logic should be: graduation requirements → course objectives → teaching content → assessment. But many colleagues reverse this. They start with the textbook content and write objectives that simply describe what they will teach, not what students will be able to do."

Base on above interviews, a common feature of teachers' metacognitive knowledge is a lack of deep understanding of the logical chain from graduation requirements to measurable student outcomes. Most teachers tend to regard course objective design as a procedural requirement for accreditation rather than a pedagogical tool for competency cultivation. This reflects the persistence of traditional content-oriented teaching concepts in engineering education. Teachers are generally more familiar with knowledge transmission than with outcome-oriented curriculum design, which weakens the practical implementation of OBE concepts.

B. Metacognitive Experience: Confusion, Frustration, and Adjustment

Metacognitive experience refers to the cognitive and emotional feelings that accompany the process of designing course objectives. This study found that teachers, especially novices, frequently experience confusion, frustration, and even resistance when trying to design logical and measurable objectives.

Teacher E (novice): "I spent a whole afternoon trying to rewrite the course objectives for my programming course. I read the graduation requirements, but I couldn't figure out how to break them down. I felt very frustrated. In the end, I just copied from the template provided by the department."

Teacher H (novice): "When I first heard about 'measurable objectives', I thought, how can I measure whether a student has 'mastered' recursion? Do I just check if they pass the exam? But the exam questions only test a few examples. I was really confused."

Teacher D (experienced): "Initially, I thought OBE was just a new buzzword. I felt it was unnecessary because I have been teaching for years and my students have always done well. But as I attended more training, I realized that my traditional objectives were indeed vague. I began to see the value, but the transition is painful."

Teacher F (novice): "I tried to write objectives using Bloom's taxonomy. But when I showed them to my mentor, she said they were still too broad. For example, 'be able to write correct programs'—she asked, 'correct under what conditions? How many test cases?' I didn't know how to be more specific."

However, as teachers gained more experience and participated in group discussions, their emotional responses became more positive. Teacher A noted: "After we revised our program's curriculum map together, I finally understood how each course contributes to a specific competency. Now designing objectives feels more meaningful."

These interviews indicate that teachers' emotional experiences are closely related to their familiarity with OBE-oriented teaching logic. Novice teachers often experience anxiety because they lack systematic training in competency-oriented curriculum design, while experienced teachers tend to encounter cognitive conflicts between traditional teaching habits and accreditation requirements. The findings also suggest that collaborative curriculum discussions and peer communication can effectively reduce teachers' resistance and improve their understanding of outcome-oriented objective design.

C. Metacognitive Monitoring: Reflection and Self-Correction

Metacognitive monitoring involves teachers' ability to evaluate their own course objective design, identify problems, and make adjustments. The interviews revealed that while some teachers engage in deep reflection, many lack systematic monitoring strategies.

Teacher G (master teacher): "I always review my course objectives after each semester. I look at the student assessment results and ask myself: did the assessment actually measure what I claimed in the objective? If not, I revise the objective or the assessment method. This is a continuous cycle."

Teacher B (experienced): "I don't systematically check my objectives, but when students perform poorly on certain tasks, I realize that my objective might have been unrealistic or misaligned. For example, I once wrote 'students will be able to design a compiler', but after the course I saw that only a

few could. So I changed it to 'design key modules of a compiler'."

Teacher E (novice): "I never thought about reflecting on my objectives. I just assumed they were fine because they came from the template. But after this interview, I realize that I should compare my objectives with what I actually teach and assess. I will start doing that."

Teacher C (experienced): "There is a common mistake: writing objectives as teaching activities rather than learning outcomes. For example, 'to teach students the basic concepts of data structures' is wrong. It should be 'students can explain and compare different data structures and choose the appropriate one for a given problem'. I used to make this mistake myself. Now I catch it when I review my syllabus."

All teachers acknowledged that peer review or departmental review of course objectives is helpful for monitoring. However, in practice, such reviews are often superficial. Teacher D said: "The department asks us to submit our syllabi, but no one really checks if the objectives are logical. The feedback is just 'approved'. Therefore, there is no real monitoring mechanism."

These findings reveal that metacognitive monitoring in course objective design is still highly dependent on individual teaching experience rather than institutionalized quality assurance mechanisms. The absence of systematic peer review and feedback systems weakens the continuous improvement process required by OBE. Furthermore, teachers with stronger reflective awareness are more likely to revise objectives according to assessment outcomes, indicating that reflective teaching practice plays an essential role in improving curriculum quality.

III. Typical Problems in Course Objective Design

Based on the interview analysis and syllabus review, we identified five common problems in current course objective design.

Problem 1: Copying from high-level universities. Many teachers directly copy course objectives from prestigious universities without considering their own students' cognitive levels or the specific graduation requirements of their own program. This leads to misalignment and unrealistic expectations.

This phenomenon reflects teachers' overreliance on external templates and insufficient confidence in independent curriculum design. It also indicates that some universities emphasize accreditation documentation more than substantive teaching reform.

Problem 2: Vague and unmeasurable verbs. Objectives frequently use verbs such as "understand", "master", "learn", and "know", which are difficult to assess. For example, "students will understand the concept of binary trees" does not specify what students should be able to do to demonstrate understanding. The widespread use of vague verbs suggests that many teachers still lack a clear understanding of measurable learning outcomes and competency-based assessment.

Problem 3: Confusion between teaching content and student outcomes. Some objectives describe what the teacher will cover (e.g., "to teach the principles of object-oriented programming") rather than what students will be able to do after learning. This reflects the persistence of teacher-centered instructional thinking. Teachers tend to focus on "what to teach" instead of "what students can achieve," which is inconsistent with the core philosophy of OBE.

Problem 4: No clear link to graduation requirements. Many course objectives are written in isolation, without any mapping to program-level graduation requirements or competency indicators. This makes it impossible to evaluate whether the program's educational goals are being achieved. Without effective curriculum mapping, course objectives cannot truly support graduation competencies, and the closed-loop continuous improvement mechanism required by engineering accreditation becomes difficult to implement.

Problem 5: Overly broad or overly narrow scope. Some objectives try to cover too many competencies in one statement (e.g., "students will be able to design, implement, test, debug, and document complete software systems"), while others are too trivial (e.g., "students will be able to define a tree in Data Structures"). This problem reflects teachers' insufficient understanding of the hierarchical structure and cognitive levels of competency-oriented objective design.

IV. Discussion

Throughout this study, we can find that the major difficulty in course objective design under engineering education accreditation lies in the construction of a logical relationship among graduation requirements, course objectives, teaching activities, and assessment methods. But many teachers are still unable to establish a clear outcome-oriented curriculum design logic. Instead of designing objectives based on competency requirements, they tend to begin with textbook content or teaching tasks. Consequently, course objectives are often written as descriptions of teaching content rather than measurable student learning outcomes. This explains why vague expressions such as "understand," "master," and "learn" are still widely used in current course objective design.

Furthermore, the study also indicates that the logic problems in course objective design are closely related to teachers' metacognitive awareness. Teachers with insufficient metacognitive knowledge often regard course objectives as formal accreditation documents rather than instructional design tools. As a result, they rely heavily on templates from other universities and rarely reflect on the consistency among objectives, teaching activities, and assessment outcomes.

Differences among teachers with different experience levels are also significant factors. Novice teachers usually experience confusion because they lack experience in transforming abstract graduation requirements into assessable learning outcomes. Experienced teachers, although more familiar with teaching practices, may still be influenced by long-established content-oriented teaching habits. In contrast, master teachers are more likely to revise course objectives through reflective

monitoring and continuous curriculum evaluation, thereby gradually forming a relatively complete outcome-oriented design logic.

Another important finding is that collaborative curriculum activities can effectively improve teachers' understanding of course objective design logic. Peer discussion, curriculum mapping, and departmental review activities help teachers gradually recognize the relationships among competency cultivation, course objectives, teaching implementation, and assessment design. These collaborative mechanisms not only improve teachers' understanding of outcome-oriented curriculum design, but also promote reflective teaching practices and continuous curriculum improvement.

Therefore, the core challenge of course objective design under engineering education accreditation lies not only in technical training on objective writing, but also in helping teachers reconstruct curriculum design logic from a competency-oriented perspective.

V. SUMMARY

This study explored the logic and common problems of course objective design under engineering education accreditation from a qualitative research perspective. Through in-depth interviews with teachers of different experience levels, the study analyzed teachers' metacognitive knowledge, emotional experiences, and reflective monitoring processes in course objective design.

The shortcomings and outlook of this study are mainly reflected in the following aspects. Firstly, the interview participants were mainly teachers from computer science and related engineering disciplines, while teachers from other disciplines were not included. Although course objective design under engineering education accreditation has common characteristics, different disciplines may exhibit different curriculum design logic and implementation challenges. Secondly, the selected interviewees mainly included master teachers, experienced teachers, and novice teachers, while students, as another important subject in teaching activities, were not involved in the interviews. Future studies should incorporate students' perspectives to further explore the consistency between course objective design and actual learning outcomes. Thirdly, this study mainly involved teachers from universities in Anhui Province, and no comparative investigation was conducted with teachers from other regions or different institutional backgrounds. Therefore, the generalizability of the findings still requires further verification.

In general, this study suggests that improving teachers' understanding of outcome-oriented curriculum logic and strengthening reflective curriculum design ability will become important directions for future engineering education reform under the framework of engineering education accreditation.

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