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Application of OBE Concept in the Optimization and Reorganization of Environmental Design Courses

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Abstract: In the existing teaching system, the environmental design professional courses have problems such as unreasonable curriculum setting, disconnection between practice and theory, and poor matching between training objectives and industry needs. To this end, this paper studies the optimization and reorganization strategy of the environmental design professional courses based on the concept of Outcome-Based Education (OBE), aiming to improve the scientific nature and practical adaptability of the curriculum system, solve the problems of loose connection between course modules, insufficient skill training, and lagging behind in the cultivation of students' comprehensive abilities. The research adopts the OBE concept, with "student-centered, learning output-oriented, and ability improvement as the goal" as the core, and optimizes the curriculum through the following strategies: reconstructing course modules, strengthening practical teaching, optimizing the evaluation system and deepening the integration of production and education, relying on corporate internships and school-enterprise cooperation projects to enhance students' industry adaptability and make the course training objectives more closely integrated with actual employment needs. The research results show that the optimized curriculum system under the guidance of OBE concept can significantly improve students' comprehensive ability in the field of environmental design. The OBE optimized curriculum has shown significant effects in improving students' practical ability. Compared with the traditional teaching model, the scores of students in the experimental group in various practical skills have been greatly improved. In terms of hand-drawing performance ability, the score of the experimental group increases from 72.4 points to 89.5 points, an increase of 23.60%.

1. Introduction

Under the background of rapid social and economic development and continuous progress in industrial technology, the curriculum system of environmental design majors in colleges and universities needs to be continuously optimized to adapt to the market's requirements for the professional ability of talents. Based on the concept of outcome-oriented education (OBE), combined with the technological innovation needs of industries such as architectural decoration and landscape design, the course group setting is optimized to improve students' design skills, innovative entrepreneurial ability and comprehensive quality. This study focuses on the impact of OBE optimized courses on students' ability development. By comparing the differences between traditional teaching and OBE optimized courses in theoretical knowledge, practical skills, innovation ability, teamwork and employment matching, this study evaluates its effectiveness in higher education reform. The study uses methods such as knowledge tests, design task tests, and industry adaptability assessments to analyze data and draw relevant conclusions, providing educators with a scientific basis for improving course design. This study can not only provide empirical support for college curriculum reform but also provide industry development with professional talents that better meet market demand.

This paper is divided into five parts. First, the introduction explains the problems existing in the curriculum system of environmental design major, and proposes curriculum optimization goals and strategies based on the OBE concept. Then, the literature review reviews the research results in related fields to provide theoretical support for this paper. Subsequently, the method section introduces in detail the course optimization plan based on the OBE concept, including market orientation, course module construction, BIM concept curriculum system construction and optimization of the practical teaching system. Next, the study demonstrates the specific effect of curriculum optimization on improving students' abilities through comparative analysis between the experimental group and the control group. Finally, the results and discussion section summarizes the research findings and puts forward suggestions for educational reform.

2. Related Work

With the continuous development of educational concepts and technologies, curriculum optimization and learning effect improvement in different disciplines and teaching models have become research hotspots. Many scholars have conducted in-depth discussions on curriculum design, learner behavior, teaching methods, and technology-assisted teaching. Ding F, Chen L (2023) emphasized the problems of insufficient curriculum planning in current business English education, and proposed to improve students' professional ability, promote the flattening of courses and diversification of knowledge reserves by streamlining teaching content, strengthening the understanding of key knowledge points and building a knowledge system [1]. Egloffstein M (2023) et al. explored learner behavior in corporate MOOCs through lagged sequence analysis. The study found that different course design methods (lecture-oriented, system interaction-oriented, and discussion-oriented) presented different interaction sequences [2]. Tabibzadeh and Parva (2023) studied student satisfaction and learning progress in architectural design course 2 under face-to-face and virtual education modes, focusing on the differences between male and female students in these two modes. The study found that female students were less satisfied with virtual education, and that students' grades in face-to-face education mode were generally higher than those in virtual education [3]. May D, Morkos B (2023) et al. studied the impact of online laboratory courses on students' motivation and self-regulated learning during the COVID-19 pandemic. The study found that students' major was the only significant factor affecting motivation and self-regulation, while unfamiliarity or uncertainty with online experiments led to lower levels of self-regulation [4]. Soyer M (2023) et al. explored the application of the #digitalpowerups strategy in an environmental sociology course. The strategy helps students increase their participation in discussions by using keywords combined with prompts in online discussion forums. The study found that #digitalpowerups encouraged students to move beyond low-level learning (such as memorization and understanding) and to participate in mid- and high-level discussions such as application, analysis, evaluation, and creation [5]. Tong W (2023) et al. considered the multidisciplinary characteristics, wide coverage and rapid development of the environmental microbiology course and proposed an effective course construction method by exploring the ideological and political elements in the course (such as patriotism, scientific spirit, practical innovation, etc.) and integrating ideological and political theory teaching into course design and classroom teaching [6]. Sun J (2023) et al. explored the effects of different learning materials (paper textbooks, wearable AR materials, and wearable hybrid AR/VR (Augmented Reality/Virtual Reality) materials) on high school students' situational interest, participation, and learning performance in physics experiment education. The results showed that students who used wearable hybrid AR/VR materials had significantly higher situational interest and learning performance than those in the traditional learning group [7]. Hare R (2025) et al. explored the application of an intelligent education system based on multi-agent reinforcement learning among first-year college students, focusing on analyzing the students' feedback on the system. The results showed that the students gave positive feedback on the system's automated tutoring and gamified virtual environment [8]. Wang W S (2024) et al. conducted a quasi-experimental study on embedded electronic circuits and practical operation tasks, and the results showed that the feedback mechanism effectively reduced learners' external cognitive load and improved their participation [9]. Wen Zhaoyang (2024) et al. designed a motivational model and developed a motivational strategy based on the model to promote students' participation in pre-study Chinese courses for beginners at Tokyo University of Science. Statistical analysis results showed that the motivational design effectively improved students' behavioral participation [10]. Yildiz Durak (2023) explored the application of chatbot technology in educational environments and evaluated its impact on visual design self-efficacy, participation, satisfaction, and learner autonomy. The study found that students with higher satisfaction performed better in visual design self-efficacy [11]. Although existing research has made important progress in curriculum optimization, teaching model innovation and technology-assisted teaching, there are still problems such as fragmented curriculum system, low integration of cross-curricular knowledge, loose combination of practice and theory, and insufficient personalized training, which makes it difficult to meet the needs of modern education for comprehensive talent training.

3. Method

3.1 Market Orientation

The curriculum reform of environmental design major should be based on social needs, strengthen practical teaching, integrate basic courses, professional courses and applied courses, so as to cultivate students' technical skills, innovative thinking and management capabilities. The industry's demand for talent is changing from single skills to comprehensive service capabilities, requiring graduates to have solid professional knowledge, strong professional qualities, practical application skills and design management capabilities. Therefore, in the curriculum setting, we should not only focus on the cultivation of design skills but also strengthen the cultivation of basic qualities and management capabilities.

3.2 Course Module Construction

Table 1. Environmental professional course system

Course Module	Course Type	Course Name
Basic Knowledge Course Module	Compulsory	Aesthetics Foundation: Design Colors, Design Sketching, Design Composition
	Compulsory	Design Theory: Principles of Interior Design, History of Chinese Arts and Crafts
	Compulsory	Design Standards: Environmental Design Drafting and Reading

	Elective	Introduction to Design, Fundamentals of Architectural Design, Ergonomics, Creative Design Thinking
Professional Skills Course Module	Compulsory	Traditional Hand-drawn Representation Skills: Hand-drawn Rendering Techniques, Architectural Model Design and Production
	Compulsory	Computer-aided Representation Skills: AutoCAD, 3Dmax, Photoshop, SketchUp
	Elective	Photography, Architectural Sketching
Professional Knowledge Course Module	Compulsory	Decorative Materials Design and Application, Residential Space Design, Commercial Space Design, Landscape and Public Facility Design, Architectural Façade Design
	Interior Elective	Furniture Design, Lighting Design, Interior Decoration Design, Restaurant Space Design, Office Space Design
	Landscape Elective	History of Chinese and Foreign Architecture, Architectural Decoration Project Budgeting, Residential Area Landscape Planning and Design, Landscape Botany
Comprehensive Practice Course Module	On-campus Intensive Practice	Architectural Environment Design Research and Quick Design Training
	On-campus Intensive Practice	Comprehensive Training in Decorative Materials and Application, Comprehensive Training in Residential Space Design, Comprehensive Training in Landscape and Environmental Planning Design
	Enterprise Internship	Professional Competency and Career Development Practice, Graduation Internship
	Graduation Project	Graduation Design (Thesis)

The curriculum system of environmental design major is composed of multiple modules, which are interrelated and jointly support the cultivation of students' comprehensive abilities to achieve the organic combination of professional knowledge, skills and practice (as shown in Table 1).

(1) Basic knowledge course module

This module covers design fundamentals, design theory and design specifications, aiming to help students establish basic design concepts, master design theory and become familiar with industry specifications. Among them, the foundation of aesthetics (design color, design sketch, design composition) strengthens students' artistic quality and basic skills, design theory (principles of interior design, history of Chinese arts and crafts) helps students master professional concepts and theoretical evolution, and environmental design drawing and reading ensures that students have basic drawing skills. In addition, students can also choose courses such as design introduction, architectural design foundation, ergonomics, design creative thinking, etc. to expand their knowledge system.

(2) Professional skills course module

This module is divided into traditional manual expression skills and computer expression skills to help students improve their design expression ability. Hand-drawn rendering expression techniques and architectural model design and production train students' manual expression ability, while computer-aided design courses such as AutoCAD, 3Dmax, Photoshop, Sketch Up, etc. cultivate students' digital expression ability. In addition, elective courses such as photography and architectural sketching can enhance students' artistic expression and spatial perception.

(3) Professional knowledge course module

This module covers compulsory courses such as decorative material design and application, residential space design, commercial space design, landscape and public facilities design, and architectural exterior design, so that students can master the core knowledge in different environmental design fields. For interior and landscape directions, corresponding elective courses are provided, such as furniture design, lighting design, display design, catering space design, office space design (interior direction) as well as Chinese and foreign architectural history, architectural decoration project budget, residential landscape planning and design, and landscape botany (landscape direction) to meet the students' personalized development needs.

(4) Comprehensive practice course module

This module highlights the importance of practical teaching, including on-campus intensive practice, enterprise comprehensive practice and graduation design. Courses such as comprehensive practice on architectural environment design research, comprehensive practice on decorative materials and applications, comprehensive practice on residential space design, and comprehensive practice on landscape environment planning and design help students deepen their theoretical knowledge in practice. Enterprise comprehensive practice (professional quality and ability improvement practice, graduation internship) strengthens students' ability to adapt to the industry, while graduation design (thesis) is the final assessment link for students to comprehensively apply the knowledge they have learned.

The optimization of this curriculum system aims to strengthen the linkage between courses through modular design, ensuring that students not only have solid theoretical knowledge and technical skills, but can also apply them flexibly in practice, thereby improving their innovation ability and industry adaptability.

3.3 Construction of Curriculum System Based on the Concept of "BIM"

The concept of "BIM" emphasizes systematization and dynamic linkage, which can effectively improve the problems of insufficient coordination and weak correlation between courses. The traditional environmental art design course system adopts a static model, and the knowledge connection between courses is weak, which makes it difficult for students to effectively integrate knowledge. However, the "BIM+ course system" can establish a dynamic linkage model to achieve the comprehensive application of knowledge points and improve teaching efficiency. For example, the course system design based on "BIM" is similar to the linkage model of Excel tables. Changing one knowledge point can trigger the automatic adjustment of other related knowledge points, making the course content more holistic and systematic.

3.4 Construction of Practical Teaching System

3.4.1 Optimization of practical training courses

The core of higher vocational education lies in practical teaching. Therefore, strengthening the reform of practical teaching course system and strengthening the cultivation of students' practical ability are the key to the optimization of current environmental design professional courses.

(1) One-week course training: Extract professional skills training content, such as *Design Sketching and* Color *Training*, *Environmental Art Drawing AutoCAD Training*, *Design Basic Composition Training*, *Interior Design Training*, etc., set up independent special training courses and equip professional training teachers.

(2) Two weeks of comprehensive practical training: Teachers and students are organized to conduct intensive practical training on *Environmental Space Design* and *Landscape Planning and Design* to improve students' comprehensive practical abilities.

(3) Comprehensive enterprise practice: Combining the school-enterprise cooperation model, students are arranged to enter enterprises for professional literacy and ability improvement practice, so that students can exercise their skills in a real working environment.

3.4.2 Optimization of course assessment system

(1) Student assessment:

1) The course score accounts for 30% and the final homework score accounts for 70%.

2) Applying a collective scoring mechanism for multiple teachers to comprehensively evaluate the quality of students' homework and the degree of learning progress.

3) Through school-enterprise cooperation, invite corporate mentors to participate in the scoring, so that the assessment system is more in line with industry needs.

(2) Teacher Assessment:

Combining student evaluation, mutual evaluation among teachers in the course team, and evaluation by corporate mentors, a multi-dimensional teacher assessment system is established to improve teaching quality.

4. Results and Discussion

4.1 Study Subjects

Junior and senior students majoring in environmental design at a certain university are selected as research subjects and divided into an experimental group (using the OBE concept to optimize the course) and a control group (using the traditional course system). There are 60 people in each group to ensure sample balance.

4.2 Experimental Process and Analysis

(1) Pre-test (beginning of the first semester)

Through the use of knowledge tests, design task tests and other means, the professional knowledge, practical skills, innovative thinking, teamwork ability and other aspects of all students are evaluated as benchmark data.

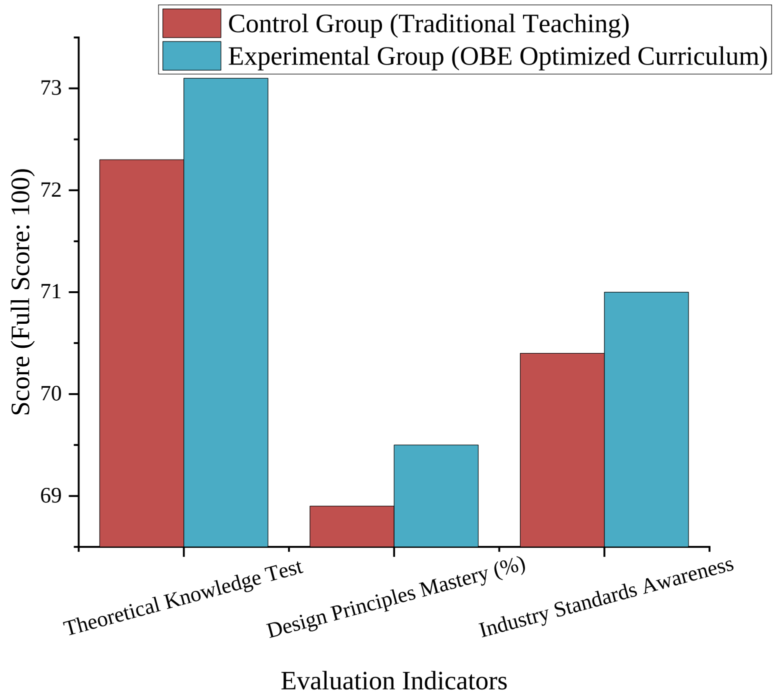

Figure 1. Professional knowledge pre-test

In the pre-test stage, the students in the control group (traditional teaching) and the experimental group (OBE optimized course) perform similarly in terms of professional knowledge, practical skills, innovative thinking and teamwork ability, ensuring the fairness of the experiment. Specifically, in terms of professional knowledge, the theoretical knowledge test score of the experimental group (73.1) is slightly higher than that of the control group (72.3), while the mastery of design principles (69.5%) is slightly lower than that of the control group (68.9%), indicating that the two groups of students have comparable theoretical knowledge reserves before the start of the course. In addition, the industry norms cognition scores do not differ much between the experimental group (71.0) and the control group (70.4), indicating that students' initial level of understanding of industry standards is relatively consistent, as shown in Figure 1.

During the one-year course teaching, the experimental group uses the optimized course system for teaching, while the control group continued to use the traditional teaching model. In order to evaluate the learning effects of the two groups of students, the mid-term examination is arranged in the fourth month. This assessment adopts a variety of evaluation methods such as small design competitions, case analysis and course projects, aiming to comprehensively examine the students' learning performance and comprehensive abilities in the mid-term stage, and compare the differences in students' learning outcomes between the optimized course system and the traditional teaching model.

(2) Post-test (end of the school year)

The final learning outcomes of the two groups of students are compared through design work review, teacher evaluation, and industry mentor feedback.

A combination of quantitative and qualitative analysis methods is used to evaluate the improvement of the two groups of students in practical ability, design quality, innovation ability, and employment matching.

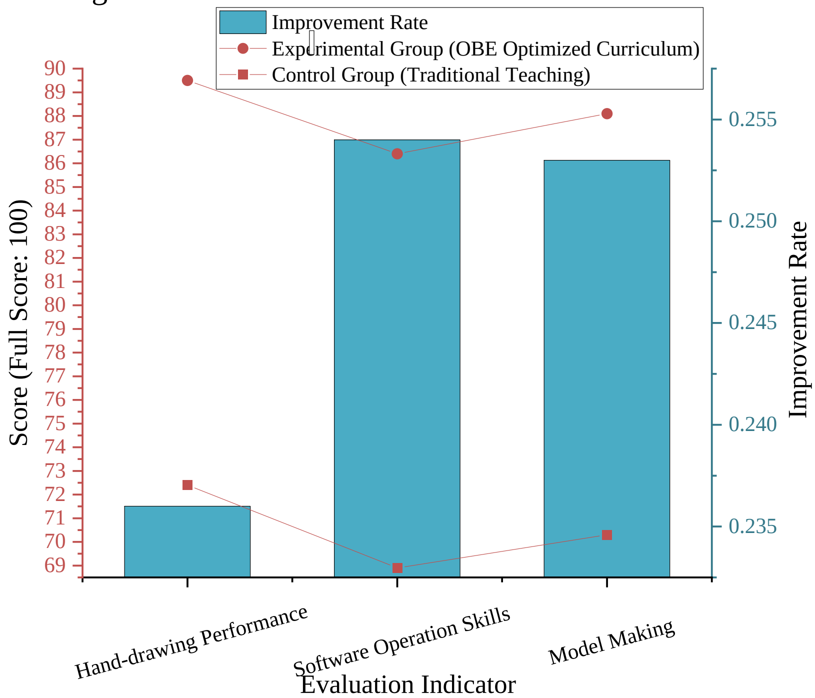

Figure 2. The impact of OBE course optimization on students' practical ability improvement

The experimental results in Figure 2 show that the OBE optimization course has shown significant effects in improving students' practical ability. Compared with the traditional teaching model, the scores of students in the experimental group in various practical skills have been greatly improved. In terms of hand-drawing expression ability, the score of the experimental group increases from 72.4 points to 89.5 points, an increase of 23.60%, indicating that the OBE teaching model pays more attention to practical training and personalized guidance, which enables students to make great progress in graphic expression and hand-drawing skills. In terms of software operation skills, the score of the experimental group increases from 68.9 points to 86.4 points, an increase of 25.40%. This shows that the OBE course has significantly improved students' software application capabilities by strengthening practical operations, project-based learning, and task-driven teaching methods, enabling them to use professional tools more proficiently for design and analysis. In terms of model making skills, the score of the experimental group increases from 70.3 points to 88.1 points, an increase of 25.30%, reflecting the effectiveness of the OBE course optimization in the hands-on practice link. Through project practice, experimental training and the application of real cases, students' abilities in material application, structural design and fine production have been greatly improved.

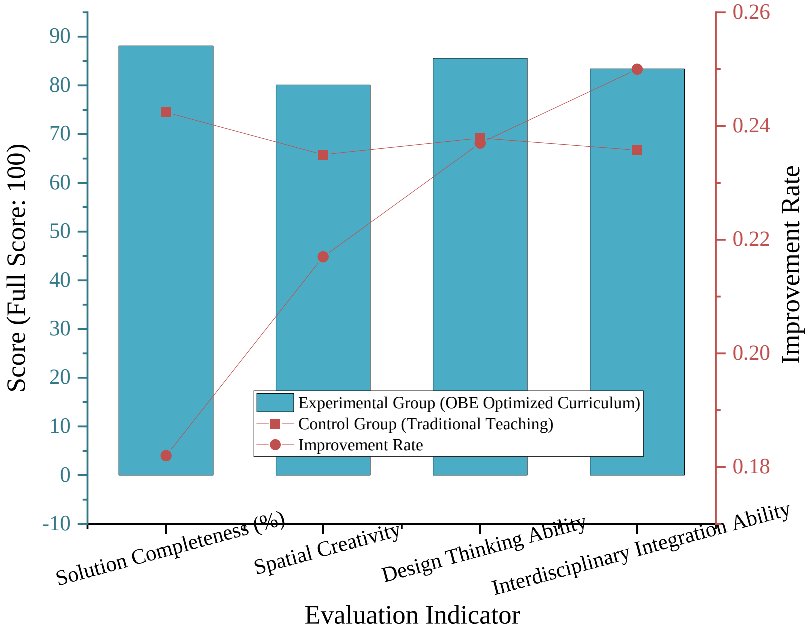

Figure 3. The impact of OBE optimization courses on students' design quality and innovation ability

The OBE optimization course has a significant effect in improving students' design quality and innovation ability. Compared with the traditional teaching model, students in the experimental group have significantly improved in various design and innovation ability indicators. In terms of the completeness of the plan, the completion rate of the experimental group increases from 74.50% to 88.10%, an increase of 18.20%, indicating that the optimized teaching model of the OBE course can guide students to conceive and present design plans more systematically, thereby improving the feasibility and completeness of the plans. In terms of spatial innovation, the score of the experimental group increases from 65.8 to 80.1, an increase of 21.70%, indicating that the OBE course pays more attention to cultivating students' spatial thinking ability and creative expression, enabling them to make greater breakthroughs in spatial conception and layout innovation (as shown in Figure 3).

The experimental data in Table 2 show that the OBE optimized course significantly improves students' employment matching, making them perform better in terms of industry adaptability and job-seeking competitiveness. In terms of graduates' industry adaptability, the adaptability score of the experimental group students increases from 71.5 points to 83.6 points, an increase of 16.80%. This result shows that the teaching model of the OBE course after optimization is more in line with industry needs. Through practice-oriented learning, real project training and corporate cooperation, students can adapt to the industry environment and job requirements more quickly after entering the workplace. In terms of job search success rate, the experimental group's job search success rate increases from 67.30% to 81.20%, an increase of 20.60%, indicating that the optimization of the

OBE course has effectively enhanced students' professional competitiveness. By strengthening practical skills, improving communication and teamwork skills, and providing more internship and employment resources, students have more advantages in the job search process and are more likely to get ideal job opportunities.

Table 2. The impact of OBE course optimization on students' employment matching

Evaluation Indicator	Control Group (Traditional Teaching)	Experimental Group (OBE Optimized Curriculum)	Improvement Rate
Graduate Industry Adaptability (out of 100)	71.5	83.6	16.80%
Job Seeking Success Rate (%)	67.3	81.2	20.60%

5. Conclusion

Based on the OBE concept, the environmental design professional curriculum system is optimized, guided by market demand, and combined with the "BIM" concept to build a dynamically linked course group, strengthen practical teaching, and enhance students' comprehensive abilities and professional competitiveness. At the same time, the assessment system should be optimized to improve the pertinence and effectiveness of course teaching, thereby promoting the improvement of the quality of talent training for environmental design professionals. Based on curriculum optimization, this study provides theoretical and practical basis for further reform of the curriculum system of environmental design major. By comparing the impact of traditional teaching and OBE optimized courses on different ability dimensions, this study draws the following conclusions: First of all, OBE optimization courses show significant advantages in practical skills and innovative thinking. Students' scores in hand-drawing performance, software operation, model making and other skills have been greatly improved, and the scores of innovative thinking have also improved. This shows that the OBE course can effectively improve students' practical operation ability and innovation ability, and enable them to have stronger design practice and thinking ability. Secondly, the OBE optimized course has also made significant progress in teamwork ability. The experimental group students perform better than the control group in terms of teamwork score and task collaboration efficiency, indicating that the OBE course has a positive effect in cultivating students' teamwork spirit and collaborative work ability. The time span of this study is relatively short, and the long-term effect of course optimization has not yet been fully reflected. Students' learning outcomes may change over time, and future research should conduct long-term follow-up to evaluate the profound impact of OBE course optimization on students' career development. With the development of globalization, future OBE courses should strengthen the cultivation of international perspectives and enhance students' competitiveness in the global workplace.

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