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BLENDED SELF-REGULATED AND REFLECTIVE LEARNING IN GRAPHIC DESIGN INSTRUCTION SUPPORTED BY A SMART EDUCATION PLATFORM

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Abstract: This paper develops and evaluates a blended instructional model that integrates self-regulated learning and reflective learning in a graphic design course supported by a smart education platform. The model addresses limited class hours, wide differences in student foundations, and pressures created by rapid tool iteration and generative artificial intelligence. The paper asks whether platform-supported self-regulation and structured reflection can improve design ability, self-regulated learning, and reflective practice. A quasi-experimental non-equivalent control group design was used with 73 second-year educational technology students. The experimental group (n=37) followed the blended model, while the control group (n=36) followed conventional project-based instruction. Instruction spanned 16 weeks in both groups and was delivered by the same teacher team, with identical content and hardware. Our data set comprised design product scores, a revised self-regulated learning scale, a design reflection quality rubric, platform logs, and interviews. Analysis of covariance and t tests showed that the experimental group scored significantly higher on design product quality, originality, self-regulated learning, and reflection quality. Platform logs also revealed more frequent and more varied learning activity. We read these results as evidence that smart education environments can support personalized exploration and structured reflection; their integration, in turn, appears to promote design thinking and professional development. The paper contributes a practical framework for design education in digital contexts and identifies adaptation, tool dependence, and teacher workload as implementation challenges.
Keywords: Self-regulated learning; Reflective learning; Smart education platform; Graphic design; Design thinking

1 INTRODUCTION

Graphic design occupies a central place in visual communication and serves as a foundational course in educational technology programs, where visual communication theory is brought together with digital design tools and multimedia technology. Its pedagogical purpose is to familiarize students with basic design elements—symbols, graphics, typography, and color—and, in doing so, to foster visual literacy, critical aesthetic judgment, and digital creation ability [1].

Teaching practice, nevertheless, remains constrained on several fronts. Instructional time is limited, which restricts opportunities to cultivate deep learning and metacognitive abilities and, in our view, makes improvements in teaching effectiveness difficult to secure. Digital natives' learning characteristics and the rapid advance of AI image-generation technology have further widened individual differences in students' foundational competencies; uniform, lockstep instructional models therefore appear increasingly inadequate. At the same time, the accelerating iteration of digital software tools and the growing ubiquity of online learning resources have eroded teachers' authority in traditional classrooms and dealt a profound blow to conventional teaching models.

Contemporary educational theory regards autonomous learning as a core competency for students, with direct consequences for their academic achievement and career development [2]. Through, reflective practice links between new and existing knowledge can be forged. Empirical work shows that reflective practice promotes deep learning and improves learning outcomes [3]. Therefore, in the course teaching, allowing students to engage in autonomous learning and reflective practice, is a very effective solution for improving the quality of the course.

2 PROBLEMS IN GRAPHIC DESIGN INSTRUCTION

2.1 Widening Differences in Student Foundations

The learning characteristics of digital natives have intensified individual differences in design education. Contemporary university students, as digital natives, differ markedly in their technology-use experience and learning approaches. Some students have already acquired basic design software skills through online learning resources and other channels before enrollment, whereas others lack such experience. Lin Chongde's research on the core competencies of Chinese students shows that differences in prior abilities directly shape both the effectiveness of, and experience in, course learning [4]. In graphic design instruction, however, uniform pacing and content arrangements are unlikely to meet the needs of students with different foundations; the result, too often, is polarization in students' ability development. As AI image generation has become more accessible, this competence gap has, in our view, become more pronounced. With tools such as Midjourney and DALL-E now widely used, some students employ them to generate design ideas and prototypes quickly, whereas others may lean on AI too heavily and neglect foundational design skills. DiFrancesca et al.'s comparative study

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of high- and low-achieving students found significant differences in their self-regulated learning strategies [5]; these differences may well be amplified in technology-rich learning environments. Graphic design courses therefore need to explore “differentiated instructional strategies” that accommodate individual differences—ensuring that basic competence standards are met while giving students at different levels appropriate room for development.

2.2 The Impact of Technological Change on Traditional Teaching Models

Digital tools are iterated far more quickly than curricula can be revised. In graphic design, change has been rapid: mainstream design software receives major version updates almost every year, while new tools and platforms continue to appear. University course content and syllabi, by contrast, are often adjusted through lengthy approval procedures; as a result, what students are taught tends to trail industry practice. This lag is consequential. It weakens graduates’ employability, and it also reduces the practical relevance of their learning. Dewey’s argument in How We Think—that education should be tied to students’ lived experience—acquires, I would argue, still greater urgency in the digital age [6].

3 THEORETICAL BASIS

3.1 Autonomous Learning Theory And Reflective Learning

Autonomous learning theory provides a foundational lens for this study. DiFrancesca et al. define autonomous learning as learners' capacity to proactively deploy strategies for managing their own learning—a construct encompassing goal setting, strategy selection, process monitoring, and outcome regulation [7]. In graphic design education, this capacity is particularly consequential, we contend, because design is fundamentally an iterative process of continuous exploration and adjustment that demands considerable self-direction and regulation. Drawing on Zimmerman's self-regulated learning theory, this study divides autonomous learning in graphic design into three cyclical phases [8]: planning (goal setting and strategy planning), performance (strategy application and process monitoring), and reflection (outcome evaluation and strategy adjustment).

Reflective learning theory usefully supplements design learning. Dewey defined reflection as “active, persistent, and careful consideration of experience,” emphasizing its effect on learning quality [9]. In graphic design education, reflection serves not only to evaluate works but also to systematically examine design thinking and decision bases. Jin Xinquan et al., in a crowdsourcing-based reflective learning model, found structured reflective practice substantially enhances learning depth and cognitive level [10]. Drawing on Gibbs’s reflective cycle and Schön’s reflective practitioner concept, this study constructs a reflective framework for graphic design learning with six stages: description (recording the design process), feelings (analyzing emotional experience), evaluation (comparing outcomes with goals), analysis (exploring factors underlying success and failure), conclusion (forming patterned understandings), and action plan (formulating improvement plans). These stages are not completed in one step; they are continuously cycled and iterated across the three phases of autonomous learning.

3.2 Instructional Model Design

Drawing on this theory, we built an integrated “autonomy–reflection” instructional model for graphic design on a smart education platform. Design competence development is the core objective; autonomous and reflective learning serve as dual pillars; the platform provides the supporting environment. Together they form a unified teaching system, and we regard that as necessary for coherent instructional design.

The system can articulate the multidimensional intended outcomes of design learning. Traditional graphic design courses tend to emphasize technical operations and the completeness of final works. This model instead divides learning goals into four dimensions: technical competence, cognitive competence, metacognitive competence, and social-emotional competence.

4 EMPIRICAL RESEARCH DESIGN AND IMPLEMENTATION

4.1 Research Design

We conducted a comparative teaching experiment across two intact classes: the 2022 and 2023 cohorts of the Educational Technology major. Notably, intact classes were retained to preserve ecological validity.

The experimental group ($n = 37$) received a "self-directed–reflection" integrated teaching model in a smart education environment; the control group ($n = 36$) received a traditional project-based teaching model. Age, gender, and pretest scores did not differ significantly between the two groups ($p > .05$), which supports their comparability.

Students’ Self-Directed Learning Scale; and reflective practice ability, gauged through the researcher-developed Design Reflection Quality Evaluation Scale. Students’ satisfaction ratings of the teaching model and feedback on their learning experience were also gathered as auxiliary dependent variables.

Control variables included instructional duration (16 weeks for both groups, 3 contact hours per week), instructors (the same teaching team), instructional content, and hardware conditions (both groups were provided with computers and design software of the same specifications). Platform use was an intervention specific to the experimental group; the

control group was not restricted from using online resources but received no dedicated learning platform or structured guidance.

4.2 Research Participants

Participants were second-year students majoring in Educational Technology at a comprehensive university, totaling 73 students in two intact classes. The experimental group had 37 students (15 male, 22 female; mean age = 19.3 years), and the control group had 36 students (14 male, 22 female; mean age = 19.1 years). All participants had completed prerequisite courses such as Introduction to Computers and Foundations of Fine Arts and possessed basic information technology operation skills and artistic literacy, but none had systematically studied graphic design courses.

The pretest of participants' "technology acceptance" showed no significant differences between the two groups in computer operation proficiency ($t = .87$, $p = .39$), online learning experience ($t = 1.02$, $p = .31$), or prior exposure to design software ($t = .76$, $p = .45$), thereby ruling out the potential influence of technical factors on the experimental results. The pretest questionnaire also confirmed that neither group had received systematic training in self-directed learning or reflection methods in their prior learning experiences.

4.3 Implementation Process of Teaching Reform

The teaching in the experimental group strictly followed the design framework of the "Autonomy–Reflection" integrated teaching model and went through the following key stages in full:

(1) Preliminary Preparation Stage (Week 1):

The preliminary preparation for teaching implementation mainly included platform training, competency diagnosis, and goal negotiation:

i) Platform training: Students were guided to use the various functions of the smart learning platform, especially the tools for recording the design process and keeping reflective journals.

ii) Competency diagnosis: Students' entry-level competencies and learning styles were assessed through design tasks and questionnaires.

iii) Goal negotiation: Course objectives and individual learning plans were discussed with students to establish personalized learning pathways.

(2) Core Teaching Stage (Weeks 2–14):

The course was organized around four design projects of progressively increasing complexity: Logo Design (basic), Flyer Design (intermediate), Infographic Design (comprehensive), and Brand Visual Identity System Design (innovative). Learning for each project followed a cyclical process of "contextual introduction—autonomous exploration—creative practice—multi-source reflection—integrated application."

Taking the Infographic Design project as an example, the specific implementation steps were as follows:

i) Contextual Introduction (1 class hour, offline): Infographic cases in the field of public health were presented; their design features and communication effects were analyzed; and the design task "Epidemic Prevention Guide" was assigned.

ii) Autonomous Exploration (2 class hours, online): According to their individual learning plans, students used platform resources to learn infographic design principles, data visualization methods, and relevant software skills.

iii) Creative Practice (3 class hours, online): students produced design sketches and digital prototypes; the platform logged the design process and version iterations automatically.

iv) Multi-source Reflection (1 class hour, blended online and offline):

Self-reflection: students kept design journals and responded to structured prompts (e.g., "How are data hierarchies represented through visual variables?").

Peer assessment: Students submitted interim works online and provided feedback on the designs of three classmates.

Teacher feedback: Professional suggestions were provided on design concepts and technical implementation.

v) Integrated Application (1 class hour): Students revised and refined their work based on feedback, and submitted the final work and reflection report.

(3) Summary and Enhancement Stage (Weeks 15–16):

i) Works Exhibition: Outstanding course design works were displayed both online and offline.

ii) Comprehensive Reflection: Students wrote a course learning summary report, reflecting on overall progress and directions for future improvement.

The control group used the traditional "project-based teaching" model, completing the same four design projects. Notably, autonomous learning and reflective practice received no systematic guidance.

5 IMPLEMENTATION EFFECTS

Reflective practice ability was another core indicator. Measured with the "Design Reflection Quality Assessment Scale," the experimental group's reflection quality proved significantly better than the control group's ($t = 7.25$, $p < .001$, $d = 1.74$). Content analysis of reflective journals further showed that experimental group students reflected more systematically and deeply—they integrated design theory with specific cases and proposed feasible improvements. Control group reflections, by contrast, remained superficial, largely limited to descriptions of technical operations and simple self-evaluations.

The development of reflection depth showed clear stage-related characteristics. Reflections in early projects mostly focused on technical problems and the appearance of works ("the color combination was not harmonious enough"); in the middle stage, they began to involve the application of design principles ("the contrast was not strong enough, resulting in an unclear information hierarchy"); in the later stage, students were able to connect to broader design contexts and user needs ("the cultural characteristics of the target group need to be considered more fully"). This progression in depth of reflection reflects the gradual maturation of students' design thinking.

6 DISCUSSION OF CHALLENGES AND LIMITATIONS

Although the integrated "autonomy–reflection" teaching model achieved generally positive results, its implementation also faced several challenges and limitations.

Differences in student adaptability constituted one of the main challenges. About 20% of students (mainly some of those in the technology-oriented and social-interaction-oriented categories) showed a lack of fit with autonomous reflective learning, reporting that they felt "uncertain about the direction" or found "reflective writing difficult." This suggests that adaptability training and differentiated support should be strengthened in the early stage of the course. As one student candidly remarked in an interview, "For the first few weeks, I was not used to deciding what to learn by myself. Later, the teacher helped me develop a more specific learning plan, and only then did I gradually find my footing."

The double-edged-sword effect of technological tools also merits attention. A small number of students (15%) relied excessively on the preset effects of design software and AI generation tools, resulting in a lack of originality in their work. Analysis of reflective journals revealed that these students' reflections focused mostly on technical operations and rarely addressed the process of creative formation. This requires teachers to place greater emphasis on originality and thinking processes in task design and evaluation criteria.

Teacher workload was a practical issue in implementation. The new model required teachers to invest more time in individualized guidance and reflective feedback. The teaching team reported that, compared with the traditional model, teaching preparation and guidance time under the new model increased by about 40%. How to optimize support tools (such as AI-assisted feedback) and build a teaching community (such as a teaching assistant team and peer review) is key to sustainable development.

The maintenance of long-term effects still requires further verification. This study tracked teaching effects for only one semester, whereas the cultivation of autonomous learning ability and reflective habits is a long-term process.

7 CONCLUSION

The findings lead us to propose several theoretical implications and practical recommendations.

Theoretically, this study confirms that self-regulated learning and reflective learning work synergistically in graphic design education. In smart education environments, self-regulated learning gives students room for personalized exploration; structured reflective practice, meanwhile, steers that exploration toward greater depth. The two reinforce each other and jointly foster design competence. We consider this an extension of DiFrancesca et al. (2016) on self-regulated learning and Jin Xinquan et al. (2020) on reflective learning: an integrated theoretical framework particularly suited to design education, a field with a strong practical orientation.

For curriculum reform in graphic design, three practical strategies are proposed. First, autonomy should be transferred progressively: structured guidance is needed early on, with autonomous space expanding as competence develops. Early projects may, for instance, specify design themes and technical requirements, whereas later ones can open up theme selection and technical pathways. Second, reflective guidance should be differentiated. We suggest diverse forms of reflective support for students with different learning styles—more specific reflective questions for technically oriented students, and more group-based reflective activities for socially oriented ones. Third, process visualization should be supported. Technological tools can be used to record and display the design process, thus providing rich materials for reflection; version comparison functions, for example, help students intuitively see the trajectory of iterative improvement.

Overall, smart-platform-supported "autonomy–reflection" teaching effectively strengthens graphic design students' all-round competence—most notably design innovation, self-regulated learning, and reflective practice. Implementation may bring adaptation and workload challenges; systematic support and differentiated instruction can address them. The study offers a theoretical reference and practical paradigm for digital-age graphic design education, with implications for curriculum reform in other practice-oriented disciplines.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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