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Research on the construction path of digital teaching models for the fashion design major--Case study of the fabric shaping design course

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----------ABSTRACT----------

With the digital transformation of higher education programmes in fashion design as the background, this study takes the fabric shaping design course as its focal case and introduces the concept of Outcome Based Education abbreviated OBE. A complete teaching cycle is constructed that clarifies learning outcomes, designs teaching activities, implements teaching processes and assesses learning outcomes in order to advance curriculum development and to enhance the practical competence and innovation awareness of students. At the implementation level the course integrates the three dimensional virtual technology of CLO 3D with a modular sequence of learning stages and combines these stages with project driven learning, case based instruction and a blended online offline format so as to strengthen three dimensional spatial understanding, course interaction and creative expression. At the same time the course integrates digital tools such as AIGC, three dimensional modeling and virtual fitting in order to accelerate scheme generation and diversified presentation and to foster the development of creative thinking among students. With respect to assessment the study responds to the complexity of evaluating both artistic and engineering dimensions through a multidimensional approach that combines qualitative and quantitative perspectives and incorporates portfolio assessment, peer review and self evaluation so as to represent the learning process and learning outcomes in a comprehensive way. The findings offer an operable set of ideas and methods for curriculum reform in fashion design and provide reference for improving teaching quality and the holistic competence of students.

Keywords: *fashion design; digital teaching; OBE; CLO and virtual simulation; AIGC*

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I. Research background and research approach

1.1 Background and problem identification

In recent years curriculum reform in the fashion design major has shifted from simple tool substitution toward a more fundamental renewal of pedagogical paradigms. Digital teaching is widely regarded as a way to achieve systematic improvements in resource organisation, learning modes and teaching efficiency. Existing studies indicate that integrating technologies such as virtual fitting and three dimensional modeling into the classroom helps to achieve more efficient scheme iteration, visual expression and collaborative communication under constraints of class time and material resources, thereby stimulating innovation awareness among students [1]. At the same time the convergence of new generation content generation technology AIGC with advanced three dimensional visualisation tools has become an important driving force for digital transformation. In this context it is practically necessary at the disciplinary level to explore a teaching path that is explicitly oriented to learning outcomes, that integrates digital tools and that develops matched organisational and assessment arrangements [2].

For the fabric shaping design course the misalignment among objectives, activities and assessment that has been produced by traditional two dimensional orientation and fragmented training is mainly reflected in three aspects. First, students display insufficient structural understanding and three dimensional expression. During integrated training that combines material process and silhouette they can often complete the practical task but find it difficult to articulate their ideas clearly. Second, the continuity and interactivity of teaching organisation are relatively weak and students lack an end to end learning experience anchored in project tasks. Third, assessment is complex yet evidence sparse, which makes it difficult to address artistic creativity and technical feasibility at the same time [3][4]. In response to these pain points existing research offers relatively operable directions for

improvement. Within the course CLO 3D and other three dimensional virtual technologies can be systematically introduced, a modular sequence of stages can be designed and these stages can be combined with project driven learning, case based teaching and a blended online offline format in order to strengthen three dimensional spatial understanding, classroom interaction and learning efficiency. In addition an integrated chain of tools linking AIGC, three dimensional modeling and virtual fitting can be employed for idea generation, rapid preview and diversified visualisation. This approach does not significantly increase the consumption of physical materials while it accelerates scheme iteration and improves the quality of visual expression. As a result a practical and feasible path has emerged for the fabric shaping design course that integrates outcome oriented teaching organisation, digital tools and platforms, project and case based learning and blended teaching modes.

1.2 Research approach and contributions

This study introduces the philosophy of Outcome Based Education and follows a complete teaching cycle that begins with the clarification of learning outcomes, continues with the design of teaching activities and the implementation of teaching processes, and concludes with the evaluation of learning outcomes. Through this backward design that works from the intended end to the beginning the course ensures that objectives, learning activities and assessment procedures all revolve around student learning outcomes and remain aligned with the overall training goals of the discipline.

At the level of implementation the study draws on existing experiences of curriculum reform and integrates them into a coherent design. First, CLO 3D and other three dimensional virtual technologies are embedded into the course structure and the curriculum is organised into modular stages that form a progressive pathway from familiarisation with tools to the deepening of creative work. Second, project driven tasks, case based teaching and a blended online offline mode are adopted to enhance classroom interaction and collaboration and to promote a closed loop of learning, application and assessment. Third, a digital tool chain that combines AIGC, three dimensional modeling and virtual fitting is used to support scheme generation, dynamic preview and diversified presentation, thereby advancing digital transformation of the course and cultivating student innovation and integrated expression.

On this basis the main contributions of the study can be summarised in three aspects. First, it proposes a digital teaching path oriented by OBE that is matched to the characteristics of the fabric shaping design course and that emphasises evidenced expressions of learning outcomes together with coherent alignment among objectives, activities and assessment. Second, it presents an implementation scheme that combines modular stage division, project driven and case based teaching and a blended online offline mode and it clarifies the key links in the integration of these elements with three dimensional virtual technologies in order to alleviate the pedagogical bottleneck between two dimensional orientation and three dimensional expression. Third, it constructs a multidimensional evaluation system that addresses the complexity arising from the coexistence of artistic and engineering requirements, combines qualitative and quantitative methods and introduces portfolio assessment, peer review and self evaluation to enhance transparency of assessment, the quality of feedback and the capacity for continuous improvement.

II. Teaching model and implementation scheme

2.1 Key features of the model OBE and digital transformation

The course adopts Outcome Based Education as the overarching framework and follows a complete teaching cycle that clarifies learning outcomes designs teaching activities implements teaching processes and evaluates learning outcomes. At the outset the course defines observable learning outcomes that students are expected to achieve and on this basis designs teaching objectives classroom activities and assessment criteria through a backward process so that the teaching process remains aligned with final outcomes and forms a closed loop that proceeds from the intended end toward the beginning. For the fabric shaping design course this approach implies that while attention is paid to the completeness and expressive quality of final works equal emphasis is placed on evidence accumulated during the learning process including intermediate outputs explanations of scheme iterations peer feedback and self reflection in order to support formative assessment and continuous improvement.

In relation to digital transformation the course integrates the three dimensional virtual technology of CLO 3D together with virtual fitting and treats this environment as a core platform for silhouette rehearsal parameter adjustment and comparison of multiple design schemes. Through the digital environment it reduces material and time costs and enhances three dimensional spatial understanding and the efficiency of classroom interaction. The course also introduces AIGC as an auxiliary tool for creative generation and visual expansion supporting texture and pattern ideation stylised sketch production and exploration of presentation layouts. In this

way it extends creative boundaries without a marked increase in the consumption of physical materials and aligns with the orientation of the course toward digital modes of expression. Overall outcome oriented backward design and the integration of digital tools reinforce one another and make the pathway from idea to expression more efficient and more manageable.

2.2 Instructional organisation and phase arrangement

Course organisation adopts a clear sequence of phases supported by corresponding methods in order to ensure coherence and traceability in the learning process. The course is structured as two progressive components the tool instruction phase and the design creativity phase. The tool instruction phase focuses on foundational competences and covers interface operations of CLO 3D basic modeling material settings and virtual fitting workflows. It also clarifies classroom conventions rules for file naming and version management and provides guidance on the use of AIGC together with essential notes on copyright and responsible use. To reduce the cost of early trial and error this phase assigns a series of small scale skill tasks such as exercises on structural representation of a single silhouette and comparison of the visual effects produced by different parameter settings for the same fabric so that students can become familiar with tools and procedures in a low risk environment.

The design creativity phase organises project based learning around authentic briefs or simulated scenarios. Students begin with thematic research and visual mapping of intentions use AIGC to support divergent ideation complete multi scheme rehearsal and local refinement in CLO 3D and then employ virtual fitting for dynamic and static inspection as well as expressive output. Within this phase case based teaching is interwoven as instructors unpack the technical pathways and expressive strategies used in exemplary projects. Interim critiques are arranged to generate timely feedback and to encourage students to complete a full cycle from problem definition to implemented solution within a specified time frame.

A blended online and offline format spans both phases. Online components support the distribution of microlecture resources submission of process oriented outputs and peer review. Offline sessions focus on group discussion demonstrations of key techniques and question answering. The two modes work together to enhance learning efficiency and the depth of interaction. Classroom rhythm unfolds in cycles of short explanation demonstration practice presentation and feedback which ensures that conceptual understanding skill acquisition and immediate assessment are embedded in daily classroom practice[4].

To implement the alignment principle of Outcome Based Education each phase is associated with specific interim outputs and assessment rules. The tool instruction phase emphasises standardisation methodological clarity and reproducibility and requires students to submit CLO 3D files with parameter annotations key operation screenshots or short videos together with records of AIGC generation. The design creativity phase highlights creativity integration and the completeness of expressive chains and requires students to submit a full set of materials that spans thematic research AIGC sketches CLO 3D schemes virtual fitting presentations and interim reports so that process evidence can substantiate portfolio assessment and self evaluation at the end of the course.

2.3 Resources and support

The resource and support system is constructed around goals of platform based management reusability and traceability. The course platform develops three types of resource repository. The example repository contains interactive CLO 3D samples representative virtual fitting scenarios and demonstration videos which facilitate self directed learning and post class replication. The template and guideline repository provides assignment briefs process recording forms examples of presentation layouts peer review sheets self evaluation forms and conventions for file naming and version management so that outputs remain comparable across groups and cohorts. The showcase and communication space is used to publish interim outputs and to organise peer feedback thereby accumulating experiences and strategies that can be drawn upon by subsequent classes.

With regard to academic norms the course articulates requirements concerning integrity and copyright in the use of AIGC. Students indicate in their submissions the stages at which AIGC has been used together with associated generation records such as key terms platform and model version. They clarify the boundaries among generation selection and further creative work and they may not treat unprocessed generated content as academic work. The assessment rubric incorporates checkpoints for adherence to these standards and for source documentation in order to construct a transparent fair and traceable learning environment.

In relation to teaching and technical support the course organises targeted workshops and training sessions at the beginning of the semester on topics such as new functions of CLO 3D optimisation of virtual fitting workflows and compliant classroom use of AIGC. Teaching assistants or technical assistants are appointed to support troubleshooting in class and maintenance of platforms. Collaboration with industry mentors in the co development of cases enriches application scenarios shortens the technology learning curve for both teachers and students and transforms the integration of digital tools into a sustainable instructional capacity.

III. Pathways for fabric shaping course development and evaluation

3.1 Learning outcomes and course objectives aligned with Outcome Based Education OBE

The course specifies learning outcomes across three dimensions of knowledge skills and dispositions and uses these outcomes as the basis for backward design of teaching objectives classroom activities and assessment arrangements. In this way the full teaching cycle advocated in Outcome Based Education is implemented by clarifying learning outcomes designing teaching activities implementing teaching processes and evaluating learning outcomes. These learning outcomes are aligned with the two phase structure outlined in the previous chapter so that P1 corresponds to the tools and standards phase and P2 corresponds to the design and integration phase.

Learning outcome LO1 concerns digital representation and rehearsal. Students are expected to use CLO 3D and related tools to complete three dimensional virtual representation and rehearsal, to understand the basic process from modeling and material assignment to virtual fitting, and to adjust parameters and compare design schemes in a digital environment.

Learning outcome LO2 addresses foundational craft competences for fabric shaping. Within the scope of the course students are expected to master basic techniques, to produce and present physical samples, to understand the relationship between digital schemes and physical outcomes, and to describe key steps and considerations in concise language during classroom discussions.

Learning outcome LO3 concerns creative expression and communication. Under a specified theme students are expected to articulate concepts, collect and refine visual intentions and develop visual narratives. They integrate sketches or rehearsal outputs generated through digital tools into coherent presentation materials that can support interim reviews and final presentations.

Learning outcome LO4 focuses on process documentation and reflective awareness. Students are expected to maintain structured process records during learning, including small interim tasks, explanations of scheme iterations, peer assessments and self evaluations. These records make the learning trajectory traceable and well evidenced and provide a basis for formative assessment and continuous improvement.

Taken together these learning outcomes translate into course objectives that use digital competence craft competence creative expression and evidence based expression as core indicators. The objectives are kept consistent with classroom activities and assessment methods and they reflect a balanced emphasis on process and product. The relationship between course objectives and graduation requirements is presented as a matrix in the course description so that levels of attainment can be checked during teaching implementation and final review, as shown in Table 1.

Table 1. OBE alignment matrix for the fabric shaping course

No.	Learning outcome LO	Observable performance	Teaching activities and phase P1 tools and standards P2 design and integration	Evidence and outputs submissions	Assessment Rubric dim. and weight	Attainment criterion	Tools and platform	Schedule wk and checkpoint
1	LO1 digital representation and rehearsal	Independently completes modeling material set and virtual fitting; tunes params; compares schemes; clear comm.	P1 CLO 3D basics and param. comparison tasks; P2 multi scheme rehearsal local refine and fitting check	CLO project files; param effect sheets; virtual fitting shots or short clips	Digital expr. 0.30; tech. feasibility 0.20; values illustrative and adjustable	Total ≥ 60 of 100; digital expr. ≥ 2 of 4; key steps complete with no omission	CLO 3D and virtual fitting req.; AIGC opt.	Wk 2 to 5 stage check; wk 8 midterm critique
2	LO2 craft competence	Masters craft within course scope; completes physical samples; explains digital physical	P1 at least 6 swatches; P2 physical sample make and display	Swatch boards; process photos; param and usage sheets	Tech. feasibility 0.20; evidence record 0.10	Swatch pass rate ≥ 80%; no major safety or compliance error	Workshop equip.; CLO params as ref.	Wk 3 to 6 swatch check; wk 10 to 12 physical display

		mapping						
3	LO3 creativity and communication	Theme focus; intention scheme alignment; complete structured materials; accurate oral brief	P2 theme research AIGC based ideation layout and presentation drill	Concept maps; sketches or rehearsal outputs; layout A2 or A3; 5 min brief script	Creative expr. 0.30; digital expr. 0.10	Theme consistency ≥ 3 of 4; brief within 5 min; key points covered	AIGC or PS opt.; classroom display tools	Wk 7 concept review; wk 13 final rehearsal and review
4	LO4 process documentation and reflection	Template based record complete; naming and version standard; revises based on feedback and notes change	P1 and P2 continuous record; peer review and self eval.; staged review	Version tree and log; peer review sheets; reflection page with key decisions	Evidence record 0.10; participation and engagement	Submission rate 100%; no missing record at key checkpoints; ≥ 2 actionable suggestions	Course platform; online forms; version rules	Weekly check; midterm and final sample review

3.2 Teaching process and task design

The teaching process is aligned with the phase structure described in chapter two. It is organised into a tool instruction phase and a design creativity phase which are connected in sequence and form a progressive structure that moves from tools and norms toward creativity and integration.

In the tool instruction phase task design emphasises basic guidance and demonstration. In class the instructor clarifies key points for software operation together with rules for file naming and version control and explains them through demonstration videos and example files. Students complete a series of small rapid exercises such as structural representation of a single silhouette and comparison of effects generated by different parameter settings applied to the same fabric in order to reduce the cost of early trial and error [3]. During this phase assignment templates and recording sheets are provided. Students submit results and short explanations using these templates which strengthens their awareness of standards and information completeness and supports reuse and comparison in later stages.

In the design creativity phase task design is driven by thematic briefs. Students collect reference materials and construct intention maps around the brief and use AIGC to support creative divergence and image generation so as to explore possibilities for texture and pattern. In the digital rehearsal stage students work in CLO 3D to compare multiple schemes and refine key areas and then employ virtual fitting for dynamic and static checks and visual communication. In the offline component students produce physical samples and present them in class. In the online component students archive process evidence and portfolio materials including images clips and explanatory text generated at each stage. At key points the instructor organises interim critiques and uses case based teaching to unpack exemplary technical pathways and modes of expression which encourages students to recognise gaps adjust their approaches and improve the quality of subsequent tasks.

The teaching process follows a classroom rhythm of short talk demonstration practice presentation and feedback. Short talks clarify task goals and operational points. Demonstrations display tools and methods. Practice activities are carried out by individuals or groups. Presentations are used to share experiences and problems. Feedback consists of teacher comments and peer suggestions. A blended online and offline format runs through both phases. Online activities support distribution of microlecture resources submission of process outputs and peer review. Offline activities focus on group discussion demonstration of key techniques and hands on troubleshooting which deepens interaction and increases learning efficiency.

Task design and assessment elements are aligned. In the tool instruction phase emphasis is placed on standards methodology and reproducibility. Students submit files with parameter annotations together with screenshots of key operations and records of generation or reference sources which demonstrate compliance and credibility. In the design creativity phase emphasis is placed on creativity integration and the completeness of expressive chains. Students provide a full set of materials extending from theme research intention maps and AIGC sketches to CLO 3D schemes virtual fitting displays and interim reports which documents the entire process from problem definition to implemented solution. These arrangements ensure consistency between learning activities and course objectives and clarify for each phase what is to be learned what is to be done what is to be submitted and how performance is assessed.

Table 2. Alignment between teaching process and tasks

Phase	Key activities onl. offl.	Submissions and checkpoints	Evaluation focus Rubric

P1 tools norms	Op. briefing; example demo; quick drills single silhouette structure expr.; same fabric diff. param. compare; onl. microlesson and sample download; offl. demo Q and A practice	Submissions CLO file with param note; key step shot or short clip; param result sheet; gen. log or source; checkpoints wk 2–5 stage review; spot check name and version	Dig. expr.; tech. feas.; evid. rec. form.
P2 design integration	Theme study and intention map; AIGC idea spread; CLO multi scheme rehearse and local refinsical sample make; stage review and case teach; onl. process upload and peer review; offl. talk key demo make and show	Submissions theme study pack; intention map; AIGC sketch; CLO scheme and fitting shot or short clip; sample photo; stage brief; checkpoints wk 8 mid review; wk 13 final rehearsal and final	Creative expr.; dig. expr.; tech. feas.; evid. rec. summ. plus form.

3.3 Evaluation methods and quality assurance

Evaluation adopts a multidimensional approach that combines qualitative and quantitative perspectives and attends to both process and outcome. Formative evaluation covers daily attendance stage based exercises and completeness of process materials and focuses on student mastery of tools and methods adherence to standards and collaboration with peers during learning. Summative evaluation is centred on portfolios and final presentations and examines conceptual interpretation technical feasibility and clarity of expression with an emphasis on the correspondence between digital tools and physical outcomes.

Portfolio assessment serves as the main vehicle for comprehensive evaluation. The portfolio includes staged assignments key screenshots and clips records of iterations and reflective texts and stresses the use of evidence to support claims. The structure of the portfolio follows the rhythm of the course which makes it possible during reviews to judge alignment between course objectives and learning outcomes. Peer review and self evaluation act as complementary mechanisms that work alongside teacher evaluation and enhance transparency of judgement and the specificity of feedback.

The quality assurance mechanism follows a course level logic of continuous improvement. At midterm and at the end of the semester the course organises collective reviews that generate lists of issues proposals for improvement and records of responsibilities and timelines which then inform the next cycle of instructional design. The course platform retains representative assignments and example files and updates templates and standards so that experience can be reused and resources shared. The teaching team and technical support staff conduct training at the beginning of the semester and provide classroom and platform support during the term in order to enable smooth implementation of blended teaching. Through these mechanisms the course realises closed loop management across objectives activities and evaluation and consolidates the use of digital tools as a sustainable instructional capacity.

IV. Conclusion

This study takes the fabric shaping design course as its focal case and proposes a digital teaching development pathway structured around Outcome Based Education. The pathway uses a phased organisation with tool instruction and design creativity as the backbone and is supported by project based learning and case teaching. A blended online and offline mode runs through implementation and enables a progression from tools and norms to creativity and integration. At the technological level three dimensional virtual environments and virtual fitting serve as core platforms for rehearsal comparison and expression and are complemented by generative tools that support creative divergence and layout optimisation. At the level of resources the course platform is built around examples templates and standards in order to accumulate process evidence and reusable assets. At the level of governance staged reviews and academic integrity requirements ensure procedural rigour and fairness in teaching.

The pathway strengthens alignment among objectives activities and evaluation. Under constraints of class time and material resources it increases the efficiency of scheme iteration and the quality of expression and at the same time enhances the depth of classroom interaction and the traceability of learning processes. At the level of learning outcomes student competence in digital expression foundational craft skills for fabric shaping creative and communicative expression and evidence based documentation and self reflection improves in a coordinated way. At the level of course operation interim outputs and assessment rules are closely matched and the portfolio becomes an effective vehicle for holistic evaluation and continuous enhancement. Platform based resources and a clear system of standards further reinforce the reuse of experience and quality assurance across cohorts and semesters. Overall this pathway offers a coherent top level logic actionable implementation details and a transferable organisational pattern and thus provides a useful reference for digital reconstruction and quality improvement in comparable courses.

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