

Competency-Enhanced E-Learning Guide in 3D Design

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ABSTRACT

This study assessed the learning competencies, achievement levels, and challenges of Bachelor of Science in Graphics and Design students at Cebu Technological University, Main Campus, as a basis for developing an E-Learning Guide in 3D design. Utilizing a descriptive research design, the study employed a researcher-made questionnaire that gathered data on students' profiles, learning competencies, levels of achievement, and challenges encountered in learning 3D design. The findings revealed that students possessed a competent level of understanding in conceptual, technical, creative, and digital aspects of 3D design. However, challenges such as limited access to updated software and equipment, insufficient instructional support, and lack of hands-on practice were identified as barriers to effective learning. Despite these limitations, students showed strong motivation and readiness to enhance their skills through modern and interactive approaches. The proposed E-Learning Guide was designed to address these gaps by providing a flexible, engaging, and technology-supported platform that supplements classroom instruction. It aims to improve accessibility, enhance learning experiences, and promote the development of creativity, technical proficiency, and confidence among students. Ultimately, the study contributes to the continuous improvement of 3D design education in the College of Technology at Cebu Technological University by aligning instructional strategies with digital advancements and student learning needs.

Keywords: Technician Education, Graphic Design, Descriptive Method of Research, Cebu Technological University Main Campus, Cebu Philippines

Chapter 1

THE PROBLEM AND ITS SCOPE

INTRODUCTION

Rationale of the Study

The integration of technology in education has transformed teaching and learning processes, enhancing accessibility, engagement, and digital competence among students in higher education. Advances in e-learning and digital platforms have reshaped instructional delivery, fostering flexible, self-paced learning environments that support diverse learners (Dolawattha & Premadasa, 2023). Technology integration enables collaborative and immersive experiences, improving communication and academic performance (Malicay, 2023). In addition, it promotes innovation and prepares learners for the demands of digital industries (Seth et al., 2024). Despite these benefits, institutions must continually adapt to the rapid pace of technological change and address infrastructure and literacy challenges (Yuna et al., 2025).

3D design has become a vital skill in modern education and creative industries, bridging art, technology, and innovation. It enhances spatial awareness, problem-solving, and visualization skills, which are

essential for architecture, animation, engineering, and product design (Li et al., 2017). In design education, the integration of 3D modeling software cultivates creativity and technical competence, preparing students for multidisciplinary collaboration (Morska & Zhmurko, 2021). Emerging technologies such as CAD and 3D printing are increasingly recognized for fostering innovation and design literacy among learners (Harron et al., 2022). Moreover, the adoption of virtual and augmented 3D environments enables immersive learning experiences that promote creative engagement and deeper understanding of visual communication (Andalib & Monsur, 2024).

Despite the growing importance of 3D design in education, many students struggle with the complexity of software interfaces, limited resources, and insufficient instructional support, which hinder their learning progress. Research shows that mastering 3D modeling requires advanced visualization and spatial thinking skills that many learners find difficult to develop without proper scaffolding (Bhaduri et al., 2021). The absence of interactive learning materials and updated technology further contributes to reduced engagement and comprehension (Fitri et al., 2023). Additionally, traditional lecture-based approaches often fail to address diverse learning styles, making it difficult for students to apply theoretical concepts effectively (Omar et al., 2020). Studies emphasize that integrating digital and hands-on learning strategies improves confidence, creativity, and overall 3D proficiency (Liu et al., 2020).

Within the BS Graphics and Design program, 3D design serves as a foundational subject that cultivates both creative and technical skills essential for professional practice. Research shows that exposure to 3D modeling and visualization significantly enhances students' spatial reasoning, problem-solving ability, and design creativity (Tomc & Kočevr, 2020). However, many students in design programs still rely on outdated curricula that do not align with industry demands (Elkashif, 2023). Innovative teaching strategies using 3D design tools such as Autodesk, Maya, and Blender have been found to improve creative thinking and engagement among learners (Li & Songsiengchai, 2025). Moreover, incorporating differentiated and project-based methods promotes higher student motivation and skill mastery in visual communication design (Gula et al., 2023).

Despite the integration of 3D design into education, significant gaps remain in instructional design and technological accessibility. Traditional teaching methods often fail to connect theoretical understanding with practical application, limiting student engagement and creative output (Khan, 2021). Many programs still lack interactive and immersive tools, such as augmented reality and virtual simulation, that can enhance conceptual learning (Putra et al., 2021). Additionally, while e-learning platforms have expanded globally, there is limited adaptation of these systems for 3D design education in developing contexts (Dritsas & Trigka, 2025). Studies highlight the urgent need for digital innovation and updated curricula that merge creativity, technology, and accessibility (Herron & Wolfe, 2021). Bridging these gaps through e-learning frameworks will modernize design education and improve student outcomes (Song & Wang, 2023).

Given the challenges identified in learning 3D design such as limited instructional clarity, inadequate hands-on practice, and outdated digital resources there is a clear need to enhance the current teaching approach at Cebu Technological University (CTU), Main Campus. While students have shown competence in foundational skills, their potential remains constrained by traditional, lecture-based instruction that lacks interactive and technology-supported components. These findings emphasize the importance of adopting modern, flexible, and engaging learning strategies suited to today's digital environment. Therefore, this study was undertaken to assess the learning competencies, achievement levels, and challenges of BS Graphics and Design students at CTU, which will serve as the basis for

proposing an E-Learning Guide to improve 3D design instruction and learning outcomes.

Theoretical Background

This research was anchored on the following theoretical and legal foundations that guided the development and direction of the study. The study is grounded in key learning theories such as Constructivism, Experiential Learning Theory, Bloom's Taxonomy of Educational Objectives, and Self-Determination Theory, which collectively emphasize active, meaningful, and student-centered learning. These frameworks support the enhancement of instructional approaches in 3D design education by promoting creativity, autonomy, and practical engagement among learners. Furthermore, the study aligns with national educational policies, particularly Republic Act No. 7722 (Higher Education Act of 1994) and CHED Memorandum Order No. 20, s. 2013, which advocate for quality, innovation, and outcome-based education.

Constructivism Theory. Proposed by Jean Piaget (1972) and expanded by Lev Vygotsky (1978), constructivism emphasizes that learners build knowledge through active engagement and meaningful experiences. In the context of 3D design education, this theory supports learning through discovery, exploration, and interaction with digital tools and real-world projects. It encourages students to construct understanding by manipulating 3D models and applying design

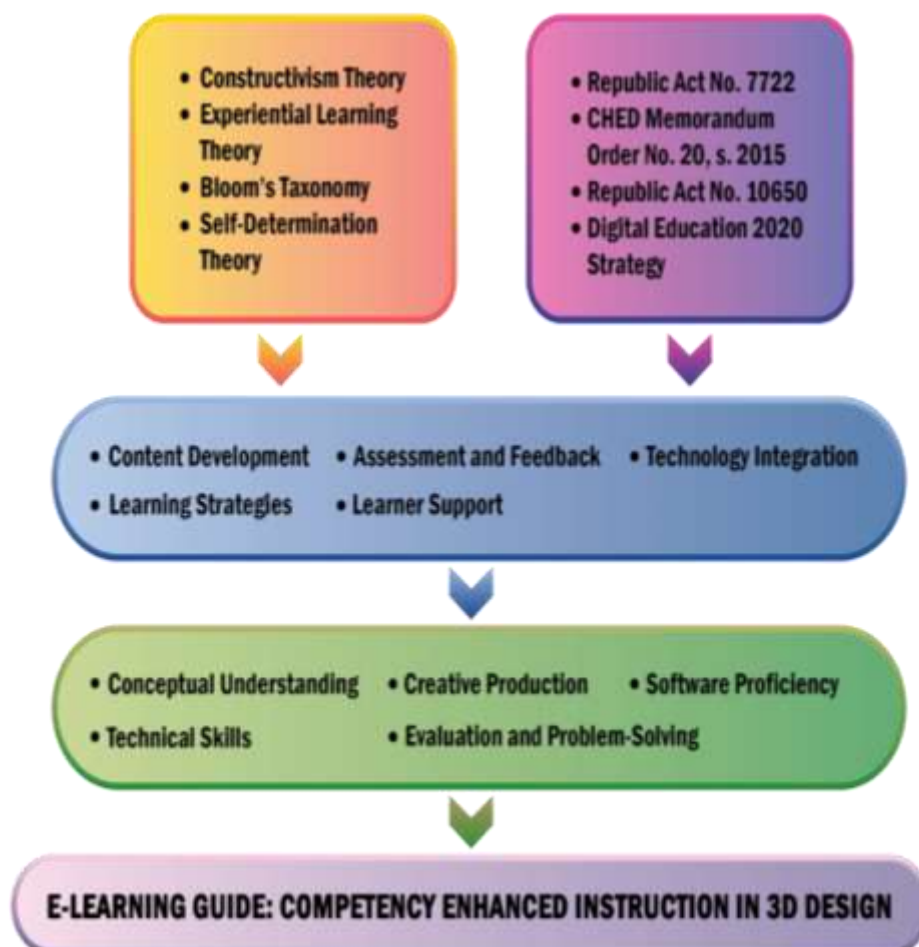


Figure 1. Theoretical-Conceptual Framework of the Study

principles, rather than passively receiving information from instructors.

Furthermore, the study is grounded in David Kolb's Experiential Learning Theory (1984), which states that knowledge is constructed through a continuous cycle of experience, reflection, conceptualization, and experimentation. This theory supports the idea that students learn 3D design more effectively through hands-on tasks such as creating, modifying, and testing 3D models. By reflecting on their experiences and applying feedback, students develop problem-solving and creative thinking skills. Integrating experiential learning in 3D design instruction at CTU encourages active learning, engagement, and retention, fostering a deeper appreciation of the design process.

In addition, Bloom's Taxonomy of Educational Objectives, developed by Benjamin Bloom (1956) and revised by Anderson and Krathwohl (2001), provides a hierarchical structure for cognitive learning that progresses from remembering and understanding to creating. In the 3D design context, this taxonomy ensures that students not only recall and comprehend design principles but also analyze and apply them creatively. It helps instructors design learning outcomes that promote critical thinking, innovation, and evaluation—skills essential in the design profession. At CTU, applying Bloom's framework ensures a structured, outcomes-based approach to instruction that develops both foundational and higher-order thinking skills.

The study also draws from Self-Determination Theory (Deci & Ryan, 1985), which highlights the importance of intrinsic motivation through autonomy, competence, and relatedness. In 3D design learning, this theory underscores the need to provide students with creative freedom, opportunities for mastery, and a supportive environment that fosters collaboration and self-expression. When students feel motivated and empowered, they become more persistent, engaged, and innovative in their work. Applying this theory to instruction at CTU encourages independent learning, enhances confidence, and strengthens students' drive to excel in their creative pursuits.

Finally, the study aligns with national educational policies that promote quality and innovation in higher education. Republic Act No. 7722, also known as the Higher Education Act of 1994, mandates the Commission on Higher Education (CHED) to advance academic excellence and technology integration in tertiary education. Similarly, CHED Memorandum Order (CMO) No. 20, s. 2013, or the Outcomes-Based Education (OBE) Framework, requires institutions to design programs that produce competent, creative, and industry-ready graduates. Guided by these policies, this research supports the development of an E-Learning Guide that integrates technology, theory, and practice enhancing both instructional quality and student learning outcomes in 3D design at Cebu Technological University.

The Constructivism Theory, rooted in the works of Jean Piaget and Lev Vygotsky, posits that learners actively construct knowledge through experience and interaction rather than passively receiving information. This theory underpins modern educational design by emphasizing student-centered learning and engagement. In 3D design education, constructivism provides the foundation for developing interactive, project-based, and collaborative learning environments. Studies show that integrating constructivist strategies in technology-based classrooms promotes deeper conceptual understanding and creativity by allowing learners to explore, manipulate, and reflect on digital models (Zhang & Liu, 2016). Similarly, Gül, Williams, and Gu (2012) demonstrated that 3D virtual worlds built on constructivist frameworks enhance learner engagement and communication through immersive collaboration (Gül et al., 2012). This aligns with the educational needs of 3D design students at Cebu Technological University, where engagement and practical exploration are essential for mastering digital creativity.

In connection to this study, constructivism supports the design of the proposed E-Learning Guide as an

interactive platform that encourages learners to build their own understanding through exploration, design experimentation, and reflection. Research highlights that constructivist-based systems improve digital literacy and innovation by allowing students to co-create and interact with virtual design environments (Jin, 2017). Likewise, Yakubu and Ahmed (2025) found that constructivism reshapes curriculum design by shifting instruction toward inquiry, collaboration, and authentic problem-solving (Yakubu & Ahmed, 2025). Applying these principles to CTU's 3D design program ensures that students not only acquire technical proficiency but also develop critical and creative thinking skills vital for professional success in the digital design industry.

The Experiential Learning Theory (ELT) developed by David Kolb (1984) emphasizes that learning occurs through a continuous process of experience, reflection, conceptualization, and experimentation. It integrates both cognitive and behavioral perspectives, allowing learners to actively apply theoretical knowledge through real-world engagement. In design education, experiential learning bridges theory and practice by engaging students in authentic, hands-on activities that foster creativity and critical thinking. Avci and Beyhan (2023) demonstrated that integrating experiential learning in architecture courses improved students' ability to translate conceptual ideas into practical designs through reflective critique sessions (Avci & Beyhan, 2023). Likewise, Dorland (2024) found that combining experiential and design thinking pedagogies enhanced innovation, collaboration, and self-paced learning among undergraduates (Dorland, 2024).

In connection to this study, ELT provides a strong foundation for developing the E-Learning Guide, where learners benefit from iterative design experiences that promote reflection and creativity. Research by Kolb and Kolb (2022) emphasized that experiential learning fosters adaptability and deeper learning in higher education, particularly when students engage in activities that simulate professional environments (Kolb & Kolb, 2022). Similarly, Mehelmy and Zeini (2024) highlighted that experiential learning through gamified and project-based activities in design programs enhances engagement, enjoyment, and learning retention (Mehelmy & Zeini, 2024). By embedding experiential learning principles, the proposed guide ensures that students gain practical exposure, refine their problem-solving skills, and connect design theory with authentic creative practice. Moreover, Bloom's Taxonomy, developed by Benjamin Bloom (1956) and revised by Anderson and Krathwohl (2001), provides a hierarchical model for cognitive development consisting of six levels: remembering, understanding, applying, analyzing, evaluating, and creating. In the context of higher education, Bloom's framework enables educators to design learning activities and assessments that move beyond rote memorization toward higher-order thinking. Recent studies emphasize that structured curriculum design based on Bloom's Taxonomy significantly enhances learning outcomes and critical thinking. For example, Hartono (2023) found that most undergraduate courses still focus on lower-order thinking skills, underscoring the need for teaching strategies that promote application and creation (Hartono, 2023). Similarly, Pugh and Gates (2021) highlighted that assessment design using Bloom's framework ensures the development of complex reasoning and problem-solving skills in higher education (Pugh & Gates, 2021).

In connection to this study, Bloom's Taxonomy supports the creation of structured learning experiences within the proposed E-Learning Guide for 3D Design at Cebu Technological University. By integrating the taxonomy's cognitive hierarchy, the guide can scaffold learning from conceptual understanding of 3D principles to the creative application of digital design tools. Research by Wei and Peng (2025) demonstrated that applying Bloom's framework within a flipped classroom model significantly improved student engagement, comprehension, and innovation (Wei & Peng, 2025). Additionally, Fayda-Kınık and

Sarikaya (2025) found that aligning e-learning design with Bloom's levels fosters both lower- and higher-order thinking, especially in online learning contexts (Fayda-Kınık & Sarikaya, 2025). Thus, Bloom's Taxonomy provides a theoretical structure for ensuring that the E-Learning Guide not only builds knowledge but also develops analysis, evaluation, and creation skills crucial for digital design education. The Self-Determination Theory (SDT), proposed by Deci and Ryan (1985), emphasizes that individuals are motivated to learn when their needs for autonomy, competence, and relatedness are fulfilled. This framework asserts that intrinsic motivation engaging in learning for personal growth and satisfaction—leads to deeper understanding and creativity. In higher education, SDT has been shown to enhance learner engagement and academic performance by fostering self-regulation and a sense of purpose (Deci et al., 1991). Recent studies have applied SDT to online and blended learning, demonstrating that autonomy-supportive environments significantly increase persistence and self-efficacy among students (Rosli et al., 2022). Similarly, Ganotice et al. (2023) found that students' perceptions of autonomy and competence strongly predict engagement and teamwork effectiveness (Ganotice et al., 2023).

In connection to this study, SDT provides a crucial foundation for designing the E-Learning Guide for 3D Design at Cebu Technological University. By incorporating autonomy-supportive features such as flexible pacing, self-directed learning modules, and peer collaboration the guide can promote intrinsic motivation and creative engagement. Shank, Tang, and Morris (2024) emphasized that integrating SDT principles into online course design enhances students' sense of competence, relatedness, and belonging, leading to improved academic performance (Shank et al., 2024). Furthermore, Khalid et al. (2023) confirmed that motivation rooted in SDT fosters sustained interest and satisfaction even in highly technical and practical disciplines (Khalid et al., 2023). Therefore, integrating SDT into the instructional design ensures that CTU students experience empowerment, competence, and connectedness key drivers of successful and meaningful 3D design learning.

The legal basis of this study is anchored in Republic Act No. 7722, known as the Higher Education Act of 1994, which established the Commission on Higher Education (CHED). This act mandates CHED to promote quality, relevance, and innovation in higher education institutions (HEIs) across the Philippines. It empowers universities like Cebu Technological University to pursue academic excellence and integrate technology in instructional delivery to meet the evolving demands of 21st-century education. As discussed by Gonzalez (1995), RA 7722 created a governance framework enabling HEIs to exercise academic freedom while ensuring accountability and responsiveness to national development goals (Gonzalez, 1995). Similarly, Santiago (2024) noted that RA 7722 underscores the importance of quality assurance and professional competence in preparing globally competitive graduates (Santiago, 2024). This legal foundation ensures that CTU's initiatives, such as developing an E-Learning Guide, are aligned with national objectives to strengthen instructional efficiency and student performance. Complementing RA 7722 is CHED Memorandum Order (CMO) No. 20, Series of 2013, which introduced the Outcomes-Based and Typology-Based Quality Assurance Framework. This policy requires HEIs to adopt Outcomes-Based Education (OBE) that focuses on measurable learning outcomes and competency-based assessment. According to Fernando (2021), OBE fosters student-centered learning and ensures that instruction is designed to achieve practical, creative, and analytical competencies (Fernando, 2021). Additionally, Sana (2024) explained that CMO 46 and its related issuances align with international standards by emphasizing outcomes-driven curriculum design that enhances efficiency and accountability in higher education (Sana, 2024). These legal frameworks collectively support the proposed E-Learning Guide for 3D Design as a strategic response to CHED's call for digital innovation, learner-centered

methodologies, and evidence-based instruction within the context of Philippine higher education.

In summary, the theoretical and legal foundations of this study collectively establish a strong framework for enhancing 3D design education through innovative and learner-centered approaches. The integration of Constructivism, Experiential Learning, Bloom's Taxonomy, and Self-Determination Theory underscores the importance of active engagement, reflective practice, structured skill development, and intrinsic motivation in fostering creativity and competence among students. Meanwhile, the legal mandates of Republic Act No. 7722 and CHED Memorandum Order No. 20, s. 2013 ensure that these pedagogical innovations align with national goals for quality and outcomes-based higher education. Grounded in these principles, the study provides a solid basis for the development of an E-Learning Guide that aims to modernize instruction, promote digital literacy, and support the continuous academic advancement of 3D design students at Cebu Technological University.

THE PROBLEM

Statement of the Problem

This study created a more effective teaching method for the Second- Year Bachelor of Science in Graphics and Design students of the College of Technology in Cebu Technological University, Main Campus, Cebu City during the (semester) of A.Y. 2025-2026 as basis for an E-Learning Guide.

Specifically, this study seeks answers to the following questions:

1. What is the profile of the student respondents in terms of:
 - 1.1. age and gender,
 - 1.2. academic performance in the 3D design subject?
2. What is the level of learning competency of the student respondents in terms of:
 - 3.1 Conceptual Understanding;
 - 3.2 Technical Skills;
 - 3.3 Creative Application; and
 - 3.4 Digital Literacy
3. As perceived by the respondent groups, what is their level of achievement in graphic design in terms of;
 - 4.1 creativity and originality,
 - 4.2 technical proficiency,
 - 4.3 application of design principles,
 - 4.4 visual communication effectiveness, and
 - 4.5 project presentation and output quality?
4. What challenges do students face in learning 3D design under the existing instructional approach?
 - 5.1 instructional clarity & content delivery,
 - 5.2 availability of resources & tools,
 - 5.3 practice and hands-on learning,
 - 5.4 instructor support, and
 - 5.5 student experience?
5. Based on the findings, what E-Learning Guide in 3D Design can be developed to address the identified learning needs and enhance the competencies of BS Graphics and Design students?

Significance of the Study

This study is significant as it provides valuable insights and practical implications for enhancing the

teaching and learning of 3D design through the development of an E-Learning Guide for the Bachelor of Science in Graphics and Design program at Cebu Technological University (CTU). The findings of this study will benefit various stakeholders in higher education as follows:

Commission on Higher Education (CHED). The results of this study can serve as a reference for CHED in promoting technology-integrated and outcomes- based instructional frameworks for design-related programs. By aligning with CHED's thrust toward innovation and quality assurance, the proposed E-Learning Guide supports the goals of RA 7722 and CMO No. 20, s. 2013, emphasizing learner-centered and industry-responsive education.

Administrators. For university and college administrators, this study offers a foundation for strategic planning and policy formulation related to digital learning implementation. It can help administrators identify areas that require resource enhancement such as upgrading software, improving facilities, and supporting faculty training to ensure that 3D design instruction remains relevant and competitive.

Faculty. For instructors in the BS Graphics and Design program, this study provides an evidence-based framework to improve instructional clarity, engagement, and assessment methods in 3D design courses. The proposed E- Learning Guide can be used as a supplemental teaching tool to facilitate interactive, flexible, and self-paced learning, helping educators better address diverse student learning styles.

Students. The study directly benefits students by introducing an engaging and accessible platform that supports independent learning and creativity. Through the E-Learning Guide, students can enhance their technical proficiency, creative skills, and digital literacy in 3D design. It also provides flexible access to instructional materials, enabling students to learn at their own pace and reinforce their classroom learning experiences.

Researcher. For the researcher, this study serves as an opportunity to contribute to the advancement of educational innovation and digital pedagogy. The process of developing and validating the E-Learning Guide provides professional growth in research, instructional design, and technology integration, aligning with the researcher's goal of improving teaching and learning practices in design education.

Future Researchers. Lastly, this study serves as a valuable reference for future researchers who wish to explore related topics in e-learning development, instructional design, or design education. It may inspire further studies focusing on the implementation, effectiveness, and scalability of technology-enhanced learning materials in other programs or disciplines.

RESEARCH METHODOLOGY

This section presents the design, the flow of the study, environment, the respondents, the instruments used, the scoring procedures and the statistical treatment of data.

Design

This study utilized a descriptive research design to assess the learning competencies, achievement levels, and challenges in 3D design among second- year BS Graphics and Design students at Cebu Technological University. The method aimed to describe and interpret the current instructional practices, resource availability, and students' experiences without manipulating any variables. Data were gathered through a structured survey questionnaire and analyzed using descriptive statistics such as mean and standard deviation.

The Flow of the Study

This research utilized the Input-Process-Output (IPO) approach as the conceptual framework of the study.

The Input includes the demographic profile of the respondents such as age, gender, and academic performance in the 3D design subject, as well as their level of aptitude in 3D design. It also covers data on students' learning competencies, achievement levels, and challenges encountered under the existing instructional approach. The Process involves the development and validation of a structured survey questionnaire, followed by data collection, tabulation, analysis, and interpretation using appropriate statistical tools. The Output of the study is the proposed E-Learning Guide designed to enhance instructional delivery and improve student learning outcomes in 3D design at Cebu Technological University. The overall flow of the study is illustrated in Figure 2 on the next page.

Environment

The location of the study is at Cebu Technological University, Main Campus with address M.J. Cuenco Avenue corner R. Palma Street, Barangay San Roque, Cebu City, which pinpoint the school environment of the study. Specifically, the research focused on the College of Technology, where the Bachelor of Science in Graphics Design program is offered.

The campus is a public university that offers a variety of technology-based

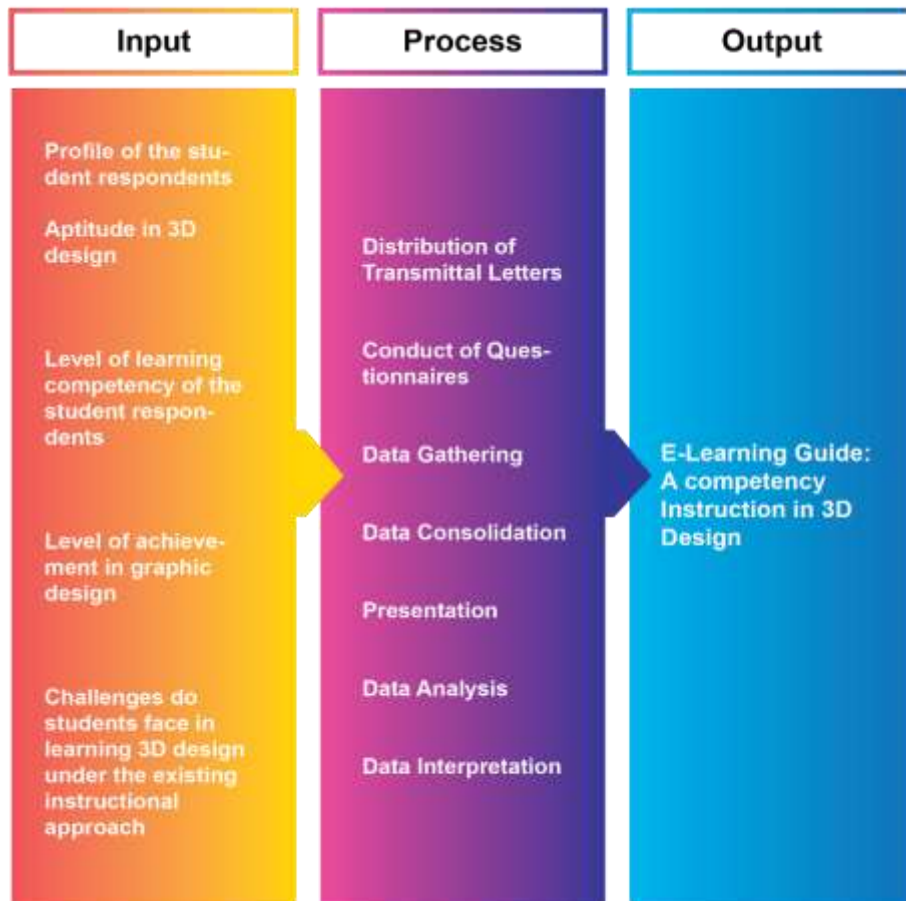


Figure 2. Flow of the Study



Figure 3. Location Map of the Research Environment

and design-related degrees. This makes it a great place to investigate how to improve training in 3D design. The research will include second-year BS Graphics

Design students who are taking the 3D Design class. These students should already know the basics of design and are now learning how to improve their skills in 3D modeling, rendering, and digital production. The setting has multimedia labs,

design studios, and computer labs that let students utilize industry-standard 3D software. However, the availability of these resources and the number of students may affect how easy it is for them to use them. The CTU Main Campus features a learning environment that works for both conventional and tech-based ways of teaching. But the transfer to e-learning and digital competency-based training still requires improvement, especially in specialized areas like 3D design. This research environment is relevant and corresponds with the study's purpose of assessing the effectiveness of an e-learning guide designed to enhance student competencies in this area.

Respondents

The respondents of the study were the second-year students enrolled in the Bachelor of Science in Graphics and Design program under the College of Technology at Cebu Technological University (CTU), Main Campus, located in Cebu City. This group was chosen as respondents because they have already been exposed to core subjects in 3D design and digital visualization, making them the most suitable participants for assessing learning competencies, achievement levels, and instructional challenges in 3D design. Their experiences and insights provided valuable data that served as the basis for developing the proposed E-Learning Guide to enhance 3D design instruction at CTU.

Table 1
Distribution of Respondents

BSGD Student	Frequency	Percentage
Male	27	40.29
Female	40	59.70
Total	67	100.00

A purposive sampling technique will be employed to ensure that only those students with direct experience in the subject are included in the study. The expected number of respondents will be based on the total population of second-year BS Graphics Design students enrolled in the 3D Design subject for the last semester. Students experienced with the subject makes them appropriate participants for assessing the effectiveness of a competency-enhance e-learning guide tailored to improved performance and engagement in 3D design.

Instruments

The main instruments use in this study are the researcher-made questionnaire in 3D Design subject which were devised and formulated using related studies as the guide in determining the learning competency of the students. To ensure the validity and reliability of the researcher-made questionnaire, several rigorous steps were undertaken during its development and evaluation. To establish content validity, the instrument was reviewed and evaluated by a panel of subject matter experts, including faculty members specializing in 3D design, instructional methodology, and educational research from the College of Technology at Cebu Technological University. These experts examined the questionnaire items to determine their clarity, relevance, and alignment with the study's objectives and theoretical foundations. Their comments and recommendations were carefully considered, and necessary revisions were made to improve the precision, coherence, and appropriateness of each question. The questions were formulated based on related literature and studies to guarantee that the indicators reflect recognized dimensions of learning competency, achievement, and challenges in 3D design. Additionally, triangulation

methods such as documentary analysis, informal interviews, and classroom observations were employed to confirm and enrich the data obtained from the questionnaire. These supplementary methods served to validate the findings and strengthen the credibility of the results. Through expert validation, adherence to established research standards, and data triangulation, the instrument achieved a high degree of validity and reliability, ensuring that it accurately captures the learning experiences, competencies, and challenges of BS Graphics and Design students in 3D design.

Data Gathering Procedure

Permission to administer the questionnaire is requested from the Dean of the College of Technology and the Campus Director, and the University President of the Cebu Technological University, Main Campus, Cebu City. For the efficient and speedy collection of data, the questionnaire is explained before it will be administered. The researcher personally dispenses, administer and retrieve the filled-out forms to ascertain that all questions are answered and returned. The retrieval of the research instruments will be finished in roughly 2 weeks.

Statistical Treatment

To analyze the data gathered using the descriptive statistical measure, the following statistical tools will be used:

Percentage and Frequency Distribution. The percentage will be used to describe the demographic profiles of the respondents.

Weighted Mean. This measure was employed to obtain the average perception or rating of the respondents regarding their learning competencies, level of achievement, and challenges in 3D design. Each response was assigned a numerical weight based on the Likert scale used in the questionnaire.

Scoring Procedure

Weight is assigned to each category on the variables as shown in the questionnaire. Likert Scale Scoring will be used as a core method to quantify student responses regarding their; competency in 3D design subject, and challenges experienced during the course. The main part of the questionnaire will utilize a 5-point Likert scale, where responses are assigned, numerical values as follows:

Scale	Numerical Rating	Descriptive Rating	Verbal Interpretation
5	4.21 – 5.00	Highly competent	This indicates that respondents demonstrate a highly competent level in the skill or concept being measured.
4	3.41 – 4.20	Competent	This suggest that respondents demonstrate a competent level in the skill or concept being measured.
3	2.61 – 3.40	Moderately Competent	This indicates that respondents demonstrate a moderate competent level in the skill or concept being measured.
2	1.81 – 2.60	Needs Improvement	This implies a need for improvement; respondents are likely struggling with the skill or do not perceive the item positively.
1	1.00 – 1.80	Not yet Competent	This shows a lack of competency; respondents are not yet demonstrating the skill or knowledge being evaluated.

Scale	Numerical Rating	Descriptive Rating	Verbal Interpretation
5	4.21 – 5.00	Highly competent	This indicates that respondents demonstrate a highly competent level in the skill or concept being measured.
	3.41 – 4.20	Competent	This suggest that respondents demonstrate a competent level in the skill or concept being measured.
3	2.61 – 3.40	Moderately Competent	This indicates that respondents demonstrate a moderate competent level in the skill or concept being measured.
2	1.81 – 2.60	Needs Improvement	This implies a need for improvement; respondents are likely struggling with the skill or do not perceive the item positively.
1	1.00 – 1.80	Not yet Competent	This shows a lack of competency; respondents are not yet demonstrating the skill or knowledge being evaluated.

In the challenges face by the students in learning 3D Design subject, this scoring is used with the following numerical values.

Scale	Numerical Rating	Descriptive Rating	Verbal Interpretation
5	4.21 – 5.00	Strongly Agree	Indicates that the student certainly experiences the challenge described or strongly affirms the statement.
4	3.41 – 4.20	Agree	Suggests that the student generally agrees with the statement or often experiences the challenge.
3	2.61 – 3.40	Neutral	Implies moderate experience or uncertainty regarding the challenge or effectiveness described.
2	1.81 – 2.60	Disagree	Indicates that the student seldom experiences the challenge or disagrees with the statement.
1	1.00 – 1.80	Strongly Disagree	Suggests that the student does not experience the challenge at all or strongly disagrees with the statement.

DEFINITION OF TERMS

For clarity and better understanding of the various contexts included in this study, the following terms are operationally defined and referenced:

Aptitude in 3D Design. This presents the data on the level of aptitude in 3D design among the respondents. It aims to assess the students' natural ability, cognitive understanding, technical capability, and creative potential in performing 3D-related tasks.

Application of Design Principles. This presents the respondents' level of skill in applying essential design principles such as balance, contrast, emphasis, rhythm, and unity in their outputs. It reflects how effectively students translate theoretical design knowledge into visually cohesive and well-structured compositions.

Availability of Resources and Tools. This refers to the adequacy, accessibility, and efficiency of digital tools, computer equipment, and learning materials necessary for 3D design practice. It also examines how

the availability or limitations of these resources affect student productivity and learning engagement.

Competency. This refers to the integrated knowledge, skills, abilities and attitudes that enable a person to perform tasks effectively and efficiently. Operationally, It refers to the students' demonstrated proficiency in conceptual understanding, technical skills, creative application and digital literacy in 3D design.

Conceptual Understanding. This refers to the respondents' comprehension of the fundamental concepts, elements, and principles of 3D design. It assesses their ability to relate theoretical knowledge to practical design problems and workflows in digital modeling.

Creative Application. This refers to how students utilize creativity and innovation in producing original and meaningful 3D design outputs. It measures the extent to which learners merge functionality, aesthetics, and originality in their creative process.

Digital Literacy. This evaluates the students' ability to effectively use various digital tools, applications, and online platforms related to 3D design. It includes managing design files, evaluating digital resources, collaborating through digital platforms, and observing ethical digital practices.

E-Learning. The delivery of instruction using electronic technologies and digital platforms. It provides a flexible, interactive, and learner-centered educational experience. Operationally, it is the learning mode employed in the proposed instructional guide where students are provided with access to digital learning materials, multimedia contents, practical exercises and assessments to support classroom instructions in 3D design.

Instructor Support. This explores the level of guidance, encouragement, and feedback that instructors provide to students during the 3D design learning process. It determines how timely and constructive instructor support influences student performance and motivation.

Instructional Clarity and Content Delivery. This part assesses the clarity, organization, and delivery of lessons related to 3D design. It examines whether teaching methods are engaging, easy to understand, and appropriately paced to support effective learning.

Practice and Hands-on Learning. This presents the extent to which students are provided opportunities for practical application of 3D design skills through exercises, projects, and real-world simulations. It evaluates how experiential learning contributes to skill mastery and confidence.

Project Presentation and Output Quality. This refers to the quality, organization, and presentation of students' final design projects. It focuses on how well the outputs meet design standards, technical accuracy, and professional presentation requirements.

Student Experience. This refers to the respondents' overall experiences in learning 3D design, including their motivation, confidence, and satisfaction with the instructional approach. It also considers how their perceptions influence learning outcomes and engagement.

Technical Proficiency. This refers on the respondents' ability to produce technically sound 3D designs using relevant software and tools. It measures their accuracy, precision, and technical control in modeling, rendering, and other design operations.

Technical Skills. This part describes the students' proficiency in operating 3D design software and applying technical procedures such as modeling, texturing, and lighting. It determines how effectively they can translate conceptual ideas into digital models.

Visual Communication Effectiveness. This section evaluates the extent to which students effectively convey design concepts and messages through visual elements. It considers clarity, audience relevance, and the overall impact of their design presentations.

Chapter 2

PRESENTATION OF DATA, ANALYSIS, AND INTERPRETATION

This chapter presents the quantitative results related to the research questions: What are the demographic profiles of the student respondents in terms of age, gender, academic performance in 3D Design, and aptitude in 3D Design. It also discusses the level of learning competency of the respondents in terms of conceptual understanding, technical skills, creative application, and digital literacy. Furthermore, this chapter examines the respondents' level of achievement in graphic design as perceived in the areas of creativity and originality, technical proficiency, application of design principles, visual communication effectiveness, and project presentation and output quality.

The data obtained from the administered questionnaire were analyzed using statistical software. Items pertaining to the demographic profile of the respondents were analyzed in terms of frequency and percentage distribution. The indicators under the level of learning competency and level of achievement in graphic design were analyzed and interpreted using the weighted mean to determine their corresponding levels.

PROFILE OF THE STUDENT RESPONDENTS

This section presents the profile of the student respondents of the study. It includes their demographic and academic characteristics in terms of age, gender, academic performance in 3D Design, and aptitude in 3D Design.

Age and Gender

Determining the respondents' age and gender profile provides a demographic overview that may help in understanding variations in learning styles, engagement levels, and adaptability to e-learning methods.

Table 2
Age and Gender

Age	Gender		Total	
	M	F	f	%
18-19	9	23	32	45.71
20-21	8	23	31	44.29
22-23	3	3	6	8.57
24-25	0	1	1	1.43
Total	20	50	70	100
Average Age: 19.81 SD; 1.40				

Table 2 shows the age and gender distribution of 70 student respondents. Most students are aged 18–19 years (45.71%), followed by 20–21 years (44.29%), while few are aged 22–23 (8.57%) and 24–25 (1.43%). Female respondents comprise 71.43%, while male account for 28.57%. The age distribution suggests that many respondents may be recent senior high school graduates adjusting to college-level learning. The higher number of female respondents suggests that the findings may reflect more of their experiences and perspective in learning 3D design. Most respondents' ages suggest transition from senior high school to college, while female predominance means the findings may more represent women's experiences in 3D design learning (OECD, 2022).

Academic Performance in 3D Design Subject

This section shows the academic performance of the respondents in their 3D Design subject. Academic

performance serves as an indicator of students' mastery of course content.

Table 3
Academic Performance

Grading Scale	GPA Range	Frequency (f)	Percentage (%)
Summa Cum Laude	1.000-1.200	2	2.86
Magna Cum Laude	1.201-1.450	5	7.14
Cum Laude	1.451-1.750	21	30.00
Without honors	1.751-2.500	42	60.00
Total		70	100.00

Table 3 presents the estimated academic classifications of 70 respondents in 3D design. Most students (60.00%) were not within the honors range, while 30.00% qualified as Cum Laude, 7.14% as Magna Cum Laude, and 2.86% as Summa Cum Laude. The findings suggest generally acceptable performance and imply the need for targeted assistance, regular feedback, and enrichment activities to improve learning outcomes (Hattie, 2023).

Level of Aptitude in 3D design

This section presents the level of confidence of the student respondents in performing various tasks and activities related to 3D Design. It examines how confident students feel in applying their conceptual knowledge and skills.

Table 4
Level of Confidence

Level of Confidence	Mean	SD	VD
Understanding 3D design concepts	3.37	0.82	H
Using 3D modeling software (e.g., Solid Works, On Shape, AutoCAD)	3.46	0.85	H
Applying textures, lighting, and rendering techniques	3.19	0.89	M
Completing 3D design projects independently	3.37	0.89	H
Creativity and originality in 3D outputs	3.19	0.79	M
Troubleshooting technical issues in software	3.36	0.96	H
Total	3.32	0.87	H

Table 4 presents the respondents' confidence in completing 3D design tasks. Overall confidence was high ($M=3.32$, $SD=0.87$), with scores ranging from 3.19 to 3.46. Students were most confident in using 3D modeling software ($M=3.46$, $SD=0.85$), followed by understanding concepts and completing projects independently ($M=3.37$, $SD=0.89$). Confidence was moderate in applying textures, lighting, and rendering techniques and in producing creative outputs ($M=3.19$, $SD=0.79$). These findings imply that instruction should emphasize experimentation, rendering practice, and problem-solving to strengthen confidence (Almulla, 2020).

LEVEL OF LEARNING COMPETENCY OF THE STUDENT RESPONDENTS

This section presents the level of learning competency of the student respondents in relation to their

performance and skills in the field of 3D design. It specifically covers four major areas: conceptual understanding, technical skills, creative application, and digital literacy.

Conceptual Understanding

This part presents the level of conceptual understanding of the student respondents in 3D Design. It focuses on their grasp of fundamental design, and concepts that serve as the foundation for practical applications.

Table 5
Conceptual Understanding

Indicators	Mean	SD	VD
1. I can clearly explain the fundamental concepts of 3D design.	3.31	0.84	C
2. I understand how design elements and principles apply to 3D work.	3.28	0.87	C
3. I am familiar with the workflow of a standard 3D design process.	3.03	0.76	C
4. I can distinguish between 2D and 3D design concepts.	3.29	0.84	C
5. I can relate theoretical knowledge to practical design problems.	3.96	0.97	C
Total	3.37	0.86	C

Table 5 presents the students' conceptual understanding of 3D design, which obtained mean scores ranging from 3.03 to 3.96, all verbally described as "Competent." This indicates that students have a solid grasp of fundamental 3D design concepts, including distinguishing between 2D and 3D designs and applying theoretical knowledge to practice. The results suggest that integrating interactive and visual learning tools can further strengthen conceptual comprehension. According to Boumaraf and Inceoglu (2020), the use of 3D modeling and printing technologies enhances students' spatial cognition and deepens their conceptual understanding of design processes (Boumaraf & Inceoglu, 2020). This implies that adopting similar technology-driven strategies in 3D design education at Cebu Technological University can enhance students' engagement, strengthen theoretical comprehension, and improve overall learning outcomes.

Technical Skills

This section discusses the respondents' level of technical skills in utilizing design software and tools related to 3D modeling, rendering, and animation.

Table 6
Technical Skills

Indicators	Mean	SD	VD
1. I am proficient in operating 3D design software (e.g., Solid Works, On Shape, AutoCAD).	3.42	0.75	C
2. I can model basic to intermediate 3D objects with accuracy.	3.99	0.81	C
3. I can apply texturing, lighting, and rendering tools effectively.	3.46	0.96	C
4. I can follow design specifications and technical guidelines.	3.29	0.77	C

5. I can troubleshoot minor technical problems in my 3D work.	3.54	0.80	C
Total	3.54	0.82	C

Table 6 presents the respondents' level of technical skills in 3D design, with mean scores ranging from 3.29 to 3.99, all verbally described as "Competent." The highest mean score was observed in modeling basic to intermediate 3D objects with accuracy ($M = 3.99$), indicating that most students possess strong practical skills in creating and manipulating 3D forms. Proficiency in software operation ($M = 3.42$) and rendering techniques ($M = 3.46$) were also rated competent, showing students' capability in using digital tools effectively. These results suggest that the current instructional approach successfully builds foundational technical proficiency but could be enhanced by providing more advanced, hands-on experiences to further strengthen expertise. According to Kumar et al. (2023), integrating 3D animation and virtual reality simulations into instruction significantly improves students' technical understanding and engagement through experiential practice (Kumar et al., 2023). This implies that incorporating immersive and gamified 3D learning environments at Cebu Technological University can enhance students' technical competence, confidence, and readiness for real-world design applications.

Creative Application

This portion highlights the level of creative application demonstrated by the respondents in their 3D Design tasks. It examines how students apply originality, innovation, and artistic expression to their projects, integrating learned concepts and technical knowledge into unique and meaningful designs.

Table 7
Creative Application

Indicators	Mean	SD	VD
1. I can create original and imaginative 3D design concepts.	3.42	0.77	C
2. I explore multiple creative solutions when designing.	3.83	0.85	C
3. I incorporate aesthetic appeal in my 3D outputs.	3.82	0.86	C
4. I can merge creativity with function and purpose in design.	3.65	0.77	C
5. I take inspiration from design trends and apply them creatively.	3.50	0.82	C
Total	3.64	0.81	C

Table 7 presents the respondents' level of creative application in 3D design, with mean scores ranging from 3.42 to 3.83, all verbally described as "Competent." The highest ratings were observed in exploring multiple creative solutions ($M = 3.83$) and incorporating aesthetic appeal in outputs ($M = 3.82$), suggesting that students demonstrate strong creativity and design sensitivity. Meanwhile, the ability to merge creativity with function ($M = 3.65$) and create original concepts ($M = 3.42$) also indicate consistent creative performance. These results show that students can effectively balance innovation and design principles but may further benefit from activities that stimulate originality and design experimentation. According

to McLaughlin et al. (2022), fostering creativity through design thinking approaches in higher education enhances students' ability to generate diverse ideas and connect creative and practical design aspects. This implies that incorporating design thinking and open-ended creative tasks in 3D design instruction at Cebu Technological University can further enhance innovation, originality, and critical design problem-solving skills among students.

Digital Literacy

This part describes the level of digital literacy of the student respondents, focusing on their ability to navigate, evaluate, and utilize digital tools and resources in their learning and design processes.

Table 8
Digital Literacy

Indicators	Mean	SD	VD
1. I can confidently use different digital tools for 3D design tasks.	3.52	0.83	C
2. I can access and evaluate online tutorials and references to improve my skills	3.87	0.90	C
3. I can manage digital files, folders, and assets effectively.	3.62	0.82	C
4. I understand and follow ethical use of digital content and resources.	3.95	0.96	C
5. I can collaborate with others using digital platforms (e.g., Google Drive, Discord, Trello).	3.65	0.86	C
Total	3.72	0.87	C

Table 8 presents the respondents' level of digital literacy, with mean scores ranging from 3.52 to 3.95, all verbally described as "Competent." The highest mean score was recorded in understanding and following the ethical use of digital content and resources ($M = 3.95$), indicating strong awareness of responsible digital practices. Students also showed high competency in accessing and evaluating online tutorials ($M = 3.87$) and collaborating through digital platforms ($M = 3.65$), reflecting effective use of digital tools for learning and teamwork. These results suggest that students are digitally adept and capable of leveraging technology to enhance their 3D design learning experience. According to Ghanbarzadeh and Ghapanchi (2020), user-friendly 3D virtual learning environments that emphasize engagement and visual interactivity significantly enhance digital competence and learning outcomes in higher education. This implies that continuous integration of collaborative digital tools and immersive online resources at Cebu Technological University can further strengthen students' digital literacy, adaptability, and readiness for technology-driven creative industries.

LEVEL OF ACHIEVEMENT IN GRAPHIC DESIGN

This section presents the level of achievement in graphic design as perceived by the student respondents. It assesses their performance in key areas that reflect their overall design capability, including creativity and originality, technical proficiency, application of design principles, visual communication effectiveness, and project presentation and output quality.

Creativity and Originality

This section presents the respondents' level of achievement in terms of creativity and originality. It focuses on their ability to generate unique, innovative, and visually appealing design concepts that reflect individuality and creative thinking.

Table 9
Creativity and Originality

Indicators	Mean	SD	VD
1. I develop unique and innovative concepts for design projects	3.37	0.82	C
2. I explore different creative approaches when starting a design task.	3.27	0.88	C
3. My designs reflect originality and artistic expression.	3.41	0.92	C
4. I am confident in presenting fresh ideas in my work.	3.37	0.82	C
5. I take creative risks that improve the visual appeal of my output.	3.41	0.85	C
Total	3.37	0.86	C

The overall mean of 3.37 with a standard deviation of 0.86 indicates that students are competent (C) in developing creative and original design concepts. The highest mean score of 3.41 was shared by two indicators "My designs reflect originality and artistic expression" and "I take creative risks that improve the visual appeal of my output." This suggests that students demonstrate a consistent effort to produce visually appealing and distinctive works. The lowest mean of 3.27 was recorded for "I explore different creative approaches when starting a design task," implying that some students may still rely on conventional methods rather than experimenting with diverse design strategies. Overall, the results show that Cebu Technological University graphics design students possess a commendable level of creativity and originality, though continuous exposure to innovation-driven activities could further strengthen their artistic development and confidence in idea generation.

Technical Proficiency

This part discusses the respondents' technical proficiency in graphic design, particularly their capability to use design software, tools, and techniques efficiently and accurately.

Table 10
Technical Proficiency

Indicators	Mean	SD	VD
1. I use graphic design software tools effectively and accurately.	4.02	0.72	C
2. I can produce clean and professional designs using digital tools.	3.95	0.84	C
3. I apply proper techniques in creating and editing digital artworks.	3.41	0.92	C
4. I use shortcuts, settings, and functions of design software efficiently.	3.37	0.88	C
5. I can work independently with minimal technical guidance.	3.95	0.72	C

Total	3.74	0.82	C
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Table 9 presents the respondents' level of creativity and originality in 3D design, with mean scores ranging from 3.27 to 3.41, all verbally described as "Competent." The results indicate that students demonstrate consistent creativity in developing unique concepts, expressing originality, and taking creative risks to enhance visual appeal. The highest mean scores were recorded in reflecting originality and artistic expression ($M = 3.41$) and taking creative risks ($M = 3.41$), showing that learners are willing to innovate within guided frameworks. These findings suggest that while students exhibit solid creative ability, there is still room to cultivate higher levels of innovation and independent idea generation through more exploratory and project-based activities.

According to McLaughlin et al. (2022), integrating design thinking approaches in higher education fosters creative confidence and encourages students to explore diverse problem-solving strategies in design-related disciplines. This implies that incorporating design thinking and open-ended creative projects in 3D design courses at Cebu Technological University can enhance students' originality, innovation, and confidence in presenting unique design ideas.

Application of Design Principles

This presents the respondents' level of achievement in graphic design in terms of application of design principles. It focuses on how effectively students apply fundamental principles such as balance, contrast, emphasis, and unity in their 3D design outputs, reflecting their ability to create visually organized and aesthetically cohesive compositions.

Table 11
Application of Design Principles

Indicators	Mean	SD	VD
1. I apply the principles of balance, contrast, emphasis, and unity in my designs.	3.81	0.70	C
2. I can effectively organize elements in a composition.	4.06.	0.83	C
3. I demonstrate understanding of typography and layout.	3.41	0.82	C
4. I choose colors, fonts, and spacing based on design purpose.	4.21	0.88	C
5. My outputs clearly reflect appropriate design principles.	3.60	0.81	C
Total	3.76	0.81	C

Table 11 presents the respondents' level of competency in applying design principles, with mean scores ranging from 3.41 to 4.21, all verbally described as "Competent." The highest mean score was recorded in choosing colors, fonts, and spacing based on design purpose ($M = 4.21$), followed by organizing elements effectively in a composition ($M = 4.06$), indicating that students are proficient in visual organization and aesthetic decision-making. Meanwhile, understanding typography and layout ($M = 3.41$) received the lowest rating, suggesting an area for improvement in technical application and visual communication. These findings imply that students demonstrate a strong grasp of core design principles

but may benefit from enhanced instruction in typography and layout integration. According to Boumaraf and Inceoğlu (2020), integrating 3D and computational modeling in design education strengthens students' spatial perception and ability to apply theoretical design concepts effectively in practice. This implies that reinforcing hands-on, technology-driven design activities at Cebu Technological University can further enhance students' understanding and practical application of design principles in 3D and graphic outputs.

Visual Communication Effectiveness

This section examines the respondents' achievement in terms of visual communication effectiveness. It evaluates how successfully students use visual elements to convey messages, emotions, and ideas.

Table 12
Visual Communication Effectiveness

Indicators	Mean	SD	VD
1. My designs effectively convey the intended message or idea.	3.41	0.79	C
2. I tailor my visuals according to audience and context.	3.37	0.65	C
3. I use imagery and graphics to enhance understanding.	3.41	0.78	C
4. I can simplify complex information through visual design.	3.74	0.74	C
5. My designs have impact and clarity in communication.	3.45	0.84	C
Total	3.48	0.76	C

Table 12 presents the respondents' level of competency in visual communication effectiveness, with an overall mean of 3.48 (SD = 0.76), verbally described as "Competent." The results indicate that students are capable of producing designs that communicate ideas clearly and appropriately for their audience. The highest rating was observed in simplifying complex information through visual design (M = 3.74), suggesting that students can translate abstract or technical ideas into understandable visuals. Meanwhile, tailoring visuals according to audience and context (M = 3.37) received the lowest mean score, implying the need for more audience-centered design training. These findings suggest that students possess adequate skills in visual communication but can further refine their ability to design with clarity, purpose, and audience sensitivity. According to McLaughlin et al. (2022), design thinking approaches in higher education strengthen students' visual problem-solving and communication skills by emphasizing empathy, user-centered design, and iterative creativity (McLaughlin et al., 2022). This implies that applying design thinking strategies and real-world communication projects at Cebu Technological University can further enhance students' ability to produce impactful, audience-driven, and conceptually strong visual designs.

Project Presentation and Output Quality

This part assesses the respondents' level of achievement based on the quality and presentation of their design projects. It considers aspects such as clarity, organization, attention to detail, and overall professionalism of the final outputs.

Table 13
Project Presentation and Output Quality

Indicators	Mean	SD	VD
1. I submit design projects that meet quality standards.	3.42	0.86	C

2. My work is organized and professionally presented.	4.05	0.75	C
3. I follow specifications and guidelines in design briefs.	3.82	0.83	C
4. I check and revise my outputs before final submission.	4.15	0.75	C
5. My outputs are visually appealing and technically accurate.	3.84	0.74	C
Total	3.86	0.79	C

Table 13 presents the respondents' level of competency in project presentation and output quality, with an overall mean of 3.86 (SD = 0.79), verbally described as "Competent." The highest mean score was observed in checking and revising outputs before final submission (M = 4.15), indicating that students demonstrate diligence and strong attention to detail. Similarly, high ratings in professional presentation (M = 4.05) and adherence to design briefs (M = 3.82) show their ability to meet academic and technical standards. These results imply that students consistently produce well-organized, visually appealing, and technically accurate outputs. According to Kumar et al. (2023), integrating interactive 3D visualization and simulation-based learning promotes precision, engagement, and professional quality in student outputs (Kumar et al., 2023). This implies that adopting immersive, technology-driven instructional methods at Cebu Technological University can further enhance students' presentation skills, attention to visual detail, and readiness for professional 3D design practice.

CHALLENGES FACE IN LEARNING 3D DESIGN

Learning 3D design presents a unique set of challenges that go beyond traditional artistic or technical disciplines. As this field combines creativity with complex software skills, learners often struggle to balance artistic expression with technical precision. Understanding these challenges is essential for developing effective teaching methods and learning strategies that empower students to succeed in this dynamic and interdisciplinary domain.

Instructional Clarity & Content Delivery

This section aims to evaluate how clearly and effectively 3D design concepts are presented in class. It assesses the clarity of explanations, the engagement of teaching methods, and the pacing of lessons to determine whether the instructional approach supports student understanding and interest.

Table 14
Instructional Clarity & Content Delivery

Indicators	Mean	SD	VD
1. The current instructional approach clearly explains 3D design concepts.	3.02	0.66	MA
2. I find it difficult to understand the lessons without visual or interactive demonstrations.	2.65	0.72	MA
3. The lectures or teaching methods are engaging and keep my attention.	3.05	0.63	MA
4. The pacing of the lessons is too fast for me to absorb the material effectively.	2.67	0.74	MA
Total	2.84	0.68	MA

Table 14 presents the respondents' assessment of instructional clarity and content delivery in 3D design,

with mean scores ranging from 2.65 to 3.05, all verbally described as “Moderately Agree.” The results indicate that while the instructional approach helps students understand 3D concepts to some extent ($M = 3.02$), learners still struggle when lessons lack visual or interactive demonstrations ($M = 2.65$). The moderate ratings on lesson engagement ($M = 3.05$) and pacing ($M = 2.67$) suggest that current teaching methods are somewhat effective but could benefit from a more interactive and student-centered approach. These findings imply that 3D design learning is more effective when instructors integrate visual, practical, and interactive teaching methods. According to Andalib and Monsur (2024), incorporating immersive and experiential technologies such as 3D modeling and virtual reality in design instruction enhances comprehension and learner engagement through multisensory interaction (Andalib & Monsur, 2024). This implies that enhancing instructional clarity through visual demonstrations and interactive digital tools can make complex 3D design lessons more accessible, engaging, and effective for students at Cebu Technological University.

Availability of Resources & Tools

This section focuses on the accessibility and adequacy of digital tools, software, and learning materials used in 3D design instruction. It also examines how technical challenges and resource availability affect students’ ability to learn and practice effectively.

Table 15
Availability of Resources & Tools

Indicators	Mean	SD	VD
1. There are sufficient digital tools and software provided for learning 3D design.	3.06	0.82	MA
2. Technical difficulties (e.g., slow computers, outdated software) hinder my learning.	3.02	0.74	MA
3. I have access to learning materials (modules, guides, or videos) that support 3D design practice.	3.12	0.68	MA
Total	3.07	0.75	MA

Table 15 presents the respondents’ assessment of the availability of resources and tools for learning 3D design, with an overall mean of 3.07 ($SD = 0.75$), verbally described as “Moderately Agree.” The results indicate that students perceive only a moderate sufficiency of digital tools, software, and learning materials. The lowest rating was noted in technical reliability ($M = 3.02$), suggesting that slow computers or outdated software occasionally hinder learning. Access to supporting materials such as modules and videos ($M = 3.12$) also suggests room for improvement in instructional resource provision. These findings imply that while basic resources for 3D design learning are available, there is a need for upgrading equipment and expanding access to updated tools and references. According to To et al. (2023), limited access to modern digital technologies and software in higher education can constrain hands-on learning and student creativity, whereas providing up-to-date 3D tools enhances learning engagement and sustainability in design education (To et al., 2023). This implies that improving digital infrastructure and ensuring continuous access to modern design software at Cebu Technological University can enhance students’ learning efficiency, technical mastery, and creative productivity in 3D design courses.

Practice and Hands-on Learning

This section evaluates the extent to which students are given opportunities to apply their learning through

practice and real-world projects. It also explores whether students receive sufficient time, support, and practical exposure to build their confidence and proficiency in using 3D design tools.

Table 16
Practice and Hands-on Learning

Indicators	Mean	SD	VD
1. I have adequate time and guidance to practice 3D design during class	2.84	0.82	MA
2. The current approach provides real-world applications or projects in 3D design.	2.92	0.87	MA
3. I feel confident using 3D design software after classroom instruction.	3.10	0.74	MA
Total	2.95	0.81	MA

Table 16 presents the respondents' assessment of practice and hands-on learning opportunities in 3D design, with mean scores ranging from 2.84 to 3.10, all verbally described as "Moderately Agree." The results indicate that while students gain some degree of practical exposure, the time and guidance provided during class ($M = 2.84$) are not fully sufficient for skill mastery. Likewise, the integration of real-world applications ($M = 2.92$) is moderate, suggesting limited experiential learning opportunities. Confidence in using 3D design software after instruction ($M = 3.10$) shows a fair level of self-assurance but points to a need for deeper hands-on engagement. These findings imply that more structured and extensive practice sessions, along with project-based learning, could significantly enhance students' practical competencies. According to Andalib and Monsur (2024), incorporating immersive 3D modeling and virtual reality-based activities in design education enhances engagement and understanding through experiential and interactive learning environments (Andalib & Monsur, 2024). This implies that strengthening practical applications and providing more guided 3D design experiences at Cebu Technological University can improve students' technical confidence and real-world design proficiency.

Instructor Support

This section assesses the level of support and guidance provided by instructors. It focuses on feedback, approachability, and responsiveness, which are crucial in helping students overcome learning challenges and improve their 3D design skills.

Table 17
Instructor Support

Indicators	Mean	SD	VD
1. My instructor provides timely and helpful feedback on my 3D design work.	2.24	0.80	D
2. I feel comfortable asking questions or seeking help from my instructor.	2.32	0.72	D
Total	2.28	0.76	D

Table 17 presents the respondents' assessment of instructor support in learning 3D design, with mean scores of 2.24 and 2.32, both verbally described as "Disagree." The results indicate that students receive only moderate levels of feedback and approachability from their instructors. The relatively low mean for

timely and helpful feedback ($M = 2.24$) suggests that opportunities for individualized guidance and critique may be limited. Similarly, the mean score for feeling comfortable seeking help ($M = 2.32$) implies that instructor-student interaction can still be improved to foster a more supportive learning atmosphere. These findings highlight the importance of strengthening communication and feedback mechanisms in 3D design instruction. According to McLaughlin et al. (2022), effective instructor support and feedback are critical components of design-based learning, enhancing student motivation, confidence, and problem-solving skills in creative disciplines (McLaughlin et al., 2022). This implies that fostering a more interactive and responsive teaching approach at Cebu Technological University can improve student engagement, learning satisfaction, and skill development in 3D design course.

Student Experience

This section seeks to understand students' overall learning experience and motivation in 3D design. It examines how students perceive the difficulty of lessons, their need for personalized instruction, and their level of motivation and engagement with the current teaching method.

Table 18
Student Experience

Indicators	Mean	SD	VD
1. I often feel overwhelmed by the complexity of 3D design lessons.	2.44	0.74	MA
2. I need more personalized guidance to improve my skills in 3D design.	2.36	0.76	MA
3. The current teaching method motivates me to learn 3D design.	2.72	0.82	MA
Total	2.51	0.77	MA

Table 18 presents the respondents' assessment of their student experience in learning 3D design, with mean scores ranging from 2.36 to 2.72, all verbally described as "Moderately agree." The findings indicate that students occasionally feel challenged by the complexity of lessons ($M = 2.44$) and express a need for more personalized guidance to improve their skills ($M = 2.36$). Meanwhile, the moderate rating for motivation ($M = 2.72$) suggests that current teaching methods only partially engage students in the learning process. These results imply that while students show interest in 3D design, they may benefit from more adaptive and learner-centered instructional strategies. According to Ghanbarzadeh and Ghapanchi (2020), interactive and visually engaging 3D virtual learning environments increase motivation, satisfaction, and persistence by making learning more immersive and responsive to individual needs (Ghanbarzadeh & Ghapanchi, 2020). This implies that enhancing instructional design through personalized digital tools and interactive approaches at Cebu Technological University can reduce cognitive overload, boost engagement, and improve the overall learning experience in 3D design education.

Chapter 3

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter exhibits and explicates the summary, findings, conclusion, and recommendations of the research study.

Summary

This study assessed the learning competencies, achievement levels, and instructional challenges in 3D

design among Second-Year Bachelor of Science in Graphics and Design students at the College of Technology, Cebu Technological University, Main Campus, for the Academic Year 2025–2026. The research served as the basis for developing an E-Learning Guide to enhance instructional delivery. A descriptive research design was employed, utilizing a structured survey questionnaire consisting of demographic profiles, Likert-scale indicators, and evaluative items. Data were collected on students' profile (age, gender, academic performance, and aptitude), learning competencies (conceptual understanding, technical skills, creative application, and digital literacy), achievement in graphic design (creativity and originality, technical proficiency, application of design principles, visual communication effectiveness, and project presentation), and challenges encountered under the existing instructional approach.

Findings

Profiles of the Student Respondents

The findings revealed that most student respondents were 18 to 19 years old, representing the typical college age group, with a higher proportion of female students enrolled in the program. In terms of academic performance in 3D design, the majority obtained satisfactory to good grades, indicating that students generally demonstrate an acceptable level of understanding and skill in the subject but still have room for further improvement.

Competence in Aptitude in 3D Design

The findings revealed that the students demonstrated a moderate aptitude in 3D design, showing sufficient understanding of basic concepts, software use, and design application. While most respondents exhibited competence in performing essential 3D tasks, results suggest that their skills are still developing and could be strengthened through more practical exercises and guided instruction. Overall, students possess the potential to enhance their 3D design aptitude with continued training and exposure to hands-on learning experiences.

Level of Learning Competency

The findings revealed that the student respondents demonstrated a competent level of learning competency across all areas of 3D design. In terms of conceptual understanding, students showed a solid grasp of fundamental design concepts and were able to relate theory to practice. For technical skills, respondents displayed proficiency in operating 3D design software and performing basic modeling tasks with accuracy. In creative application, students effectively incorporated originality and aesthetic quality in their outputs, though further development in innovation is encouraged. Meanwhile, their digital literacy was found to be strong, as they confidently utilized digital tools, managed design files, and adhered to ethical standards in using digital resources. Overall, the results indicate that students are competent in core 3D design skills but would benefit from

enhanced hands-on and project-based learning to achieve higher mastery.

Level of Achievement in Graphic Design

The findings revealed that the student respondents attained a competent level of achievement in various aspects of graphic design. In terms of creativity and originality, students were able to generate unique and expressive ideas, though there is still room to further enhance innovation and risk-taking in their designs. Their technical proficiency was also competent, reflecting their ability to operate design software and apply technical processes effectively. In the application of design principles, students demonstrated a strong understanding of balance, color harmony, and composition in their outputs. For visual

communication effectiveness, they showed the ability to convey messages clearly through appropriate visual elements and design strategies. Lastly, in project presentation and output quality, students produced well-organized, visually appealing, and technically accurate works that met academic standards.

Challenges in Learning 3D Design

The findings revealed that students encountered several challenges in learning 3D design under the existing instructional approach. Many respondents reported limited hands-on practice and insufficient time to apply 3D design concepts effectively during class. Technical issues such as slow computers and outdated software also hindered their learning experience. In addition, students expressed a need for more personalized guidance and timely feedback from instructors to help them overcome difficulties and improve their skills. Some also felt overwhelmed by the complexity of lessons and found it challenging to stay motivated without engaging, interactive activities. Overall, the results indicate that enhancing resource availability, instructor support, and practical learning opportunities would help address these challenges and improve students' competence and confidence in 3D design.

Conclusion

The study revealed that the Bachelor of Science in Graphics and Design students of Cebu Technological University have a competent level of learning competency and achievement in 3D design. The students demonstrated satisfactory conceptual understanding, technical skills, creative application and digital literacy which enabled them to competently perform in graphic design tasks. The core knowledge and skills expected in the course are further exemplified by their achievement in creativity, technical proficiency, application of design principles, visual communication and project presentation.

But it was also found that students are facing instructional and technical difficulties impacting the effectiveness of the current teaching method. Students are denied the opportunity to develop higher levels of competency and achievement because of the lack of access to practice hands-on skills, limited laboratory resources, out of date hardware and software, limited instructional time, and the need for more personalized guidance and instructor feedback in a timely manner. The results of this study indicate that present teaching methods are sufficient to develop basic skills but need to be improved to cater for the varied learning needs of students and the practical requirements of 3D design education.

Therefore, it is concluded that a more effective, learner-centered, technology-enhanced instructional approach is needed in teaching 3D design. The results of this study served as an empirical basis for the formulation of an E-Learning Guide to complement classroom instruction with interactive learning resources, guided activities, practice exercises, and self-paced learning options. The proposed E-Learning Guide is designed to develop student competencies and improved academic performance, respond to the instructional challenges identified in the study, and promote greater engagement, creativity, and independent learning. Henceforth, the study's primary goal of establishing the foundation for the creation of a more effective teaching method for the Bachelor of Science in Graphics and Design students by developing an E-Learning Guide has been accomplished.

Recommendation

It is recommended that the output of the study, the E-Learning Guide for 3D Design, be implemented to enhance instructional delivery and improve students' learning experiences, competencies, and creativity in 3D design at Cebu Technological University

Chapter 4**OUTPUT OF THE STUDY**

This chapter presents the output based on the findings of the study entitled “Learning Competencies, Achievement, and Challenges in 3D Design as Basis for an E-Learning Guide for BS Graphics and Design Students.” It serves as a proposal to the College of Technology of Cebu Technological University, Main Campus, for the improvement of 3D design instruction and the integration of the proposed E-Learning Guide into the teaching and learning process.

Rationale

The rapid advancement of digital technology has significantly transformed the field of graphic design, emphasizing the need for students to develop strong competencies in 3D design. However, findings from the study revealed that students at Cebu Technological University, Main Campus, face several challenges, including limited hands-on practice, outdated resources, and insufficient instructional support. These factors hinder the full development of their technical skills, creativity, and confidence in applying 3D design concepts. To address these gaps, the proposed E-Learning Guide aims to provide a structured, accessible, and interactive learning platform that supplements traditional instruction. It will offer step-by-step tutorials, practice exercises, and digital learning materials that allow students to learn at their own pace while reinforcing conceptual understanding and technical proficiency. Additionally, it will serve as a tool for instructors to enhance teaching strategies through feedback, project-based activities, and digital collaboration. Ultimately, this enhancement plan seeks to improve the overall quality of 3D design education in the College of Technology by fostering a more engaging, flexible, and technology-driven learning environment that prepares students for real-world design applications and future industry demands.

Objectives

- Enhance instructional delivery by providing a structured, technology- integrated platform that supports interactive and student-centered learning in 3D design.
- Improve students’ learning competencies by reinforcing their conceptual understanding, technical proficiency, creative application, and digital literacy through guided digital modules and activities.
- Address identified learning challenges such as limited hands-on practice, inadequate instructional support, and lack of updated resources by offering accessible and engaging digital learning materials.
- Foster creativity and innovation by incorporating project-based, exploratory, and practice-oriented learning experiences that encourage independent and collaborative work.
- Support faculty development by serving as a supplemental teaching tool that enables instructors to integrate e-learning strategies, provide timely feedback, and monitor student progress effectively.
- Promote flexible and self-paced learning by allowing students to access instructional content anytime and anywhere, thereby accommodating different learning styles and paces.

Scheme of Implementation

The implementation process starts with institutional presentation and approval, and the expert validation to ensure instructional material is accurate, relevant and in line with the course learning outcome. Then the faculty members and students are oriented on the proper use of the E-Learning Guide to enhance its effective integration in the teaching and learning process. The guide serves as a supplemental instructional tool during implementation that instructors use to monitor student engagement, learning progress, and performance. Finally, ongoing evaluation and periodic improvement are conducted based on feedback from users and evaluation result to ensure that the instructional material is responsive to curricular needs,

technological developments, and the changing needs of learners. The proposed E-Learning Guide is expected to be systematically implemented to improved instructional delivery, students' competency and academic achievement, and the more engaging, more flexible, and more learner-centered approach to 3D design education.

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