Enhancing Digital Drawing Proficiency: An Examination of Assignment Redesign and Instructional Approaches in Higher Education Contexts

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To cite this article:

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Article Info	Abstract
	Within digital drawing courses, students are immersed in the utilization of software tools and technological advancements to craft a diverse array of artwork, illustrations, graphics, and animations, adhering to both industry standards and artistic principles. However, tailoring the complexity of digital drawing assignments to accommodate students across a spectrum of freehand drawing skills, ranging from novice to advanced levels, poses a notable challenge. This study endeavors to investigate the efficacy of integrating a specific teaching model in the design of assignments within digital drawing classes of lower-year students in higher education and its subsequent impact on students' performance. The study adopts a three-phase data collection methodology, comprising a pre-test, intervention phase, and post-intervention assessment, supplemented by a self-reflection questionnaire to gauge students' perceptions of the learning process. By employing visual analysis in tandem with quantitative data derived from the final scores of a selected drawing exercise, a comparative analysis was conducted to elucidate the relationship between assignment design, instructional methodologies, and students' learning performance. Notably, an improvement in students' drawing proficiency was observed compared to analogous exercises conducted in previous semesters, signifying the efficacy of tailored assignment redesigns aligned with students' drawing capabilities, coupled with supporting instructional methods.

Introduction

Drawings are used as a visual representation of ideas, thoughts, and designs in the design fields of architecture, interior design, fashion, and graphic design, among others (Abdullah et al., 2023). Unquestionably, in recent years, after the emergence of drawing as a discipline in institutions with university status, we witness drawings' importance and growing gravitational power (Côrte-Real, 2021). Technological advances had an impact on the field of education, and computer technologies were started to be used mainly in visual arts, architecture and planning departments in colleges (Eren, 2020). Computer graphics means have brought to life such new types of fine arts as digital drawing and digital painting, which lay the foundations for creating various types of digital visualizations, animations, illustrations, as well as graphic elements of computer games, virtual and augmented reality, design of web-resources, software interfaces and other digital design objects (Budiman et. al., 2019).

Disciplines such as digital drawing and digital painting have emerged to address the growing need for graphic elements in computer games, virtual and augmented reality environments, web interfaces, and software design (Osadcha et. al., 2021). Just as the drawing implements had evolved through the centuries, so the digital tablets should be regarded as a novel drawing medium that can blend the perception and creativity of the freehand drawing on paper with the commodities offered by the computer (Leandri, 2019). Consequently, educational institutions have adapted their curricula to incorporate a range of digital design courses, often supplanting traditional offerings such as Engineering Graphics, photography, and hand-rendered design visualization (Lothrop, 2012).

Within the Creative Media and Digital Technologies curriculum at Prince of Songkla University International College in Thailand, two primary tracks are provided, focusing on digital arts and interactive media. Among the foundational courses introduced in the first year of study is digital drawing, which is strategically aligned with program learning outcomes (PLO) designed to cultivate applied skills relevant to various design disciplines, including animation, game art, graphic design, and storyboarding. However, shortcomings in teaching methodologies have been identified based on classroom experiences and project outcomes, resulting in a lower quality of students' drawings. This deficiency has also been observed to impact the quality of works in subsequent courses, such as Storyboarding, Motion Graphic Design, and Concept Art for animation. In response to this issue, the Digital Drawing course has been chosen for classroom action research, reflecting an ongoing commitment to enhancing teaching methodologies and ultimately improving learning outcomes.

Description and Context

The Digital Drawing course aims to equip students with essential skills in digital illustration and graphic creation, encompassing technical proficiency in software operation, understanding importance of art fundamentals in commercial design, and motor skills necessary for executing digital processes. This course is crucial for subsequent coursework related to graphic asset design, sketching, and animation, where digital hand-drawn illustration is an integral part of the design process. The course adopts a tutorial-based format and is structured around two main trajectories:

1. Freehand drawing in raster-based software and core art elements, including line quality, volume, value and lighting, texture, color, basics of character drawing, and various types of perspective and composition rules relevant to illustration.
2. Drawing techniques employing vector digital tools and their efficient utilization in illustration.

According to Leandri (2021), digital freehand drawing, facilitated by digital drawing tablets, enables rapid iterations and experimentation, fostering an environment conducive to enhanced creative ideation. The digital pen-tablet and software tools can be adjusted according to the needs of design students, instructors, and practitioners (Yang, 2019). Each class session focuses on a specific art element, facilitating understanding through creative assignments and practical application. As noted by Black and Browning (2011), engaging in creative digital assignments enables students to master the effects tools and creatively employ technology.

Detection of Shortcomings

Based on a comprehensive assessment of submitted works and classroom observations across previous digital drawing courses, certain students encountered significant challenges in attaining the objectives of their assignments. Fundamental components of artistic expression, such as line quality, proportionality, lighting, and shading, were not effectively utilized to convey objects, characters, or environments in the illusion of three-dimensional forms. These deficiencies manifested in the observational digital drawings/paintings, particularly concerning:

- *Line quality:* Students exhibited shortcomings in the utilization of lines concerning reference imagery, displaying jagged lines instead of smooth ones and employing uniformed/technical lines rather than lines varying in thickness and intensity based on the light source.
- *Proportionality:* Observation issues were apparent in capturing accurate dimensions and distances between objects coupled with the distortion of basic geometrical forms.
- *Rendering:* Challenges arose in rendering shades and light reflections, leading to the presence of blur, smudged, and uncontrolled painted stains in an attempt to depict these elements. This resulted in the flattening of shapes and the creation of chaotic graphical representations, giving the impression of errors.

Consequently, students with prior drawing experience demonstrated notable progress, further honing their skills, while novice learners exhibited slower advancement or experienced stagnation. Rosenshine (1997) suggested that varying levels of persistence in learning tasks can be traced back to individuals' past experiences of success or failure in similar endeavors. Additionally, Thurlow and Ford (2018) highlighted that novice sketchers often exhibit reluctance toward sketching, a phenomenon referred to as "sketch inhibition," which, despite its frequent mention by educators in design higher education, has received limited scholarly attention. Booth et al. (2015) identified numerous sources of inhibition, including personal, intellectual, skill-based, social, situational, technological, and comparative factors. Thurlow (2019) emphasized that the presence of sketch inhibition among student designers can lead to diminished design quality. Fava (2020) underscored a prevailing perception among higher education lecturers in art and design that the drawing skills of school-leavers have exhibited a gradual decline over the past two decades. These lecturers contend that standards in drawing become considerably higher upon entry into higher education, a shift that may engender anxiety and stress among students, create divisions within the classroom, and demand a significant portion of lecturers' time in endeavors to elevate drawing skills to a proficient level. The survey findings by Ramalho da Silva and Palaré (2023) further corroborate this viewpoint, revealing that the skills acquired in secondary schools' art education fail to meet the expectations held by higher education drawing instructors for their incoming students. In a systematic review of drawing exercises in design education aimed at ideation purposes, Novica (2023) noted that while the majority of studies focused on final-year design students, there is a need for greater examination of the cognitive processes of lower-year students who may grapple with abstract thinking or lack the requisite skills to effectively articulate their ideas through drawing.

Based on past experiences in formulating digital drawing assignments, it becomes apparent that task complexity presupposes a foundational level of drawing proficiency, thereby potentially exacerbating student challenges.

Consequently, a critical reevaluation of methodologies is warranted, prompting the following inquiries:

1. Will the redesigning of assignments and modifications tailored to the current drawing abilities of students enhance the overall quality of their drawings compared to previous semesters and narrow the disparity between proficient and novice students in terms of drawing quality?

2. Will targeted interventions in instructional methods assist students in rectifying flawed techniques and achieving improved outcomes, as evidenced by higher scores?

By drawing upon established best practices from previous research to inform revisions and enhance learning outcomes, coupled with a pragmatic exploration of instructional strategies in the classroom, this study aims to advance a teaching framework adaptable to various disciplines related to digital drawing, particularly in the early stages of higher education.

Methodology

This classroom action research employed a multi-faceted approach to data collection, encompassing a pre-assessment, first post-intervention assessment and post-intervention assessment followed by self-reflection questionnaire administered to students. The pre-assessment phase involved a drawing exercise, illuminating students' baseline competencies and providing foundational insights to inform subsequent assignment design. The first post intervention assessment relied on observation and field notes recording student's progress during guided practice in class. The post-intervention assessment, conducted upon course completion, aimed to compare overall outcomes with those of prior digital drawing courses. This assessment encompassed descriptive and mean analyses, employing rubric score criteria to evaluate students' final works.

Additionally, a self-reflection questionnaire was administered to gauge students' perceptions of assignments, offering nuanced feedback beyond conventional lecturer evaluations. Data collected from these assessments were recorded for subsequent analysis. The study comprised 32 first-year students enrolled at Prince of Songkhla University International College in Hat Yai in Thailand, exhibiting a spectrum of freehand drawing proficiency ranging from novice to advanced levels. Conducted within a digital media classroom setting equipped with requisite technological resources including a projector screen, computers, software, and pen tablets, the research sought to assess digital drawing assignments design through students' learning experiences.

Following data collection, a diverse array of analytical methods was employed. Descriptive analysis was utilized to identify student challenges in attaining exercise objectives, providing valuable insights into areas requiring instructional emphasis. Frequency count and percentage analyses were employed to scrutinize participants' responses to the self-reflection questionnaire, offering quantitative insights into student perceptions. Meanwhile, mean analysis facilitated a comparative evaluation of data from the current study with that of prior courses, providing a robust basis for assessing learning outcomes over time. Owing to the substantial volume of data acquired for each exercise encompassed within assignments 1, 2, and the final project, this paper will focus on presenting the design of one drawing exercise that focuses on art element light and value (exercise 2) along with the instructional procedures employed. This singular exercise will be sufficiently illustrative to inform adaptability

and applicability of the instructional framework in digital drawing classes.

Results

The Intervention Procedure

The primary objective of organizing digital drawing classes is to establish a supportive instructional framework that facilitates students' acquisition of new skills and knowledge, thereby bridging the gap between their current competencies and the learning objectives of the course. This approach is grounded in the implementation of a pedagogical model that guides the development of learning experiences and the establishment of supportive structures conducive to learning, as described by Behar-Horenstein and Seabert (2005). Additionally, in alignment with the perspective of Joyce and Weil (2003), instructional models serve as blueprints for learning processes, with the overarching goal being the enhancement of students' capacity to learn more effectively in the future. This enhancement stems from the acquisition of both knowledge and skills during the instructional period and the mastery of learning processes, thus fostering enduring capabilities for future learning endeavors.

The instructional framework employed in this study was derived from general teaching model, albeit tailored to suit the specific requirements of the subject matter. The schematic representation of this adapted model is delineated below (Figure 1). The General Teaching Model (GTM), proposed by David T. Miles and Roger E. Robinson (1971), represents a comprehensive framework for instructional design, influenced by the contributions of scholars Robert Gagne, Robert Glaser, and James Popham. This model, renowned for its adaptability across diverse educational contexts and subjects, offers a structured approach to the teaching process, serving as a guide for instructional planning and implementation. Given the unique characteristics of digital drawing class settings, the interactive nature of GTM aligns well with the design features of this course, which comprises four key components:

1. *Instructional Objectives:* These objectives delineate the intended learning outcomes in specific, measurable, and observable terms, guiding instructors in determining the content to be taught and providing a clear direction for both educators and learners.

2. *Pre-assessment:* Pre-assessment activities facilitate the understanding of students' prior drawing skills, and learning goals across cognitive and psychomotor domains. This information informs decisions regarding exercise complexity, instructional pacing, and assessment criteria tailored to the needs of the current cohort of digital drawing students.

3. *Instructional Procedures:* The instructional procedures encompass the selection of appropriate teaching materials and the assignments design, with a focus on effective teaching strategies. Details of the instructional steps and arrangement are provided in the lesson plan at the appendix section (Supplementary material A).

4. *Evaluation:* The evaluation stage entails assessing the instructional effectiveness in achieving desired learning outcomes, aiming to maximize student mastery of instructional objectives. Through the analysis of assessment results, including rubric evaluations of student work and self-reflection questionnaires regarding assignment appropriateness, adjustments to exercise objectives or instructional procedures will be made as necessary to optimize class efficiency and promote enhanced learning experiences.
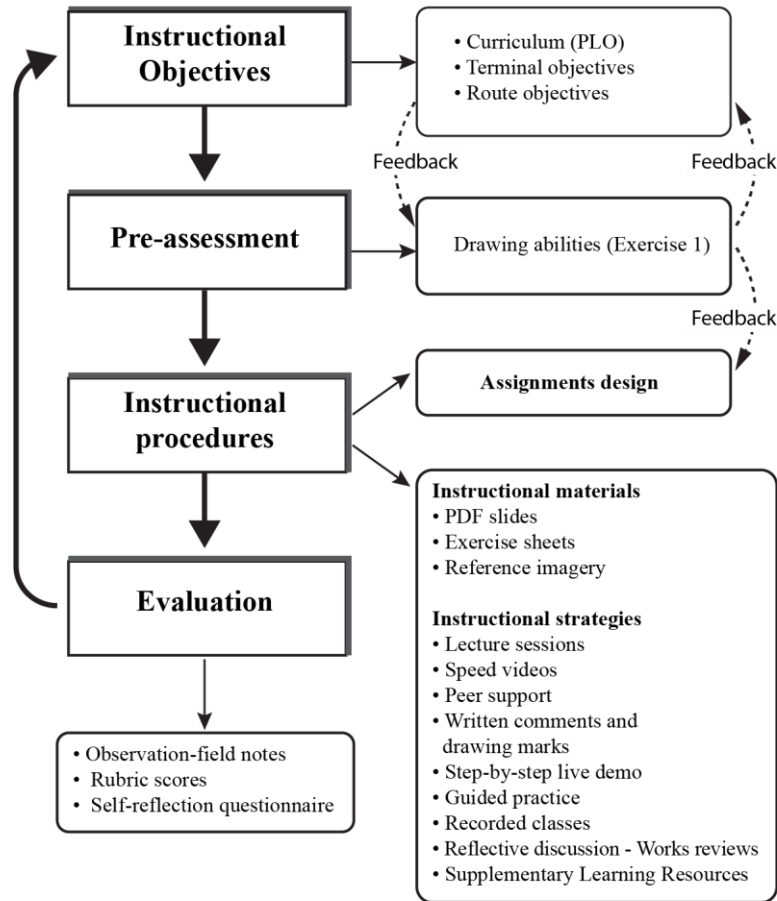
Figure 1. The General Teaching Model – adaptation for digital drawing

Pre-assessment Exercise Results

The feedback obtained from the pre-assessment drawing exercise, delineated as exercise 1 within the rubric score criteria, illuminated various facets of students' observational acumen, task completion endeavors, and proficiency in employing drawing tablets. The rubric segments for evaluating this exercise encompassed criteria such as line smoothness and diversity (pertaining to line quality and its efficiency), completeness of compositions (quantitative aspect), and execution quality with quantitative aspect (Table 1).

Table 1. Rubric Criteria for Pre-Assessment Exercise 1

a) Quality of line 2%
• There should be attempt of achieving smoothness in line strokes (1%)
• Some of the lines should give indication of light source by varying in thickness and darkness (1%)
b) Execution 2%
• Artwork is fully accomplished - minimum 6 thumbnail sketches (1%)
• All parts of the artwork are visible without confusing sections that indicate error (1%)

The primary objective of this exercise was to delve into the nuances of line quality and the visual depiction of

geometric volumes, given the fundamental role of line quality in both traditional and digital drawing contexts. Line quality, in this context, referred variations in an attribute of a line, such as thickness, darkness, or smoothness. Hampton (2009) employs the term "economy of line" to describe these variations that can be used to show how light falls on a subject. The exercise involved students sketching shapes from reference images and using different line thicknesses and darknesses to show light source. Students were also asked to imagine lines going across the shapes to create a sense of 3D form. This is in line with what Ocvirk (2013) said about how these lines can show the curves and bends on a surface. Each student was required to replicate this process thrice for two distinct reference images, within small composition frames akin to thumbnail sketches. Emphasizing the iterative nature of drawing, in accordance with Goldschmidt's (1991) observation that designers refine their sketches iteratively until achieving desired clarity, repetition served as a pivotal stage for enhancing line smoothness and observational acuity, particularly for novices utilizing pen tablets.

The pre-assessment exercise saw the participation of thirty-two students, revealing varying degrees of proficiency. Notably, evaluation criteria prioritized evidence of efforts over flawless execution or aesthetic appeal, emphasizing visible attempts at line smoothness and variety rather than consistent mastery. Twenty-one students met all the requirements for the exercises and received the maximum score of 4%. However, among the eight students who scored 3%, four deviated from the exercise objectives by using hatching and cross-hatching techniques that made their drawings appear flat instead of creating a three-dimensional effect. Three students had sections in their drawings that were smudged and blurred, indicating errors, while one student did not demonstrate smooth line strokes, instead producing jagged, shaky lines. Two students achieved a score of 2%; one showed no attempt at creating smooth lines and had distorted forms, while the other struggled with jagged and uniform lines that failed to convey the light source. One student did not submit their work.
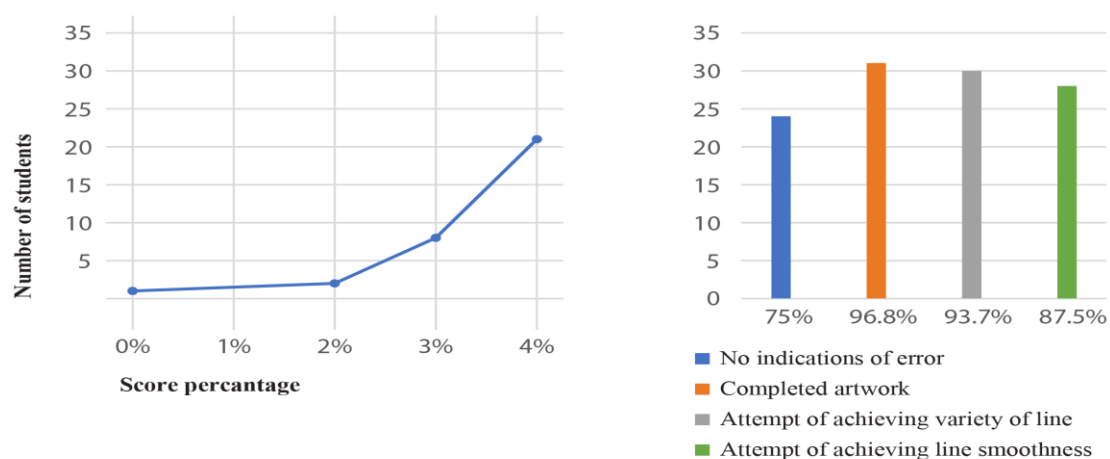

Figure 2. Pre-Assessment Exercise 1 Rubric Score Results

Based on a visual analysis, it was decided to maintain the complexity of the reference images for Exercise 2, focusing on basic geometric forms to help students become familiar with brush and blending tools before progressing to more complex subjects such as figure drawing. Addressing the challenge of achieving smooth lines, future classes will emphasize four technical aspects to improve drawing quality: effective use of pressure-sensitive

brushes, strategic canvas zooming, precise hand movements, and ergonomic considerations for optimal drawing posture.

Designing Assignments: Aligning with Instructional Goals Using Pre-Assessment Exercise Outcomes

For the Digital Drawing subject, instructional objectives were aligned with program learning outcomes (PLOs), focusing on technical software skills, creative design processes, and professional digital art approaches:

- To get set of technical skills in using software for digital illustration (PLO 8.1)
- To learn creative design process from brief to the final artwork. (PLO 10.1)
- To apply different techniques in creative process of digital illustration. (ELO 10.2)
- To develop a professional approach in digital art creation through class assignments and be familiar with copyrights regulations (PLO 12)

These competencies were delineated into behavioral terms, distinguishing between terminal objectives (reflecting post-course independent practice) and route objectives (necessary for progression within the course). Therefore, the objectives of each exercise extend beyond immediate proficiency and are designed to equip students with abilities necessary for their progression into subsequent units within digital drawing classes, as well as to prepare them for engagement in related subjects and the future practices following the completion of the course.

Assignments within the course are delineated into two primary categories comprising exercises and a culminating final project. The first assignment encompasses six exercises conducted within the raster-based application Adobe Photoshop, consistent with Cantrell and Michaels' (2010) affirmation that Photoshop stands as the principal raster-based tool employed in digital rendering. Moreover, Bah (2009) underscores Photoshop's aptitude for intricate color variations, textural manipulation, photographic editing, and the creation of computer-generated artwork simulating hand-drawn material. These exercises primarily accentuate freehand observational drawing, echoing Budiman's (2019) assertion that such activities augment perceptual awareness amid the evolving landscape of digital design. Utilizing image or photographic references throughout, as advocated by Holinaty et al. (2021), artists predominantly rely on reference imagery to navigate unfamiliar or previously unexplored subjects.

Conversely, the second assignment comprises two exercises executed within the vector-based platform Adobe Illustrator. Vector graphics, as elucidated by Lutkevich (2021), entail computer-generated images formulated via a sequence of commands or mathematical statements, facilitating their placement within a two- or three-dimensional space. Adobe Illustrator's widespread adoption among diverse creative disciplines underscores its efficacy in generating scalable artwork distinguished by sleek lines and nuanced color gradations. Notably, these exercises familiarize students with the process of manually converting raster images into vector illustrations.

Both sets of exercises are strategically crafted to cultivate proficiencies aligned with program learning outcomes (PLOs), serving the dual purpose of honing digital tool proficiency (Adobe software) and refining freehand observational drawing skills. Central to the instructional approach in the digital drawing course is the systematic introduction of novel challenges through each exercise, thereby engendering iterative practice in digital graphic

creation while sequentially addressing distinct art elements. This pedagogical strategy, as per Mittler's (2006) delineation of the foundational elements of art, underscores the focused exploration of color, value, line, texture, shape, form, and space within each exercise. Moreover, guided by Aguilar and Azpeitia's (2013) conceptualization, the cyclical implementation of exercises underscores their interrelated nature, fostering skill development in a progressive and proportional manner.

Exercise 2 Objectives Description

As an extension of pre-assessment exercise 1 described above, exercise 2 focuses on the fundamental concept of light and value, which serves as a cornerstone skill in various rendering tasks within digital drawing classes. Proficiency in comprehending the interplay between light and value is crucial for creating the illusion of three-dimensional form, depth, and realism, which are essential elements applicable to subsequent units such as texture, color harmonies, perspective, and character drawing. Additionally, mastery of this foundational skill extends beyond the immediate objectives of the course, as it holds significant relevance in other digital art-related disciplines, including game art, concept art for animation, anatomy for animation and sculpting, 3D modeling, and 2D and 3D animation. Through a series of five exercises involving small paintings, students are encouraged to explore the impact of different lighting conditions (daylight and artificial light) on their painting approaches and techniques, thereby enhancing their understanding of interpreting three-dimensional visual elements in compositions.

Table 2. Exercise 2 Description

Competencies and Objectives	Description of the task and / or procedure	Digital drawing techniques, tools and functions to be learned
PLO 8.1 PLO 10.1 PLO 10.2 PLO 12 Terminal Route	**Exercise 2: Light and Value**	
• • • •	The task involves interpreting basic geometric forms depicted in provided reference images through the application of varying values from lightest to darkest, with consideration given to the light source. The document comprises two reference images depicting geometric shapes arranged spatially under differing lighting conditions, including natural daylight and artificial illumination. Students are instructed to generate value compositions for each repeated iteration, employing diverse rendering and blending techniques. The primary objective is to convey the illusion of three-dimensional forms by applying different values along the spectrum between black and white, guided by the depicted light source in the reference images. Emphasis is placed on achieving smooth transitions from dark to light values to enhance the realism and perceptual depth of the rendered three-dimensional forms.	**Digital Line Drawing and painting** **Panel Menus:** Windows/workspace, Layers, Brush settings, Color **Application Menus:** Undo, Redo, Copy, Paste **Tools:** Selection, Brush, Eraser, Paint Bucket, Gradient.

Performance Results

During the practice hours for exercise 2, ten students demonstrated commendable proficiency, evident in their production of high-quality works characterized by authentic depictions of three-dimensional forms, smooth transitions between low and high key values, and the effective portrayal of spatial depth. The evaluation of this section within the field notes corresponded to rubric score ranges spanning from 4 to 5%.

Conversely, a predominant trend observed among fourteen students was the utilization of uniform brush strokes, resulting in rigidity and an unnatural appearance within the visual compositions. This phenomenon aligned with rubric score ranges of 2 to 3%. Seven students encountered challenges in delineating clear shapes and transitions in value, consequently compromising the clarity of their compositions. The quality of works within this subset aligned with rubric score ranges from 0 to 1%.

Following the suggested revisions in reflective discussion and work reviews, a notable enhancement in outcomes evaluated by rubrics was discerned, with seventeen students achieving the maximum score criterion of 5%. Among the twelve students attaining a score of 4%, deficiencies were identified, including incomplete sections within drawings and errors such as distorted shadows, smudged visual elements, and overlapping contour lines. Conversely, two students achieving a score of 3% presented incomplete works lacking indications of light sources and exhibiting areas of smudging indicative of error. A singular student, scoring at the 1% level, exhibited visible challenges in drawing, evidenced by limited ranges of dark and light values, absence of discernible light sources, and distorted shadows (Figure 3).

These findings suggest progression in students' performance influenced by feedback mechanisms such as work reviews in reflective discussions and individual guidance, including peer support, highlighting the time required for students to enhance their drawing performance between the pre-submission and final submission stages.
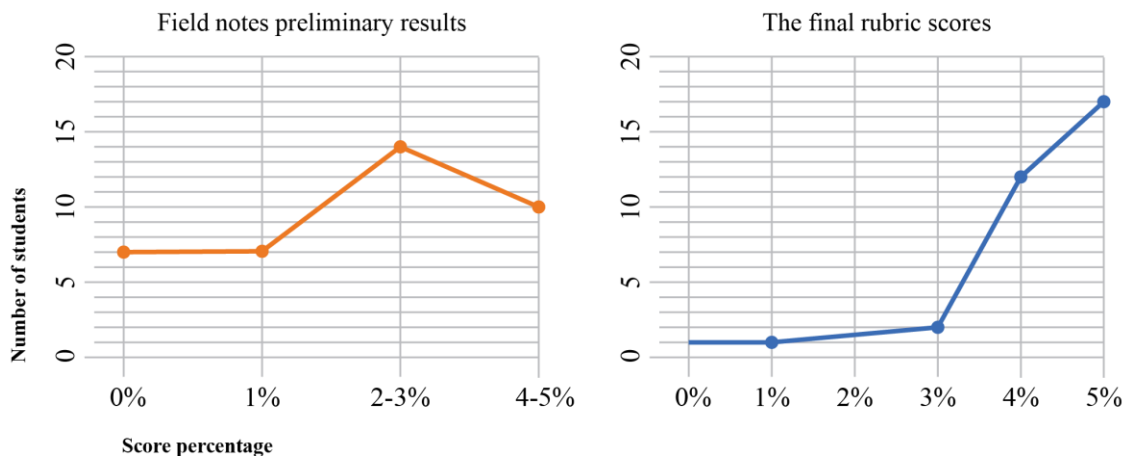

Figure 3. Exercise 2 Preliminary Results and the Final Rubric Results

For the light and value exercise in the previous semester 2022, students were tasked with creating a digital painting

using only shades ranging from black to white, focusing on capturing light and shadows. They were provided with a line drawing of a human face as a guide, but were challenged by the intricate shapes of facial features and the need for precise brushwork. Unlike a simpler exercise from the following semester, students had to demonstrate a strong understanding of facial anatomy and pay significantly closer attention to details like shadows in the eyelids, lips, and ears. These difficulties led to slower pace of drawing process and lower scores according to the rubric criteria. In figure 4 is presented redesigned exercise with reduced complexity of the task in semester 2023 (credited to Thitivorada Thongsawat, on the right) in comparison with the same task in semester 2022 (attributed to Pawarisa Suksong, on the left).

Figure 4. Sample Drawings Generated by Students Exercise 2

The rubric criteria scores were categorized into four ranges: maximum (5%), high (4%), moderate (3%), and low (1-0%). As shown in Table 3, the 2023 semester saw a greater proportion of students achieving maximum and high scores, while the proportion attaining moderate and low scores notably decreased following the intervention in exercise design, resulting in a higher average score. These findings suggest a positive trend in final outcomes influenced by the redesigned exercise. The redesign simplified exercise by replacing portraits with basic geometric shapes. This allowed students, especially those unfamiliar with anatomy, to focus on light and shadow transitions on smooth surfaces. Additionally, painting geometric forms in space helped students practice creating depth using value, a skill less emphasized with detailed portraits.

Table 3. The Final Scores for the Exercise 2, Semesters 2022 and 2023

Semester year	No. of Students	The percentage of students achieving scores in light and value exercise ranging from the highest to the lowest				Mean	Std. Deviation
		Maximum	High	Moderate	Low		
2022	19	42.1%	31,57%	10.52%	5.26%	3.894	1.370106924
2023	32	53.12%	37.5%	6.25%	3.12%	4.375	0.870669005

Students' Responses from the Self-reflection Questionnaire

The anonymous self-reflection questionnaire elicited responses from twenty-six out of a total of 32 students

enrolled in the course. The responses were aimed at evaluating the efficacy of instructional delivery, with the overarching goal of garnering insights into class efficiency from the students' perspective, thereby informing potential areas for improvement. Analysis of the responses indicated that a significant proportion (30.8%) of participants reported no major difficulties with freehand drawing, while 26.9% expressed concerns regarding line quality and efficiency (Figure 5). These findings suggest areas for potential enhancement in the design of line drawing exercises.

Below are listed possible difficulties related to freehand drawing you might faced during assignment 1 (exercises from 1 to 6). Please choose one closest to your situation.

- I can hardly control line due to smooth surface of pen tablet
- Not sure where to use different types of line (thickness and intensity)
- Not have enough patience to erase lines and do it again
- Not sure what looks wrong so i just continue drawing lines until it looks finished
- I cannot fully focus on drawing because of too many tool settings and functions
- All mentioned above applies
- I had no major problems with freehand drawing

Figure 5. Students' Response on Freehand Drawing Difficulties

Close to 90% of respondents (88.5%) found the final assignment (movie poster illustration) valuable. They felt the techniques learned in class prepared them well for the challenges of the final project. Additionally, almost all respondents (96.1%) acknowledged the project's benefit in showcasing their creative abilities for their portfolios. Additionally, students reported that all instructional methods were helpful. Guided practice, individualized support, and peer learning were particularly beneficial, according to findings in Figure 6. This is because nine students preferred individual guidance and eight students preferred peer collaboration. Exercise 2 revisions led to improved performance, highlighting the value of employed instructional methods. Table 4 summarizes the self-reflection questionnaire.

Regarding communication during class assignments, I feel more comfortable if I:

- Ask lecturer if I need help, consultations or opinion
- Wait for lecturer to approach me and then I will ask for help or consultations
- Ask senior students if I need help or consultations
- Ask my classmate for help because maybe he/she knows better than me
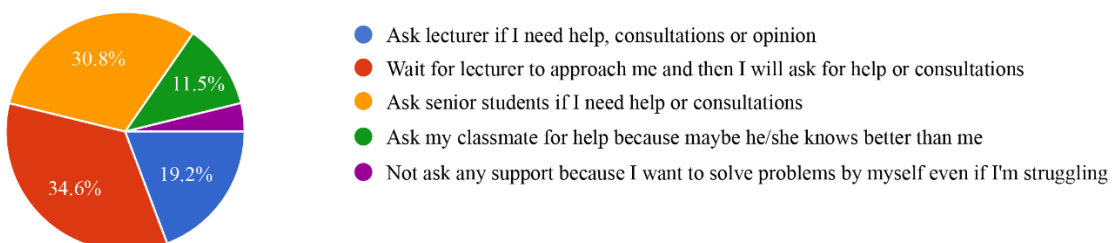- Not ask any support because I want to solve problems by myself even if I'm struggling

Figure 6. Students' Response on Communication in Class

In table 4 are presented instructional components utilized in the current study during the 2023 semester, juxtaposed with those from the preceding semester in 2022. This comparison aims to elucidate the impact of instructional quality on the enhanced scores achieved by students.

Table 4. Instructional Components Utilized in Semester 2022 and 2023

Instructional strategies	Semester 2022	Semester 2023
Lecture sessions	●	●
Speed videos		●
Peer support		●
Written comments and drawing marks		●
Step-by-step live demo	●	●
Guided practice	●	●
Recorded classes	●	●
Reflective discussion - Works reviews	●	●
Supplementary Learning Resources	●	●
Pre assessment exercise		●
Self-reflection questionnaire		●

Table 5. Students' Response on the Quality of Instructional Delivery

Topic	Agree	Disagree
The final project (Movie Poster Design) has given me the opportunity to showcase my creative talents, and digital drawing/painting skills which may be a core part of my portfolio.	96.1% (25)	3.8 (1)
Techniques learned in digital drawing classes (supported by self-learning) is enough for me to carry out the final project (movie poster design) according to the evaluation criteria.	88.5% (23)	11.5% (3)
Assessment criteria and instructions for the most of tasks are clearly explained, demonstrated and supported with examples of good work.	96.2% (25)	3.8% (1)
Lecturer informed us about all available resources (PDF slides, online learning, informative links etc.) to enable students to take responsibility for organizing their own learning.	100% (26)	0%
Lecturer encouraged us to be involved in the feedback process as an active participant by sharing opinions and ideas - not only as a feedback receiver.	100% (26)	0%
Lecturer gave enough time for accomplishing each assignment/exercise and opportunity to re-submit my improved work.	100% (26)	0%
I found useful lecture sessions.	96.2% (25)	3.8% (1)
I found useful step-by-step live demonstration.	96.2% (25)	3.8% (1)
I found helpful speed videos.	92.3% (24)	7.7% (2)
I found helpful recorded classes.	88.5% (23)	11.5% (3)
I found helpful individual verbal explanations (guided practice, corrective feedback and individual support).	100% (26)	0%
I found helpful demonstration individually (guided practice, corrective feedback and individual support).	100% (26)	0%
I found useful written comments and drawing marks.	96.2% (25)	3.8% (1)
I found helpful works reviews and reflective discussions.	92.3% (24)	7.7% (2)
I found helpful peer support.	96.2% (25)	3.8% (1)
I found useful supplementary learning resources.	100% (26)	0%

Discussion and Conclusion

Numerous studies indicate the potential benefits of enhancing visualization skills through freehand drawing and sketching across various design disciplines, regardless of the tools employed, whether traditional or digital. Such practices can enhance students' drawing proficiencies across specialized courses, which often emphasize design concept exploration, experimentation with diverse styles and techniques, and the application of design theories within digital contexts. According to Aboalgasm & Ward (2014), digital drawing tools offer advantages for students with limited drawing skills, allowing for easier adaptation of drawings compared to traditional methods. Black and Browning (2011) highlighted importance of learning software through creation without being overly concerned about comprehending all that there is to know about the software. This is important in designing assignments where the main focus should be on understanding of essential art fundamentals, facilitated by software tools that enhance speed and efficiency in achieving desired objectives. For example, integrating real models in observational drawing exercises has shown positive effects on industrial design students' familiarity with various formal proportions and spatial features of products (Felip-Miralles & Navarro-Lizandra, 2018). Similarly, action classroom research by Marji et al. (2023) demonstrated significant improvements in learning outcomes for orthographic drawing concepts compared to conventional learning models, highlighting the efficacy of real models in enhancing learning experiences. In addition to designing digital drawing assignments, the instructional approach and quality of instructional delivery are equally important considerations in digital drawing education. Thompson and Cuseo (2014) posit that the efficiency of diversity education hinges not solely on the curriculum's substance but also on the pedagogical techniques employed for its dissemination. Formative assessment plays a crucial role in emphasizing trial and error in the learning process. As underscored by Sawer (2017), studio pedagogy, characterized by active student involvement and formative evaluation, nurtures an environment conducive to unstructured exploration, enabling students to exercise autonomy, experiment, and glean insights from setbacks. Moreover, in addressing formative feedback during guided practice in design-oriented subjects, it is pertinent to acknowledge the significance of teacher-student interaction within studio class environments. Research conducted by Goldschmidt et al. (2009) underscores the value of one-on-one critiques in studio settings among architecture students. The study underscored students' reliance on their instructors during the initial stages of their learning journey, coupled with feelings of uncertainty until they received both validation and explicit guidance from their teachers to advance their projects.

Based on the data collected and analyzed, the study findings indicate an improvement in students' overall performance in digital drawing compared to their previous performances when taught without a strategically tailored teaching plan. This suggests that students may achieve greater success in subjects involving digital drawing as a core component of practice when complexity of exercise design is aligned with their existing skills and abilities. Therefore, regular utilization of pre-assessment exercises in the development of teaching plans is recommended. Field notes, structured according to rubric assessment criteria, served as valuable tools for monitoring students' progress and engagement during guided practice sessions as part of formative assessment. The study's instructional approach, emphasizing guided practice and reviews, improved students' ability to correct mistakes, understand the integration of art elements like value and light in digital drawing, and depict scenes with a three-dimensional illusion based on reference images. Analysis of data from the self-reflection questionnaire

revealed several insights regarding students' perceptions of the teaching model, including:

1. The design of assignments and opportunities for work revisions facilitated adequate preparation for more complex tasks, such as the final project and improved their drawing performance reflected by rubric scores.

2. There is potential for improvement in mastering line quality, indicating hesitancy in engaging with line drawing exercises, and thereby underscoring the necessity for greater emphasis on strategies for teaching these types of exercises.

3. The teaching model fostered active engagement, preventing passivity among students in receiving feedback

4. Regardless of students' different drawing skill levels and cultural backgrounds, the teaching model employed was straightforward and comprehensible, aiding students in understanding assignment objectives in relation to assessment criteria.

5. Students' most preferable learning modality was guided practice in class where lecturer approaching each student individually and helping them to achieve exercise objectives by explaining, advising and demonstrating drawing.

Recommendations for the Future Practice

Based on the outcomes of implementing the teaching model in this study and the author's six years of experience teaching digital drawing courses at an International College in Thailand, the following limitations and recommendations are noted:

1. *Cultural Considerations:* Previous research by Chang et al. (2022) underscored a predominantly teacher-centered learning environment in international faculties in Thailand, suggesting a tendency for students to be passive participants rather than active learners. Similarly, Saetang (2014) advocated for a shift towards a more interactive classroom approach suitable for Thai students. Cultural factors, such as behaviors influenced by cultural norms, such as reluctance to seek help and slow responses, must be acknowledged when planning effective teaching strategies, particularly when instructors from foreign backgrounds lead classes. The findings align with student responses in a self-reflection questionnaire in this study, where most students preferred instructors to initiate interaction before providing assistance. Therefore, individual consultations and instructor-initiated interactions are crucial for fostering a supportive learning environment in Thai digital drawing classes.

2. *Theme Selection*: Reference imagery theme selection significantly impacts students' motivation, which in turn influences drawing quality. To cater to diverse preferences, instructors should offer multiple reference image options for each observational drawing exercise, allowing students to choose themes that align with their interests.

3. *Pre-assessment Reference Imagery:* The reference imagery used in pre-assessment exercise should predominantly feature basic geometric forms rather than organic shapes or human anatomy motifs. Clear and distinct visual elements in these forms aid in aligning students' drawing tasks with the rubric score criteria.

4. *Preparing Multiple Exercises:* Implementing the teaching model necessitates the preparation of multiple

exercises with varying levels of complexity for each instructional unit. This proactive approach facilitates the selection of appropriate themes from pre-made exercises based on students' drawing proficiency, streamlining the instructional process.

5. *Review and Revision:* Regular review of students' drawings, accompanied by demonstrations of improvements in reflective discussions and dedicated time for students to revise and refine their work, are imperative for enhancing the quality of drawing performance throughout the course duration.

6. *Instructor Proficiency:* The instructor leading the digital drawing course should possess expertise as a practicing art/design professional, capable of demonstrating drawing tasks proficiently during class sessions, in line with established assessment criteria.

7. *Self-reflection Questionnaire Design:* The self-reflection questionnaire aimed at gauging students' perceptions should be designed to address specific aspects of the digital drawing class that warrant modification or enhancement in future iterations rather than to record students' overall satisfaction.

It is pertinent to acknowledge that implementing this teaching model may pose challenges in classes exceeding 32 students, primarily due to constraints on time available for providing individual guidance and reviewing works. Consequently, in larger higher education classes, alternative instructional methodologies should be explored.

Acknowledgement

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Appendix A. Lesson Plan

142–141 Digital Drawing / Lesson plan / Credits3 (1-4-4) / Lecture: Discussion 15 hours, Practice 60 hours
Program Bachelor of Science in Creative Media and Digital Technologies (International program)
Year 1, Academic Year 2023, Semester 1 / Section: 01 / Module: MO2.1 / Curriculum: CMDT (2563)
Course Lecturer: Aj. Dimitrije Curcic
Subject area: Digital Drawing Fundamentals (raster and vector graphics) / Software tools: Adobe Photoshop, Illustrator

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Week 2 / Date: 05 July 2023 / Time: 8am - 5pm

8am - 9am
Marking attendance
Works reviews and reflective discussions (Feedback-checkpoint on development - exercise 1)

9am - 11am
Lecture session - Lighting and value
• Understanding shadows and highlights:
• light and shadow
• Observation
• Painting
• Fundamentals of optics
• Casting shadow
• Double shadow
• Diffused light
• Specular reflection
• Diffuse reflection
• **External sources** (for further reading, case studies, digital art websites and tutorials)
• Establishing assessment criteria for Exercise 2 and Instructions for its execution (accompanied by PDF slides)

11am - 12pm
Test exercise (live demo) shading spheres & blending tool

1pm - 3pm
Assignment 1/Exercise 2/Light and Value
Brief: The file contains 2 reference images (daylight and artificial source of light) of geometrical forms arranged in space.
Students are required to create value compositions using different rendering and blending texhniques for each composition.
The objective is to create illusion of three-dimensional forms by painting different values (from black to white) based on the light source.

Speed video - showing process of accomplishing exercise 2 from start to finish and explaining

Live demo (accomplishing the first composition - daylight)
• Step 1: Creating grey neutral background
• Step 2: measuring distances between objects and making marks
• Step 3: drawing shapes with controlled brush strokes and suggesting three-dimensional forms
• Step 4: Making precise selections over drawing by using marquee selection and pen tool
• Step 5: Creating new layers and painting inside selections using soft brush tool
• Step 6: Refining edges using brush and blur tools and making soft gradients using gradient tool
• Step 7: Merging layers after all refinments

3pm - 4.45pm
Live demo (starting the second composition - artificial light/painting without using selection tools)
• Step 1: Creating grey neutral background
• Step 2: Measuring distances between objects and making marks
• Step 3: Drawing shapes with controlled brush strokes and suggesting three-dimensional forms
• Step 4: Paint-over drawing using custom brush and wet blender tool

Guided practice and peer support (one senior student, third year)
• Teacher and senior student supervising independent work of students in class for the rest of the drawings (technical assistance, advising and individual support)
• Teacher marking students' progress in field notes

4.45pm - 5pm
Summarizing the Class
• Verification of assessment standards for Exercise 2 and instructions for submitting works
• Uploading recorded class to Microsoft OneDrive storage
• Posting announcement for exercise 2 instructions, deadline and link to class material (PDF slides, exercise sheets, speed video and recorded class)
Written comments and drawing marks on possible improvements of students' drawings should be uploaded in Microsoft OneDrive online storage in the period between 5 and 10 July, 2023.

Appendix B. Pre-assessment Exercise Sheet

Example drawings are work of student Pornnutcha Pattanathaiyanon.
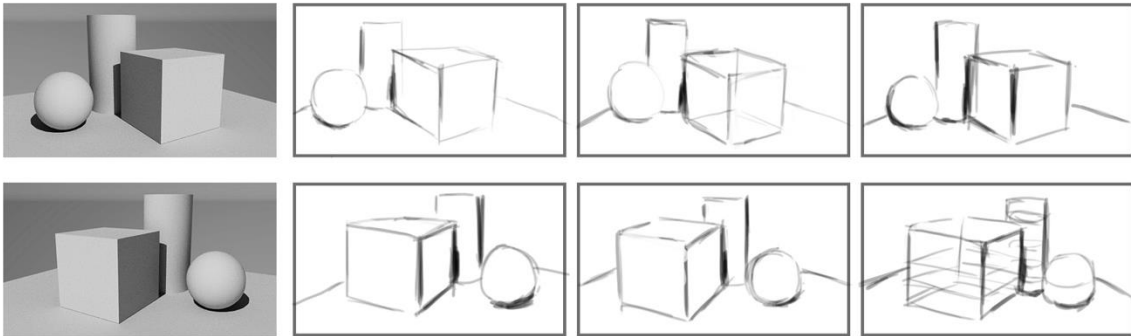
Exercise 1 (Pre-assessment)
Create thumbnail sketches within given frames based on given reference images (on the left).
Each composition repeat minimum 3 times using as many different types of line as possible in order to suggest three dimensional forms.
If repeat more than 3 times, it can be saved in layers with visibility toggled off.
Do not render shades – try to describe 3D forms with single lines of different thickness and darkness.

Student: Pornnutcha Pattanathaiyanon
ID: 6611610011

Appendix C. Exercise Sheet Light and Value (exercise 2, semester 1, 2023)

Example drawings are work of student Thitivorada Thongsawat.
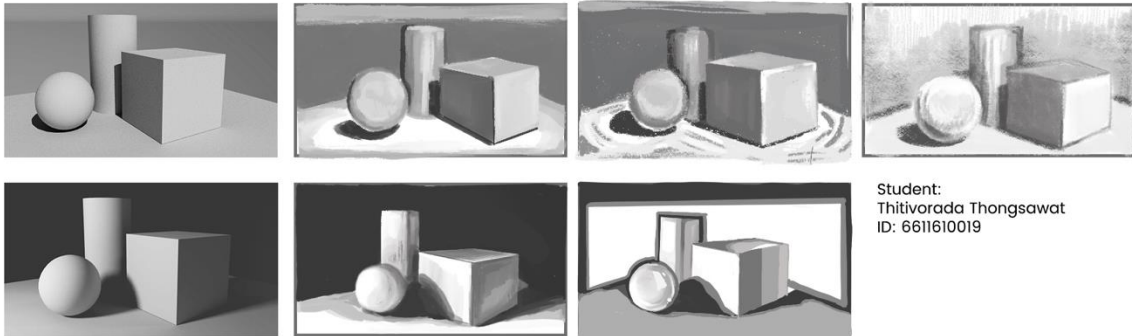
Student:
Thitivorada Thongsawat
ID: 6611610019

Exercise 2:
Create value compositions starting with rough and refined drawing gradually using different rendering and blending texhniques.
The first composition simulates daylight - repeat minimum 3 times using mostly high key values in different rendering and blending variations.
The second composition simulates artificial lighting with dominant low key values next to high key accents creating high contrasted image - repeat minimum 3 times in different rendering and blending variations.

Appendix D. Field Notes Light and Value Exercise (exercise 2, semester 1, 2023)

Exercise 2:		
Section 1 Dark and light values have the following quality:		
a) Uncontrolled / chaotic/ smudged / blurred / hard to clearly see forms in composition		0-1%
b) Controlled / unnatural / stiff / clearly indicate 3 dimensional forms		2-3%
c) Dynamic/natural representation of forms / clearly indicate 3 dimensional forms		4-5%
d) Full range of values from darkest to lightest		
e) No full range of values from darkest to lightest		
Section 2 Efforts and results on accomplishing exercise objectives in class:		
a) Keeps trying/following instructions (seeking support)		
b) Keeps trying/following instructions (not seeking support unless lecturer approaches)		
c) Keeps trying/not following instructions (seeking support)		
d) Keeps trying/not following instructions (not seeking support)		
e) Quit trying/not following class		

#	Id number	Student name	Nickname	Section 1	Section 2	Seat
01	Student 1		OU	a **(b)** c **(d)** e	**(a)** b c d e	
02	Student 2		ART	**(a)** b c **(d)** e	a **(b)** c d e	
03	Student 3		BELGIUM	**(a)** b c **(d)** e	a b c **(d)** e	
04	Student 4		PIANO	a **(b)** c **(d)** e	**(a)** b c d e	
05	Student 5		KRAAN	**(a)** b c **(d)** e	a **(b)** c d e	
06	Student 6		DOME	a **(b)** c (d) e	a **(b)** c d e	
07	Student 7		DIN	a **(b)** c **(d)** e	**(a)** b c d e	
08	Student 8		POOM 020	a **(b)** c (d) e	a **(b)** c d e	
09	Student 9		CHU	a b **(c)(d)** e	a **(b)** c d e	
10	Student 10		TONGTA	a b **(c)(d)** e	a **(b)** c d e	
11	Student 11		FRESH	a **(b)** c **(d)** e	a **(b)** c d e	
12	Student 12		TRANG	a **(b)** c **(d)** e	a **(b)** c d e	
13	Student 13		TAN	**(a)** b c d **(e)**	**(a)** b c d e	
14	Student 14		SUPREME	**(a)** b c d **(e)**	a **(b)** c d e	
15	Student 15		MIND	a b **(c)(d)** e	a **(b)** c d e	
16	Student 16		NAT	a b **(c)(d)** e	a **(b)** c d e	
17	Student 17		EARN	a **(b)** c **(d)** e	a **(b)** c d e	
18	Student 18		USAMAN	a b **(c)** **(d)** e	a **(b)** c d e	
19	Student 19		Top	a b **(c)** (d) e	a **(b)** c d e	
20	Student 20		NADIA	a b **(c)(d)** e	a **(b)** c d e	
21	Student 21		POOM 47	a **(b)** c **(d)** e	a **(b)** c d e	
22	Student 22		Top	a **(b)** c **(d)** e	a **(b)** c d e	
23	Student 23		TED D.	**(a)** b c d **(e)**	a b c **(d)** e	

Appendix E. Rubric Score Criteria Light and Value Exercise (exercise 2, semester 1, 2023)

Total 5%	*Concept and objective: **Light and Value*** The file contains 2 reference images (daylight and artificial source of light) of geometrical forms arranged in space. Students create value compositions based on reference images of geometrical forms under different lighting conditions, aiming to create the illusion of three-dimensional forms.	
Exercise 2	**a) Light and Value 3%** • There should be attempt of achieving a full range of values (from darkest to lightest) in describing three-dimensional forms 1% • The light source is indicated in all objects 1% • Some values (shades) are creating illusion of three-dimensional forms 1%	**b) Execution 2%** • Artwork is fully accomplished (minimum 5 thumbnail sketches) 1% • All parts of the artwork are visible without confusing sections that indicate error 1%

Appendix F. Examples of the Students' Works (movie poster illustration) for the Final Project, Semester 1, 2023

Image 1. Chuhada Hemman, Image 2. Pornnutcha Pattanathaiyanon, Image 3. Natnicha Thongmak, Image 4. Tonboon Jusapalo