Integration of Graphic Design Thinking Assessment Tools for 21st Century

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Abstract: 21st Century of quality education involves multiple facets, nevertheless it shouldn't limit to content knowledge while learning skill development such as thinking skill, communication and creativity have to be the emphasis. P21 framework [1] have been addressed to the educators without offering any effective instructional formulae to achieve those upgraded objectives. To propose a revised graphic design instructional framework that places emphasis on competency, it would be helpful to analyze the current Malaysian educational approaches to match the new generation of learning trends. This paper suggests that the flexibility and multiple dimensions of assessments in graphic design learning should be taken into consideration in proposing a revised graphic design instructional framework. An updated instruction framework has been introduced to focus on learners' creativity, ownership, and real-world problem-solving skills, as well as the ability to communicate and collaborate. Giridharan's [2] report suggested that there is a necessity to update graphic design curriculum to prepare the students for upcoming challenges, especially in the era of IR 4.0. Indeed, today's education should measure how much one has learned through ownership instead of how much knowledge one has gained. In encouraging graphic design pedagogy to be more inclusive, a newly revised teaching instructional framework is proposed to stimulate active learning as well as thinking skills embedded in the learning experience. Integrated Creative Activity Instruction (ICAI) is the recommended solution for the next generation of graphic design learning with problem-based learning as a key vehicle. ICAI framework was developed and designed based on James Gibson's [3] Affordance Theory and Robert Marzano's [4]. New Thinking taxonomy It is imperative to implement new ICAI pedagogy to infuse creative and critical thinking into the course curriculum to produce graduates who will be in line with the industry and professional demands. There are three stages in this research study, needs analysis, pilot test, and ICAI evaluation stage. The final phase of ICAI evaluation has proven that the newly proposed framework can stimulate the academic performance of average and low achievers for better learning satisfaction and creativity development in a graphic design context. Research findings have proven that high creativity is parallel with higher learning satisfaction and performance in graphic design learning. To ensure graphic designer professionalism align with the digital economy, the finding of this study encompass the importance of creativity development and thinking skills in producing future graphic design graduates with high competency in solving real world problems.

Keywords: *Graphic Design, Teaching Instruction, Competency, Project-Based Learning, Assessment Tool*

1. Introduction

Education today is no longer measured on knowledge but instead on competency-based acquisition for learning. Tsisana Palmer [5] an American instructor, suggests that 21st Century educators should promote learner-centered

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classrooms and personalized instructions. In the internet age, students have unlimited access to knowledge that develops cognitive faculties; and there certainly is no need for teachers to spoon-feed knowledge or teach "one-size fits all" content. Students have different personalities, goals, and needs, thus offering personalized instructions is desirable. When students are allowed to make their own choices, they will own their learning, increase intrinsic motivation, and put in more effort as they have ownership of the project. Graphic design has been a sound-established popular education pathway in Malaysia since the 1980s, yet its teaching and learning have little research. It is hoped that an analysis of the current instructional approaches to match P21's Framework [1] for 21st Century of graphic design learning could provide enlightenment toward new teaching and learning.

According to Stork [6] attractive areas of knowledge often require more effective training, creative thinking, access to new knowledge, syncretic participation of different arts, so the next generation of specialists need to develop their digital competence. The author also mentioned the importance of individual competency ensuring a positive educational environment at the university, stimulating individual interests, opportunities for effective career development are prerequisites for successful realization. Thinking skill and creativity are essential in preparing students for the future. Therefore, the critical assessment of teaching graphic design should focus on learners' creativity and innovation, critical thinking and problem-solving skills, as well as the ability to communicate and collaborate. Benny Lim's [7] article suggested: "A Discussion on Creativity and Design Education in Singapore and Malaysia, the common trend of design education in both Singapore and Malaysia is still focusing on the training of design skills meant to solve problems." Education providers should actively look at how they can rework their current design syllabus to include design-thinking capabilities. For the last few years, Malaysian employers have been constantly providing feedback that graduates are poor in critical thinking and communication skills, as well as language proficiency which been recognized as essential for success in the 21st Century.

"Many scholars believe the fault lies in Malaysia's exam-driven approach to learning. Students largely focus on memorizing static information without attaining a deep understanding of the material" [8]. The article also stated that this phenomenon is not happening in Malaysia alone, but it is affecting the whole of Asia. The statement aligns with Radu's [9] publication about the 'New Education' philosophy, which promotes Progressivism by John Dewey and describes education as a process of growth and experimentation whereby thought and reason are applied as the solution to problems. John Dewey also suggested education philosophies should develop following the fundamental of realism and the principle of practicality, which aims to connect real-world progressions. Therefore, problem-solving learning processes should focus on actual case study and not exam-driven assessment. The two aspects of psychological and sociological connections are critical foundations of design thinking activities. This philosophy should extend to graphic design learning in the 21st Century. According to Bapna [10] suggested that 21st Century skills were deemed important for thriving in a rapidly changing economy, and it was felt that mainstream school curriculum was not addressing these skills adequately. In order to bring structure to the discourse on 21st Century skills, many organizations have since developed frameworks that describe, and define, the competencies required for functioning in the 21st century.

This research aims to uplift the quality of graphic design teaching by experimenting multi-perspective of graphic design assessment tools in comparison to the traditional institutional evaluation systems. The proposed ICAI framework aims to provide a wider coverage of assessment tools to recognize student's learning effectiveness. Learning effectiveness can be measured through post-treatment analysis of the learners' performance after the intervention is completed. Rogoff [11] suggests that "teaching and learning participation involve three aspects: intrapersonal plane, interpersonal plane, and the community. Interpersonal involves interaction between learners, instructors, and academic staff. Intrapersonal refer to individual meta-cognitive thinking while community refers to the influences from outside world and society". Graphic design learners spent most of their time undertaking practical project work in a studio accompanied by informal teaching and learning environment. A few theoretical subjects are included in the syllabus to support effective learning. However, very few learners can interweave the theoretical and practical aspects. This gap is formed whereby critical and creative skills are taught separately and are not suitable to obtain the desired results. So, majority of the learners can produce only stereotypical work that is void of original ideas. Another contribution of this is learners tend to rely heavily on online information to produce their projects. They know very little of the cultural norms of various societies, especially international communities. Hence, they possess only scant knowledge of the creative industry.

Graphic design learners need to be aware of the nature and application of multi-dimensional intelligence in the design process. This intelligence is crucial for them to be more productive, efficient, intuitive, and current in their work. It has been observed that learners are more prepared to produce better results by looking at things from a variety of perspectives, and the knowledge that they have obtained from within and outside learning institutions. Therefore, institutions must provide the teaching and learning process as well as equip an individual to think outside the box. Furthermore, the same line of implementation efforts should be designed to ensure a feasible approach to differentiated learning at higher education be implemented.

2. Problem Statement

Conventionally, graphic design education was drawn from the principles of studio-based learning, project-based learning, and public critique [12]. Guided by feedback from instructors and peers, these learning approaches typically engage learners in authentic learning environments with increasingly complex design projects as they advance through the course. This learning-by-doing approach reinforces a traditional pedagogical belief in design curricula that the best way to learn about design is through designing [13]. On the surface, this seems to be an effective way to approach the complex and ill-structured nature of design problems. However, on close semester-end assessment without a unified rubric, this may not be the most efficient way to evaluate students' portfolio, nor is it considered as effective learning opportunities. In the traditional pedagogical model, the final design artifact is the primary measure of education which has the effect of focusing learners on the outcome of the project rather than the process by which that outcome is achieved [14, 15]. It is rarely evident that the knowledge that a graphic design student has learned as new knowledge is bound within the artifact and the context in which it was developed. To address these limitations, a revised pedagogical approach was designed to seek support for cognitive engagement through reflective practice, encourage abstract levels of cognition, and support the articulation of generalizations from the learning experience. Through this process of generalization, the aim is to assist the learner in articulating the knowledge represented in their design experience, as well as capable to establish a platform to support knowledge transfer.

Expressive Creativity is the type of spontaneous creativity often seen in children and is exemplified in drawings and play. Scientists and artists illustrate Productive Creativity in which the scientist or artist is driven by a desire to create that is structured but retains an element of spontaneity. The third classification is Inventive Creativity. Inventive Creativity can be described as a problem-solving or invention done to enhance on existing technological solutions. As an example, an engine would be invented to make farm tractors more fuel-efficient. Innovative Creativity deals with the capacity to improve or reinvent an existing organism or object through the utilization of conceptualization. For example, a recent movement to reinvent government, in which the existing governmental structure was redefined through reconceptualization. The final type of creative skill is Emergenative Creativity. It is a new creation that provides an opening for an entirely new paradigm. Emergenative Creativity is a discovery that opens an explosion of ideas in a synergetic fashion [16]. Torrance [17] defined creativity as a process of becoming sensitive to a problem, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on. Creativity is also described as an ability to search for solutions, making guesses, or a hypothesis about these deficiencies; testing and retesting these hypotheses, and

evaluating the impact of knowledge.

Sternberg and Luppart [18] distinguished the differences between knowledge and usable knowledge. They stated: "knowledge can be learned in a way that makes it inert." According to Sternberg and Luppart [18], in discussing the importance of motivation, two fundamental types were identified: 'Intrinsic Motivation' and the 'Motivation to Excel'. 'Intrinsic Motivation' was an essential element because learners are much more likely to be creative if they enjoy what they are doing. 'Motivation to Excel' was emphasized because these individuals are willing to work for creative excellence.

The core of gestation phase of the creative process model is the creative attributes that was referred to by Torrance [17] as creative thinking abilities. These creative attributes are fluency, flexibility, originality, elaboration, the abstractness of the title, resistance to closure, emotional expressiveness, articulateness, movement and expressiveness, and fantasy. The Torrance Test of Creative Thinking (TTCT) is an instrument that can be used to operationalize and measure these creative attributes. This process may or may not be linear. Each iteration is different in time and shape, depending on its interaction with the other catalysts and inhibitors described in the model. It is even possible that a full iteration may not be completed because of factors such as motivation. The final phase of this model results in an end product and verification of creativity that is expressive in problem solution and validation for the typologies of invention proposed by Taylor [19]. However, it is essential to point out that there is a crucial time dimension to creativity. The time dimension is influenced by the perceived importance of the problem, as well as the motivation for a problem resolution. The author relied on a framework as follows: The specific objectives of the study were: (1) to describe the learners in terms of academic classification, creative thinking abilities, and critical thinking disposition; (2) to determine the amount of variance in creative thinking ability explained by critical thinking disposition; and to (3) determine the relationship between creative thinking ability and gender. The researchers utilized two instruments for data collection.

One Size Doesn't Fit All - Creativity and inborn intelligence in Gardner's studies are interrelated; both are connected to a learning environment and professional development with curriculum innovation. High, average, and low achievers are among graphic design learners. This study suggested that an integrated instructional strategy needed to be introduced to cater to all ability groups. Education policies are complex issues and are the same in that the implementation of learners from different abilities and learning styles are always grouped in the system. While policymakers are aware that the one-size-fits-all method does not work for teaching, learners are always unmoving and remain the same. They are grouped regardless of the disparity levels in their learning capabilities and abilities. The authors stated that learners are treated more as machines than humans

throughout the learning process in the current scenario.

All learners are different in the sense that they all come from different socioeconomic backgrounds, possess experiences unique to them, and have additional physical attributes. However, despite knowing all of this, policymakers are still engaged in planning "the Lesson" that prescribes a single homogenous framework that will inevitably leave some learners out. The expectation is on the learner to adjust to the learning rather than have the education adapted to the learner. The author suggests that adjustments should be based on the sound knowledge of the learner. This expectation includes what they know already, can do, like, are like, need, or prefer. Instructors need to understand their learners first before adopting any teaching style or approach. Based on this, the authors stated that learners should be allowed to determine instructional decisions and that programs, materials, and resources, in the same way should not guide curriculum and instruction. The specific materials and resources are then selected to teach in accordance with the needs of the specific group of learners and the standards being taught. The author proposes that the quest in schools and classrooms everywhere is to foster success for learners in their lives through becoming self-directed, productive problem solvers and thinkers.

In Gayle's [20] book, the authors stated that research be conducted on studying and implementing research-based instructional strategies and assessment tools that would make a difference in student achievement. One such strategy is the use of differentiation in the classroom. Differentiation is a pedagogical philosophy that enables educators to plan strategically to reach the needs of the diverse learners in classrooms today to achieve targeted standards. Differentiation is not a set of tools but a belief system. Educators embrace to meet the unique needs of every learner.

The philosophy entails the deployment of various strategies and activities that are informed by prior knowledge of the learners' abilities and disposition. Hence the term differentiated strategies and activities. By using differentiated strategies and activities, educators are implementing this philosophy daily in classrooms across the grade levels and content areas. The Differentiated Classroom - a differentiated classroom is one in which the teacher responds to the unique needs of learners. Tomlinson [21] proposed content, process, and product as things that were differentiated in a classroom. The content is what is taught. The way a learner interprets, adapts, and finds ownership is the process. The product shows the learner's interpretation and what they know. In a differentiated classroom, learners are given options to reach targeted standards successfully. These options, issued by the instructors, meet the learner at their level and assist them in moving a level up. In a differentiated classroom, instructors are engaged in differentiating content, assessment tools, performance tasks, and instructional strategies. One way to determine is to provide different content to meet the varying needs of learners. The authors propose that the standards be

communicated and taught through the content and meet the needs of the learners. Strategic decisions would also take into account the information and resources being deployed. This study is implemented by using different genres, leveling materials, using a various of instructional materials, providing choice, and using selective abandonment. Most instructors are already effectively differentiating assessment during and after the learning. However, it is equally important to assess knowledge and interests before the teaching. Planning quality learning experiences in teaching also requires an understanding of learners' prior knowledge in the subject matter as well as to dispense a blending of formal and informal tools for ongoing assessment. Learners demonstrate their knowledge in a variety of ways, and this should inform the provision of various opportunities and choices for learners to demonstrate their knowledge. For example, learners can choose how to display their understanding by creating a prop, giving an oral report, or engaging in a central experience.

P21 Learning Framework [1] was discussed worldwide to propose a new model with prioritized learning objectives. However, Chu [22] suggested that the limitation of this P21 model was mentioned to educators without offering any effective instructional formulae. According to an investigation by Chu et al. [22], most educators today struggle to find practical instructional approach to accomplish those prioritized learning objectives. Therefore, this research aims to investigate and develop an effective way of teaching instruction, as well as the areas to assess and recognize all graphic design learner groups. Referring to Giridharan's [2] report, it is suggested that for graphic design courses, a new proposed instructional approach should be introduced to replace the traditional models.

Henard and Roseveare [23] have agreed that students today seem to be more aware of the equality of treatment and support for the provision of equal teaching and learning opportunities to be assessed fairly. Crosling [24] mentioned that "The globalized and interconnected world impacts the higher education system worldwide, resulting in greatly increased student diversity over the past few decades." The diversity includes international students from the non-English speaking backgrounds, mature- aged women and men in non-traditional disciplines, and students with disabilities. Generational change of students is evident and needs to be acknowledged in educational programs and subsequently in the assessment. Students of Gen X and Gen Y today hold values and expectations that differ from the previous generations of students. 21st Century graphic design students come from various backgrounds with a wide range of intelligence. Traditional curricular instructions have always neglected individual differences in group learning, especially in the average and low achiever groups. Graphic design students today are technological natives, with technology imbuing all aspects of their lives in discovering individual talents through creative development. Therefore, revised assessment tools are needed to satisfy those

achievements from different perspectives.

Crosling [24] also suggested that assessment tasks should require students think flexibly, to self-reflect, solve problems, and use creativity to improve learning effectiveness. Creativity development and the ability to solve real-world problems in the graphic design curriculum are two important stimulations to transform graphic design curriculum into a competency-based education. Due to recent globalization in graphic design trends and professions, critics of current studio-based pedagogy suggest that graphic design curricula should be revised to improve student's learning experience and satisfaction. Creativity theories are attributed to accidental discoveries which lead to higher-order thinking in the cognitive domain. According to Malaysian former prime minister Dr. Mahathir Mohamed [25], the goal of Vision 2020 is to make Malaysia a developed country, not only in the economic sense, but a nation that is fully developed economically, politically, socially, spiritually, psychologically, and culturally. One of the outcomes of these reform efforts was introducing of a more focused and concentrated attempt to teach thinking skills in schools.

3. Research Objective & Significance of Study

This research study aims to introduce an integrated instructional framework which align to 21st Century of graphic design learning to replace Traditional Method.

Firstly, this study hopes to discover gaps between the Traditional Method and the new proposed framework. There could be many flaws in the process when the educators try to implement an up-to-date curriculum and teach according to industry requirements. Therefore, it is essential to evaluate their course curriculum and instructional approaches in both public and private to ensure that both are on par and capable of producing high-quality graphic design graduates that is required by the relevant industries.

Secondly, this study hopes to promote ICAI framework to ensure the new graphic design instruction approach is designed based on the 21st Century learning framework. According to an investigation by Chu [22], most educators today struggle to find an effective instructional strategy to achieve course learning objectives. P21 [1] has proposed an integrated learning framework for global educators but not yet an effective instructional model for 21st Century learners. This research study aims to introduce a workable instructional framework to prepare next generation of graphic design graduates with high competency in creativity and thinking skill.

This study suggested that 21st Century of graphic design learning should focus on how the learning skill could be improved to help learners to think, analyze and connect to relevant information from the Internet sources for a solution creation. In the process to improve, think, analyze and connect, problem-based learning as instructional strategy in teaching graphic design is recommended in this study. The suggestion has been aligned with the finding of Moust [26]

to suggest that PBL is essential educational method to improve learners' skill for effective learning. According to the group of researchers, these ingredients served as a problem description, which invites further active deliberation; prior knowledge that is activated by the process of thinking through the problem; questions raised by the problem and the need or motivation to look for further information relevant to the problem at hand. When other students, who are also interested in the problem, share in the process of active deliberation and all this takes place under the guidance of a tutor, the essential elements of problem-based learning are in place.

Lastly, this research study hopes to help graphic design practitioners to develop an integrated assessment tool to match 21st Century of learning requirement. This research study aims to set up an active learning environment that supports the teaching and learning activities appropriate to achieve the desired outcomes. The key is in the components of the teaching system, especially the teaching methods used, and the assessment tasks are aligned with the learning activities to produce the intended outcomes. The learner would often find themselves trapped without knowing what they are supposed to learn. Biggs [27] summarized that a good teaching plan should come from integrating curriculum, learning outcomes, teaching instruction, and assessment method. Biggs' [27] proposal about his new opinion is in constructive alignment, which refers to the idea that students create their preferred learning destinations according to their individual goals. The lesson contents should not transmit from instructor to learner. Otherwise, it would not fit well into the student-centered pedagogy. Graphic design learners come from different backgrounds with diversified intelligence. Therefore a 'One Size Fit All' lesson plan will not be justified, and a new instructional framework is needed.

In summary, ICAI framework promote active graphic design learning by thinking skill infusion with four sub components. There are Workbook Documentation; Small Group Discussion; Weekly Practical Guide; and supporting by Problem-Based case study instructions. Monitoring Tools: TTCT, AACU [33] Rubrics and Focus Group Interview. Workbook documentation help learner to stimulate two-way of reflective thinking, while weekly practical guide encouraged average achievers and low achiever groups to follow easy thinking steps by simple key word research stimulations. TTCT to measure Creativity development, AACU [33] to evaluate Creative Thinking and Problem-Solving skills and Focus Group interviews witness students' learning effectiveness with satisfaction.

Thinking skills is now one of the six pillars listed in the 2015-2025 Malaysian Higher Education Blueprint. This newly proposed instructional framework uses problem-based learning as the fundamental approach and thinking skills as a vehicle to connect all the course learning outcomes and contents by systematic analysis. In problem-based learning, students are brought together in small tutorial groups of about four to six group members. During the small group

discussion, they are confronted with the problem as the starting point of the collaborative learning process. Leaners are expected to discuss the problem under the weekly practical guide. Initially the small discussion groups will produce a tentative analysis of the problem based on their prior knowledge, and subsequently those analysis will lead to activate brainstorming among members. These questions will be used by the students as learning objectives for self-study. Weekly Practical Guide modules are arranged sequentially to form a thinking process activity. Problem-Based Learning have suggested that students learn to analyze and solve the relevant problems of their domain of study, that they acquire knowledge that is retained over long stretches of life and can also be actually used; and that students develop the necessary self-directed skills for life-long learning.

With this newly proposed framework, graphic design courses could enable the institution of higher learning in Malaysia to produce better quality graphic design graduates. The new proposed framework could help to improve the art and design program standard set by the Malaysian Quality Assurance (MQA) body. This new instructional framework will ensure the graphic design teaching and learning effectiveness could focus on new active thinking processes with greater flexibility to prepare graduates for the 21st Century employment. Greater flexibility means that a teaching plan is suggested to cater to learners of diverse abilities, especially for average and slow achievers in graphic design learning.

4.1 Research Design & Assessment Tools

This research study employed a Mixed Methods Research methodology involving the use of both quantitative and qualitative research instruments. Mixed Methods Research starts a new era in the con-ceptualization and utilization of integrated approaches across the social and behavioral sciences. For almost three decades, various scholars have discussed and debated the concepts, methods, and standards of quality for studies that utilize a combination of quality approaches [28].

Mixed Method Triangulation was chosen to ensure this research study compiles opinions and suggestions from graphic design stakeholders. To reduce biases in the collected data, the effort to cover both qualitative and quantitative methods was utilized to increase the reliability of this research findings. Situations were examined from multiple perspectives where triangulation were collected through focus group interviews, observations, and design workbook analysis. The first stage of Needs Analysis employed descriptive research that was designed to investigate the flaws of current teaching instruction and hopes to compile stakeholder opinions to improve the quality of graphic design learning. This research study introduced a revised instructional tool within the knowledge presentation and contextual limitations during the assessment. Findings of the

investigation were aimed to be shared and hoped to be recommended as an alternative teaching instruction to educators.

The new proposed instructional framework is named as the Integrated Creative Activity Instruction (ICAI). There were three phases in this research design, the first was Needs Analysis, the second was Development of ICAI/ Pilot Test, and the third was ICAI Evaluation. The objective of this research was designed to comprehend and demonstrate a specific circumstance comprehensively based on participant's lived experiences in real-life situations. Gagne [29] stated that nine-events of instruction have proven helpful for classroom design teaching. Whereby, Yin [30] said that a case study provides an in-depth understanding of cases in natural surroundings.

This experimental case study was conducted based on one private University through a convenient sampling method. The researcher was offered a job as teaching staff and given permission to conduct the research activities for the duration of four years. The sample group was chosen due to it was the largest graphic design from private institution population in 2015.

Sample Group One' Learners in TM and ICAI
(Stage 2 -Pilot Test)

Pretest			Treatment	Posttest		
HA_1	AA_1	LA_1	X	HA_1	AA_1	LA_1

Sample Group Two' Learners in CCD2 and CCD3 (Stage 2-Pilot Test)

Pretest			Treatment	Posttest		
HA_2	AA_2	LA_2	X	HA_2	AA_2	LA_2

Sample Group Three' Learners in CCD2 and CCD3 (Stage 3-Evaluation)

Pretest			Treatment	Posttest		
HA_3	AA_3	LA_3	X	HA_3	AA_3	LA_3

Figure1: Experimental Design

High Ability – HA, Average Ability – AA, and Low Ability – LA
Pre-Treatment-Traditional Method on CCD 1 and Post ICAI treatment on CCD2 and CCD3

4.2 Methodology & Instrument

The research design adopted a triangulation research model, in which three assessment tools and two monitoring tools were used:

Assessment Tools
1. Torrance Tests of Creative Thinking (TTCT) was chosen to test the new proposed instructional framework efficacy in creativity.

2. ACCU Creative Thinking Value and ACCU Problem-Solving Value was chosen to test new proposed instructional framework efficacy in semester-end performance.

3. Focus Group Interview is set to obtain individual learning experience and satisfactory levels from all the three different experimental groups (high, average, and low achievers).

<u>Individual Monitoring Tools</u>
1. Problem-based learning is set as individual monitoring sheet
2. Weekly-based design workbook documentation

A test that assessed creativity was adopted from the TTCT and developed for this research. The duration of the tests was 80 minutes. Participants were streamed into three ability groups from the same graphic design class. The creativity test comprised five sections:

<u>Section A</u>: A Fluency test comprised of 40 questions that were designed to measure learners' ability to produce figural images.

<u>Section B</u>: 40 questions set to measure the originality of participant's ability in producing uncommon or unique ideas.

<u>Section C</u>: 20 questions set to measure participant's ability to abstract used and imaginative ability.

<u>Section D</u>: 40 questions set to measure learners' degree of openness in completing a figure.

<u>Section E</u>: 2 questions set to measure participant's ability to develop; embroider and embellish ideas.

Before the actual evaluation stage, a pilot test was conducted to test and improve the reliability of instrument. The total score of the five sections was combined and summed up to 100 in percentage. The pre-test and post-test were administered to all the three sample groups. The efficacy of the new proposed instructional framework was determined by comparing the Pre-Tests and Post-tests scores in creativity.

Figure 2: TTCT Assessment Samples

4.3 Classroom Observation through Workbook and Portfolio

According to Christians and Carey [31], observation is a technique of obtaining data through direct contact with sample groups. The main focus of the qualitative research used in this study was to ensure all the activities and observations must be in their natural state without bias present. The classroom observation served as a passive observation as well as an active observation. Passive observation means sample group monitoring from a distance, whereas active observation means the researcher should take a middle position in educational stimulation. A list of focus areas for classroom observation for data analysis was considered:

i. Aware of self-strengths and weaknesses
ii. Have a clear understanding of the problem
iii. Able to analyze information about the problem
iv. Able to identify the relevant information
v. Able to provide justifications for solution
vi. Flexible to contribute to small group discussions as well as working alone
vii. Aware of competition and willing to take the challenge for higher achievement
viii. Able to organize and manage time effectively
ix. Able to convert and document all the thinking activities inside a workbook
x. Able to connect all the learned skills, knowledge, and apply
xi. Able to present creative solutions clearly
xii. Positive thinker and aware of self-strengths and weaknesses
xiii. Able to rationalize evidence to support final proposal presentation and defense

4.4 Semester-End Evaluation & Assessment

The interview questions were selected based on the qualitative research methodology. The interview used semi-structured to sample student experience in design thinking and new proposed instructional model effectiveness. Participants were selected from three ability groups based on their academic results from the previous semester. According to Rhodes [32]., a semester-end assessment could be assessed using standardized Rubrics for Pre-Test and Post Test, to test outcome and achievement. It was an internationally recognized tool developed and monitored by the Association of American Colleges and Universities (AACU) [33], established in Washington DC, United States America.
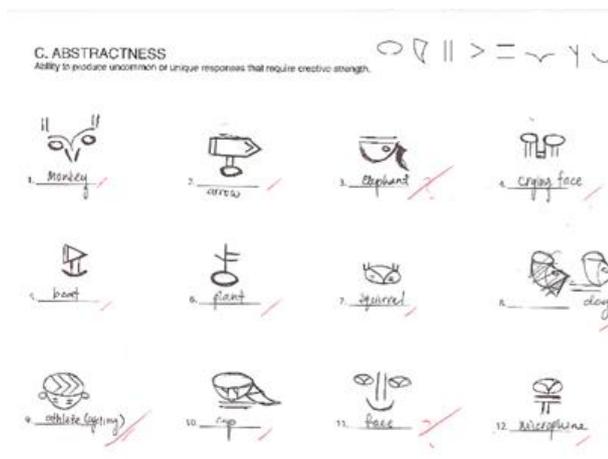
Table 1: Sample of Semester-end Evaluation with AACU Rubrics

No.	Assessment Criteria	Creative Thinking Value	A 1	A 2	A3
1.	Acquiring Competencies	The great skill with high professionalism.	C4	C4	C4
2.	Taking Risks	Dare to take a risk with a series of graphic experiments	C4	C4	M3
3.	Problem Solving	Able to demonstrate ability to explore multiple approaches from multiple angles in solving a visual problem	C4	C4	M3
4.	Embracing Contradictions	Excellent understanding of artistic philosophies. The final visuals are impressive and translate the excitement of an energy drink. The quality that produced is matches industry standards	M3	C4	C4
5.	Innovative Thinking	Few attempts to create novelty design, clean, Minimalist, and innovative ideas	C4	C4	M3
6.	Connecting, Synthesizing & Transforming	Recognize primary connections through process of idea generation	C4	C4	C4
No	Assessment Criteria	Problem Solving & Critical Thinking Value	A 1	A 2	A 3
1.	Define Problem	Demonstrate a high level of ability to identify problems	C4	C4	M3
2.	Identify Strategies	Demonstrate superb color strategy with unique motives	M3	C4	C4
3.	Proposed Solutions/ Hypothesis	Final visual perfectly translates oriental values	C4	C4	M3
4.	Evaluate Potential Solutions	The visual has demonstrated a strong concept with great oral presentation	C4	C4	C4
5.	Implement Solutions	The visual shows significant impact with multiple contextual factors, simple yet powerful	C4	C4	C4
6.	Evaluate Outcomes	The candidate has demonstrated good art sense with impressive execution skills in design thinking	C4	C4	C4
	Overall achievement	Capstone 4 80/100			

4.5 Data Collection

Creative Communication Design (CCD) is the core project-based learning subject to monitor students learning effectiveness from year one to final year at one private University. Bachelor of Graphic Design and Multimedia outlined CCD1 was about new logo design and corporate

identity system design, while CCD2 entailed brand packaging design, and CCD3 covered a complete advertising campaign design. Students were assessed by a brand re-positioning proposal that consisted of the brand logo re-development, corporate identity system, product packaging, print campaign, and Point-of-Purchase visual. During this process, the design workbook remained an essential vehicle for ICAI implementation to record all the design thinking activities for 14 weeks. The first five weeks focused heavily on critical thinking processes. It started with the first week of course briefing and choosing one of the four topics provided. In week three, students were requested to discover specific brand requirements according to market research and analysis. The problem identified from the brand product or service is then converted into an opportunity to be incorporated into a new design to consumers. The confirmed problem statement then subsequently became a Unique Selling Preposition of the new product or service. Results of thinking processes were then documented and listed as a marketing proposal. Each student was required to present their marketing proposal on week five. Hereafter, creative thinking components started to take place from week six onwards. The weekly practical guide was designed to ensure proper operational guidance were given to the learning of design thinking among the students.

Overall, 14 weeks' worth of thinking processes were documented to allow learners to understand their own thinking patterns, including how they started and where they ended. This research design requires all the student's final design portfolio to be exhibited in a hall for evaluation purpose with AACU [33] rubrics. Individual design portfolios were then measured by both Creative Thinking values and Problem Solving & Critical Thinking values under AACU rubrics. The third control group started with the TM teaching method in CCD1. The ICAI treatment was given during CCD2 and CCD3 to compare individuals' performance before and after ICAI treatments. Semester-end evaluations were completed by all three PBL independent assessors based on individual design portfolios in week 15. Overall score value according to the AACU [33] rubrics was concluded by the majority vote of three assessors, while a summary of learning progress was reported by the module lecturer based on class observation and individual consultation.

4.6 Semester-end Assessment and Results

Association of American Colleges & Universities (AACU) [33] Rubrics is an internationally recognized rubric system that helped to evaluate students' thinking achievement in various areas by the end of the semester. In this research, Creative Thinking rubrics and Problem-Solving & Critical Thinking rubrics were used as a key instrument to measure individual learners' thinking development in design. Achievement was divided into five categories including: 1) 'Capstone 4' for 80-99 score, 2) 'Milestones 3' for 60-79

score, 3) 'Milestones 2' for 40-59 score, 4) 'Benchmark 1' for 20-39 score and, 5) 'Under Performed' 1-19 score. There were two types of assessment models used for evaluating the ICAI experiment by the end of the research stage.

Firstly, the marking scheme under AACU [33] rubrics in a set of criteria for assessing the ICAI efficacy was created. For the semester-end portfolio assessment form, a collection of standards was integrated into four evaluation areas, including 1) idea, 2) techniques, 3) artistic and 4) functional. All the evaluation requirements were allocated with appropriate percentages to measure the score reserved for an individual's artwork. On the other hand, the workbook assessment form was designed based on five components, including 1) Marketing proposal, 2) brand logo design, 3) packaging design, 4) portfolio exhibition display, and 5) final oral presentation. The evaluation weightage was distributed equally, with 20% for each component. This assessment form was created to reward the grade. The findings will be documented and analyzed as the level of individual achievement under ICAI instructional framework simulation.

The second assessment tool was panel evaluation. This research experiment required the evaluation sheet (see *Table 1*) to be filled up by panels (three assessors from Graphic Design and Multimedia Department) which were invited to attend the presentation of ICAI's evaluation gallery. The criteria for this evaluation sheet mainly focused on two areas: 1) problem-solving skills to measure the ability of student and identify problems that defined the need for further design, and 2) creative thinking to assess the student's creativity that demonstrates the synthesis of their ideas.

In the evaluation gallery, students are required to display their artworks (one enlarged print) on the wall while workbooks were placed on the tables. Formal assessment by assessor to evaluate group verbal presentations and followed by individual presentations. After the presentation, Q&A session was carried out followed by the feedback from assessors that was given to the individual students. At the final stage, assessors were required to evaluate each student's ability in problem-solving and creative thinking skills. In total, three were 26 students in control Group Three, whereas two of them decided to withdraw from this experiment. Control Group Three was categorized into three ability groups according to CCD1 results; semester score above 70 were labeled as a high achiever, semester score between 60 to 69 were marked as average achiever, whereas semester score between 60 and below labeled as a low achiever. Six participants were labeled as high achievers after CCD1, whereas thirteen for average and five for low achievers.

4.7 Summary of Findings

The research design employed to evaluate ICAI efficacy through mixed-method design where results were measured based on academic performance, creativity, and learning satisfaction. Academic performance scores were evaluated through semester-end portfolio assessment; creativity

measures were evaluated through pre and post of ICAI treatment, including the use of TTCT, while the satisfactory learning experiences were recorded and evaluated though focus group interviews. The process of data collection and data analysis was designed based on Control Group Three, which was labelled as N=24 as a research sample of Graphic Design and Multimedia program students. The overall results were summarized with pre and post evaluations under three areas, including 1) The Semester-end Assessment, 2) TTCT Evaluation, and 3) Focus Group Interview.

Semester-end assessment was completed with the help of three PBL instructors from the University. In this context, the ICAI instruction framework has shown positive effects to the average and low achiever groups in semester-end portfolio performance. However, the effectiveness only applied to high achiever participants due to intrinsic and extrinsic motivation during and outside of the classroom. Means of CCD3 results in comparison to CCD1 (the average achiever group) have reported 2.46% higher; whereas low achiever group has improved from 36.90 to 58.60; 21.7 % higher. Similar results were reported for TTCT evaluation.

TTCT2 results, as compared to TTCT1, have shown significant improvement to average (26.38% higher) and low (21.71% higher) achiever groups after the ICAI treatment in individual creativity. However, the opposite results were recorded in the high (1.34% decline) achiever group. After ICAI treatment, control Group Three was reported to create the most impact on the average group members. All the three ability groups said ICAI treatment is favorable since the results in TTCT2 were significantly improved compared to TTCT1 scores. The high achiever group have recorded the greatest improvement in the Fluency and Elaboration test in contrast to the average and low achiever groups. However, the average achiever group championed in Abstract and Resistance, while the low achiever group showed the biggest improvement in Originality. The results also showed significant responses from CCD students toward ICAI treatments on Abstractness, Resistance to premature closing, and Elaboration variables (in TTCT evaluations). Whereas there were no effective responses toward ICAI treatments on Fluency and Originality variables. The cause of the small research sample and time factor between pre- and post-experiment gaps could be a possibility.

During the post-ICAI Focus Group Interview, out of the eleven participants in research focus group members, ten were recorded having positive experiences with ICAI approaches in the graphic design of PBL learning. Only one participant recorded a negative experience with ICAI treatment. In addition, the design workbook progress has shown significant improvement in thinking development after ICAI implementation in graphic design PBL learning.

The overall results above have confirmed academic performance and creativity improvement are parallel in graphic design learning. The relationship between creativity in thinking, learning satisfaction and academic performance are inseparable. When individual performance has recorded a higher score, creativity measure will follow, and the learner will get satisfaction in graphic design learning. However, the high academic achievers might not always enjoy the same achievement in creativity due to intrinsic and extrinsic motivation. In some instances, the low achiever group members are doing better than the high and average achievers in creativity. As a result, the high academic scorers do not always mean that they can demonstrate high creativity. The low achievers also have the possibility to record high creativity scores with imagination, creative thinking ability, and prior experiences.

4.8 Results and Summary

Under ICAI experiment, the implementation of problem-based learning has suggested that learners are learning to analyze and solve real-world problems, that enable graphic designers to develop necessary self-directed skills according to individual competencies. This potential phenomenon can only be achieved if the learner adopts a positive learning attitude with satisfaction. In this study, ICAI framework has proven how problem-based learning works with effective instructional approach as the graphic design students are learning with thinking skill infusion to connect with information for a tangible solution. Learning effectiveness with high ownership stimulate average and low achievers for intrinsic motivation as a motor for learning. Learning with thinking as the key construction of meaning with high intrinsic and extrinsic motivations.

Proponents of problem-based learning has suggested that acquiring knowledge through working on problems in small groups will foster active thinking while learning. Problem-based learning means that although much of the work has to be done on weekly practical guide reflections, with workbook documentation as the evidence. ICAI instruction also recognizes and highlights the interactive or collaborative aspects of learning in small group discussions. All the four ICAI instructional components are complementing to each other for comprehensive of graphic design learning which dominant by thinking, beside aesthetic-base of design skill. Additional assessment tools like TTCT and focus group interview helped instructors to evaluate learners' progressions under the proposed ICAI framework. Focus group interview helped instructors to learn students' learning experiences under the proposed ICAI framework.

A pilot test on ICAI efficacy in Control Group Two has demonstrated positive learning experiences to show the reliability of measurement instruments under Problem-Based Learning (PBL) simulations. Individual assessments are measured under academic performance, creativity assessment under AACU, and PBL participations. The results are reported below:

Table 2: Creativity, Academic Performance and PBL Assessment Tools

Experiment Groups	Significance	CCD2 Academic	CCD3 Academic	CCD2 AACU	CCD3 AACU	CCD2 PBL	CCD3 PBL
High Achiever							
Participant A1	-3	76 A-	73 B+	M3	M3	6	6
Participant A2	-8	83 A	75 A-	C4	M3	6	5
Participant A3	-1	77 A-	76 A-	M3	M3	6	8
Average Achiever							
Participant B4	+10	68 B	78 A-	C3	C3	6	8
Participant B5	+12	70 B+	82 A	M3	C4	6	9
Participant B6	+4	72 B+	76 A-	C3	C3	7	8
Low Achiever							
Participant C7	+3	58 C+	61 B-	M2	M3	3	5
Participant C8	+8	62 B-	70 B+	M3	M3	3	6
Participant C9	+12	56 C+	68 B	M2	M3	4	6
Participant C10	+5	55 C+	60 B-	M2	M3	3	5
Class average		69.4	70				
Standard Deviation		8.59	16				
Highest		85	82				
Lowest		55	60				

Overall class marks did not show stark differences between CCD2 and CCD3 stages. The significance was only 0.6 marks in contrast. With the introduction of ICAI, however, the control group has shown more significance in standard deviation statistics. It means, overall, students' performance for CCD3 is well-distributed compared to CCD2 after ICAI treatment. The group managed to produce different levels of visual production with variety rather than stereotypes of creative outputs. High achiever participants have managed to adapt PBL instructions in a short period. Despite demonstrating negative academic results, high achiever participants managed to maintain similar academic scores without further improvement in performance after ICAI treatment. ICAI has shown less impact towards high achiever participants since the members are already equipped with the higher ability in thinking and practical skills. Logically, the group members are highly motivated with consistent academic performance, apart from good time management and planning. Whereas average achiever participants have enjoyed a better improved learning experience with ICAI implementation in graphic design classes. On top of the improved learning experience, the Control Group Two were given extra challenging learning efforts in both design workbook documentation and PBL participation. Majority of average achievers have demonstrated significant

improvement in academic performance, as well as creativity assessment under AACU [2] rubrics. Post-ICAI evaluation of average achievers has inspired a quarter of the group members to learn effectively and be ready to convert themselves into high achiever clusters.

Similar results happened to low achiever participants. Post ICAI treatment also pushed the group members to improve individual performance in academics. During the observation, low achiever participants have found a new interest in learning. The group members have enjoyed a better learning experience in PBL instructions, as well as a weekly practical instruction guide and small group discussion arrangement for further learning satisfactions under ICAI. All the instruments for the pilot test seem to be reliable and effective, except for minor fine-tuning in timing. TTCT was also tested and will be used for the final evaluation stage.

The Gap between TM and ICAI

One of the key objectives of this research project was to find identify the gap between TM and ICAI model, and as well as provide a new instructional solution that matching the requirements of 21st Century learning. Graphic design education involves a complex thinking process and requires holistic learning approaches that include knowing how to learn in current real-life challenges. The Tradition Model (TM) in graphic design pedagogies was derived from Bauhaus philosophies and Swiss studio-based instruction. In TM, students learn by doing practical assignments according to the instructor's requirements. In graphic design curricula, thinking skill is offered as a separate subject, and the primary evaluation method is usually used on the final artifacts to measure individual performance. Integrated Creative Activity Instruction (ICAI) is a new prototype teaching instruction created through this research project to help average and low achievers to learn by thinking effectively in graphic design courses in Malaysian private tertiary education. ICAI emphasizes design thinking processes and infusion of thinking skills. It is a pedagogical strategy to enhance learners' higher-order thinking skills. The review of literature allows the comparison of TM and gaps that ICAI can fill from various perspectives, including pedagogy, course content design, and classroom activity. The outcome of the analysis in the later part of this paper will be able provide a new option for graphic design education. By the end of the literature review, a summary of findings characterized as below:

Table 3: Research Gap Between TM and ICAI

The 'Instructor as researcher' means teacher centered

Traditonal Model (TM)	New Proposed ICAI
Instructor as a researcher	Learner as a researcher
Learning by doing according to what the instructor's wants	Learning by thinking according to learners' choice
Low ownership in learning	High ownership in learning
Linear and rational	Flexible, multi-dimensional, and reflective
Lesson content is structured	Lesson content is open, and up-to-date
Design theory and practical skills are emphasized	Real-world challenges and thinking processes are emphasized

instructional model. Instructors tend to plan and design the project brief according to individual interests or preferences, leaving tiny room for a learner to choose and define the research destinations. As a result, learners are designed to accept requirements from the same brief. Lesson contents are fixed and stereotyped with standard syllabus and instructional approach dominated by lectures and class tutorials. It is not good news for average and slow learners in a group. Usually, the scope of studies was decided by the lecturer and in relation which related to the topic. Students are required to create a stereotyped of a neat, and beautiful artwork according to the lecturer's wishes. ICAI, the new proposed instructional approach, should offer characteristics that satisfy learners' satisfactions to provide flexible and effective teaching instruction that meets the requirements of 21st Century learning frameworks.

Think-Based Instructional Strategy

This research study suggests that new teaching pedagogy should focus on thinking process to help graphic design students to analyse Internet information, to conduct market research, as well as to think critically and creatively for innovation in creative design production. Graphic designers' creative and innovative production will impact positive national economic developments in long run. Graphic design students on the other hands positive international economic developments in long run. Graphic design students on the other hands must develop strong critical thinking, problem-solving and interpersonal communication skills in order to be successful in an increasingly fluid, interconnected, and complex world in the context of new entrepreneurship. P21 Learning framework has provided ICAI framework a strong foundation to reposition graphic design curriculum to require more than just thinking skill and content knowledge. The ability to convert creative ideas into tangible solutions from daily challenges require higher order thinking with creativity. Creative reproduction skills remain crucial for 21st Century graphic designers. ICAI framework helps graphic design students to connect all learned knowledge and skill together with ready information to create design solutions. The ability to evaluate and analyse multi-platform possibilities in graphic design helps to solve complex problems. It will also make graphic designers to become more competitive in IR 4.0 competition, whereby graphic designers can be replaced by robots. This research study has proven that problem-based curricula enhance student learning enjoy far more than students in similar conventional curricula. Graduates from problem-based classroom report that they consider themselves better equipped in interpersonal competencies, such as teamwork, consulting with clients, and leadership. PBL students consider themselves more independent, more creative and more efficient in their work. PBL students also display better problem-solving skills than students from conventional programs, although they do not have more profession-specific knowledge.

Creativity is widely thought to be a key 21st Century skill. The ability to produce something new and useful, and solve problems creatively, is considered a must-have for most careers in today's knowledge economy. Creativity has been behind the scientific findings that have had global impact, behind the new movements in art and behind the innovations leading to social change. Creativity involves the creation of products concrete objects or ideas that are new and useful. The psychometric approach to measuring creativity has been the predominant means of studying this skill. It is the approach in which creativity is adopted as a measurable mental trait or human characteristic that can be quantified by appropriate measurement instruments. The measurements are mostly quantitative. PBL monitoring, small group discussion and measured by TTCT. The importance of critical thinking skills in student learning has been of significant concern to educators for a long time. The Partnership for 21st Century skills lists Critical Thinking as one of the essential learning and innovation skills that are necessary to prepare students for complex life and work environments in the 21st Century. Despite the widespread acknowledgement of the importance of Critical Thinking as an outcome of student learning, there is an evident lack of consensus on how to define it. Critical Thinking comprises of the mental processes, strategies and representations that are used to solve problems, make decisions, and learn new concepts. A number of definitions followed. Robert Ennis' [34] definition that 'Critical Thinking is reason-able, reflective thinking that is focused on deciding what to believe or do' is concise and widely used for its contribution to the development of the Critical Thinking tradition. That conclude that thinking skills activation and connection thru metacognitive activities are crucial to prepare a comprehensive instructional approach that align with 21st Century of graphic design learners' requirement.

Comprehensive Graphic Design Assessment Tool

Empathy is an individual's ability to detect what another individual is feeling, and experience an emotion that is consistent with that feeling. The emotional component of Empathy refers to the experience of feeling what another is feeling (87,88) and is the subjective 'reflection' of another person's observable experience. The currently prevailing view of Empathy takes an integrative approach. This approach defines Empathy is viewed as a multidimensional construct, with two major components – the emotional and the cognitive. There are several techniques used to measure

Empathy. These include self-reported responses, ratings of observed facial expressions/gestures and physiological measurements, including brain imaging. Physiological measures of Empathy monitor participants' heart rates, skin conductance, general somatic activity, pulse transmission time to finger, and finger pulse amplitude to assess whether an individual is matching their affective state to another's. ICAI framework proposed the combination of integrated tools such as weekly PBL monitoring, workbook documentation, small group discussion and evaluated by AACU [33] rubrics and Focus Group Interview to improve effective learning of average and low achiever group.

According to the study of Graham [35] in chunking, priming and active learning, Executive Function is a group of skills that equip individuals with adaptive, self-regulated, goal-directed and problem-solving behavior, providing for a sense of readiness, agency, flexibility, and coherence. There is a significant overlap in constructs across skills. For example, analogical thinking, abstract thinking and logical thinking are constructs within the Creativity skillset that could potentially be a part of the Critical Thinking skillset. The ability to think, to be curious and creative may not necessarily be fostered through the education system as it stands today, but through learning processes that focus more on enquiry, play, exploration and experimentation. Possessing communication-related skills is vital to student success within and beyond college. The utilization of these skills, or being considered socially competent, has been linked to personal, relational, and occupational success. Building on research from education and cognitive psychology on chunking, priming, and active learning, we propose an innovative, blended teaching method, the utility of which is in its capability to present complex skill sets in manageable units of information, thus allowing students time to reflect on and incorporate such information into their schema of what it means to be socially competent.

Problem-Based Learning for High Competency

Problem-based Learning has used as the key vehicle to deliver graphic design learning by thinking skill infusion in this study. As Müller, Schäfer, & Gomann [36] reinstate of the importance of PBL in promoting competences in shaping the future employability, this study was appropriate in cultivating the use of problem-based instructional strategy in ICAI framework. In recent years, competency orientation has become a primary focus of educational debate [37, 38]. According to the studies, competencies are understood as cognitive abilities and skills to solve specific problems associated with motivational, volitional, and social dispositions for using these skills and abilities in variable situations [39]. Updated instructional approach focus on competence has shifted attention from the development and assessment of general cognitive abilities to more complex ability constructs related to real-world contexts [40]. In comparison ICAI framework proposal to other studies, the

improved problem-based approaches such as project-based learning and inquiry-based learning have their strengths especially in long-term retention and skill development [41].

They are seen as promising methods of establishing competence development in educational courses, thereby providing a comprehensive basis for promoting learning, processes, and the skills necessary to operate effectively in professional and private life. PBL has explained how problem-based case studies as assignment option may develop students' research skill with high level of reflective competencies. Comparing this research to Wong [42] about the perception gaps in the argument of graphic designer competency, as well as Chiang [43] in regard to investigate an instrument model for competency assessment of graphic design graduates in Malaysia, this research aims to provide a comprehensive analysis of new proposed instructional approach for 21st Century of graphic design learning; which was based on thinking skill infusion and how to improve graphic design assessment. ICAI framework also serving as an alternative suggestion to understand how those profession competencies could developed according to individual intelligence, instead of just one stereotyped of semester-end portfolio assessment model.

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