Thinking Skills Infusion of Creativity Development for 21st Century Learning

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ABSTRACT

To provide enlightenment regarding a newly proposed graphic design course framework based on competency, it would be helpful to conduct an analysis on the current Malaysian instructional approaches to match the 21st Century learning trends. This study suggests that the flexibility and the multiple dimensions of assessments in graphic design learning should be taken into consideration. The revised instruction framework should focus on learners' creativity, ownership and real-world problem-solving skills, as well as the ability to communicate and collaborate. Giridharan's report (2017) suggested that there is a necessity to update the curriculum to prepare the students for the upcoming challenges, especially in the era of IR 4.0. Integrated Creative Activity Instruction (ICAI) is the recommended solution for the next generation graphic design learning with problem-based learning as key vehicle. ICAI framework was developed and designed based on James Gibson's (1986) Affordance Theory and Robert Marzano's (2000) New Thinking taxonomy. It is imperative to implement new ICAI pedagogy in order 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 study, Needs Analysis, Pilot Test, and ICAI Evaluation. Final stage of ICAI evaluation has proven that the newly proposed framework is able to stimulate academic performance of average and low achievers for better learning satisfaction and creativity development in graphic design context. Research findings have proven that high creativity is parallel with higher learning satisfaction and performance in graphic design learning.

Keywords: Graphic Design, Project-Based Learning, Creativity, Infusion Technique, Critical & Creative Thinking

INTRODUCTION

Visual processing plays a crucial role in engaging cognitive functions through sensory stimuli, which is essential for learning and problem-solving. Graphic design programs, such as Adobe Illustrator and Photoshop, contribute significantly to enhancing analytical and interpretative skills by integrating visual communication elements, including typography, layout, and image processing (Dilek, 2010; Huh, 2016). By organizing information visually, graphic design engages learners and enhances visual thinking skills, which is essential for effective problem-solving and creativity (Amer & Al-Masry 2016). Educational frameworks that focus on visual thinking can significantly enhance students' project development and information visualization skills (Bueno, 2020). Visual thinking, which includes the use of imagery, charts, and mind maps, supports the comprehension and retention of information. Individuals possessing strong visual skills often grasp concepts more quickly (De Alencar, 2003). These skills involve distinguishing details, visualizing concepts, organizing data spatially, recalling images, and analyzing relationships (Johnson & Mayer 2009). Design thinking combines creative and analytical methods, enhancing problem-solving capabilities in visual communication design (Anwar, Bachri, & Kristanto, 2024).

Crosling (2017, p.32) has shared a quote from the great educationalist John Dewey as saying that "If we teach today as we taught yesterday, we rob our children of tomorrow". This inspiring quote has implied and suggested that academic staffs from higher educational institutions have a huge responsibility to keep their academic programs updated and look out for the best teaching approaches to prepare the students for effective learning and satisfaction. Raman (2017, Introduction p.5) explained "The future for education is seen as hugely dynamic

and mobile. Knowledge comes from reflection and contemplation. The engine for learning is a continuous cycle of engagement and reflection. With the advent of social or participatory web, it has enabled users to participate actively in knowledge building. The principles of active production, collaboration, sharing, publishing and social bookmarking have been transferred to education". Today's learning environment presents many new learning opportunities whereby current technology allows opportunities for collaboration between teachers and students in a classroom. Teaching should not be a one-way communication process anymore. Battelleforkids (2009) an USA based non-profit educational organization has recognized that students could develop their own driving goals, would conduct their own research, have easy access to experts, and thus create final projects themselves using multimedia devices already available. All they need is proper guidance. The change of learners' learning habits requires the necessity of new teaching pedagogy, particularly at tertiary level.

Raman (2017, Introduction p.6) further explained "We are moving from a teaching paradigm towards a student-centered learning paradigm… the initiative for designing a curriculum may well shift a bit from the academic supplier to the student user. The new learning paradigm will no doubt be more experience-based. Project-based learning as a subcategory of experience-based learning is not new. The simple idea to start from a real as opposed to a stylized problem, and have the students learn from the experience they build up in solving these problems, will get more applications in other disciplines". Therefore, the editor of 'Emerging Trends in Higher Education Pedagogy's suggestion that current education should focus on open curriculum that offers learner with flexible real-life project-based learning challenges, and learner experience with satisfaction should be the key measuring tool is agreed. The above statement was fully supported by a group of educational scholars. According to Sharples, et al. (2015) "Innovative pedagogies have been defined as theories and pedagogies and practices of teaching, learning and assessment for the modern technology enabled world." A new education pedagogy should be revised to offer flexible delivery in teaching, as well as assessment tools that focuses on individual cognitive development.

What does the flexible or 'openness' pedagogy mean in the educational context? McAndrew (2010) explained that 'openness' refers to characteristics of educational pedagogy that encourage learners to change their learning habits with integration of information and telecommunication technologies to embrace openness in all aspects related to learning. Menon (2017) suggested that 'openness' pedagogy and technology integration, originated from the United Kingdom, are mutually complimentary and complemented each other mainly during the last five decades. This 'open education' move has been proven successful under different modes, models and strategies in providing effective learning environment to next generation of learners, according to their individual needs within the complexity of the learning situation impacted by number, heterogeneity, ethnicity, differential abilities, etc. It is important to understand the design process to be able to comprehend the way designer think, functions and could be taught. Foremost, the design process can be defined as a systematic series of steps used in creating utilitarian products and processes. Many have outlined various series of the aforementioned design process steps. According to (Barbour, 2016), there are many ways to look at design processes. Specifically, one can look at design processes in three specific ways. One way to look at design processes is the way an individual process is constructed. Moreover, one can analyze design processes in education and how each process relates to education. Finally, we can look at how an individual design field examines the process.

Giridharan's report (2017) has given Malaysian education industry a good reminder with meaningful aspiration. A second look at the Malaysian graphic design education curriculum and teaching approach in 21st Century is therefore found to be necessary. Referring to Giridharan's report, this researcher suggested that for graphic design courses, new instructional approaches could be introduced to replace the traditional models. It is thus pertinent for the Malaysian educators to nurture the next generation of graphic designers such that they would be able to innovate original ideas to become world-class designers with appropriate thinking skills. This new approach will help the Malaysian government to achieve its 2030 Aspirations of becoming a developed nation. It is hoped that an analysis of the current instructional approaches to match the P21's Framework for the 21st Century Learning could help to provide some enlightenment towards some new teaching and learning methods for Malaysia, particularly in graphic design sector.

Ananiadou and Claro (2009) reported that the P21 Framework for 21st Century Learning as an important guide to inspire world educators, which was developed by Battelleforkids.org. It is a non-profit organization based in

the United States with input from educators, education experts, and business leaders. Ananiadou and Claro (2009) added P21 framework is meant to provide and illustrate the skills, knowledge, expertise, and support systems that 21st Century students need to succeed in work, life, and citizenship. The framework is being used by thousands of educators and hundreds of schools in the United States and abroad to put 21st Century skills at the center of learning. On the other hand, Voogt and Roblin (2010, 2012) described 21st Century Skills as 'new competencies' which society is increasingly demanding from the existing workforce and therefore in educational terms from the students who need to be trained today for future jobs. They restated that the term of 21st Century Skills is "…an overarching concept for the knowledge, skills and dispositions that citizens need to be able to contribute to the knowledge society' (Voogt & Roblin, 2010, p.16). However, Chalkiadaki (2018, p.5) further described "21st Century Skills as encompassing a broad range of skillsets and professional attributes, including: creativity, divergent thinking, critical thinking, team working (especially in heterogeneous groups), work autonomy, developed cognitive and interpersonal skills, social and civic competences, responsible national and global citizenship, consciousness of interdependence, acceptance and understanding of diversity, recognition and development of personal attributes, interactive use of tools, communication in mother tongue and foreign languages, mathematical and science competence, digital competence, sense of initiative and entrepreneurship, accountability, leadership, cultural awareness and expression, physical well-being". P21 Learning framework and 21st Century competency is interconnected in education and workforce. P21 sets new learning components in helping the next generation of educators to prepare effective learning instruction with technology, whereas the 21st Century Skills outline basic employment criteria needed.

As summary, Ananiadou & Claro (2009) has reported that P21 Framework proposes that learning and innovation skills should focus on four aspects: creativity, critical thinking, communication and collaboration. These four aspects are found to be essential in preparing graphic design students for the future. Therefore, this researcher proposes that the key assessment of teaching graphic design students in Malaysia should consider the learners' creativity and innovation; critical thinking and problem-solving skills, as well as their ability to communicate and collaborate. Chalkiadaki (2018) also mentioned it is important that all schools, college and universities, education authorities, and stakeholders combine knowledge and skills with the necessary support systems of standards, assessments, curriculum and instruction, professional development, and learning environments. P21 framework also encourages students to be more engaged in the learning process and graduate to thrive in today's digitally and globally interconnected world.

Poon (2016, p.6) article reinstated how the technology has changed graphic designer roles today 'Modernisation of graphic design: The possibilities and challenges of digitalisation' means that graphic designers today are accustomed with computers as a central designing device. Conventional graphic designers were trained in mastery of form, function, materials and aesthetics. The designers have now started to experiment with digital processes in creating industrial imageries and viewed experimentation as a means of supplementing their design outcomes. The technology has provided a new digital platform for graphic design activities that leads new growth and destination for future development. According to Poon (2016), graphic design practitioners in the modern era could exert their influence and resources independently. During the digital transformation processes, thinking skills are among the crucial vehicles for graphic designers to analyze and synthesize complex information before innovating new creations in entrepreneurial design.

Thinking Skill Development in Malaysia

Schraw and Gutierrez (2012) have explained that thinking skill interventions usually focus on an integrated set of cognitive and self-regulatory strategies that improve learning. Cognitive strategies refer to fine-grained skills that are included in instructions, such as identifying important information, making inferences, and summarizing. These skills are referred as first-order thinking skills. In contrast, self-regulatory skills are used to manage, monitor, and evaluate ongoing learning. These skills are referred as second-order thinking skills.

In discussing the thinking skill and design education in Singapore and Malaysia, Lim (2015) noted that although most design graduates have good design ability, they are not capable to identify new possibilities and develop commercially viable solutions. As a result, most of them merely "end up in roles where they design according to a set of given instructions" (Lim, 2015, p. 58). Debbie (2011) conducted interviews with prominent industry experts to collect their insights into the current state of graphic design education in Malaysia. All interviewees

agreed that higher educational institutions fail to produce industry-ready workforce. Despite the increasing numbers of graphic design graduates annually, the standard of design education in Malaysia is declining. Debbie (2011) highlighted in her study that "The role of education institutions in developing the necessary knowledge and skills of future designers is questionable" (p.140). Therefore, a revised graphic design curriculum is needed and thinking skills are one of the ingredients in helping graphic designers to solve real-world problems.

In 2013, the Education Ministry started developing the Malaysia Higher Education Blueprint 2015-2025 in order to help our youths to gain the necessary skills allowing them to stand a better chance for future employment. The Education Ministry emphasizes a well-balance between both knowledge and skills as well as ethics and morality. Most importantly, thinking skills has been emphasized as one of the 6 key attributes in the new Higher Education Blueprint 2015–2025.

Tan Sri Dato' Haji Muhyiddin bin Haji Mohd Yassin (Higher Education Blueprint 2015–2025 Foreword 1, 2013) has launched Ministry of Education's aspiration in 2013, aimed to create an excellent education system that could rank among the world's leading education systems. For Malaysia, this bold approach would enhance the country's ability to compete in the global economy. According to the former Deputy Prime Minister and Minister of Education in 2013, "Malaysian government is committed to transform Malaysia's education system over the next one-and-a-half decades. Our goal, and the purpose of the education system, is to equip our students holistically to allow them to succeed in the 21st Century, with all of the opportunities and challenges that this new era presents". The Malaysian government aimed to improve education quality among all Malaysian schools in order to progress with the current world trend in terms of teaching and learning. In addition, Tan Sri Dato' Haji Muhyiddin bin Haji Mohd Yassin also mentioned "In order to compete with the best in the world, our education system must develop young Malaysians who are knowledgeable, think critically and creatively, have leadership skills and are able to communicate with the rest of the world". It is proven that thinking skills are fully supported and recognized by the Malaysian government and it is crucial for next generation to be focused especially in education and career development.

Various government agencies and professional bodies like the Agency for Innovation Malaysia (AIM) and Malaysian Global Innovation & Creativity Centre (MaGIC) have been given the responsibility to educate and promote awareness regarding creative thinking and creativity in Malaysia to innovate the graphic design education. The Malaysian government strongly believes that the positive cultivation of good thinking and creativity amongst Malaysian graphic design graduates will help in achieving the national missions towards a developed nation. So, it is pertinent for Malaysian institutions of higher education to play a pivotal role in producing creative and talented of designers in the future.

Thinking Skill and Job Market

Kim (2016), the President of the Centre for Asia Leadership in an article from The Edge Malaysia recognized that thinking should remain as today's most important skill to pursue a career. The author suggested that the competency assessment and employment opportunity is always the key measure for the success of the education system in a country. Kim mentioned that about 250,000 fresh graduates enter the Malaysian job market annually. Due to the country's challenging economic environment, the Malaysian Employers Federation (MEF) has estimated that only 40% of the fresh graduates would be able to enter the workforce in 2016, down from 65% in 2015. The percentage is expected to further reduce for the year 2020 and later. Today's job seeks need to equip themselves with thinking skills for better job opportunities.

Similar research was conducted by Malaysian researchers on graduates' employability. According to Sirat, Chan, Shuib, Abdul Rahman, Ahmad Kamil & Natachatar Singh (2012), almost 40% of the survey population believed graduates have poor character, attitude and personality; all of which are related to emotional intelligence (EQ); whereas 25% have issues with their problem-solving skills. Those statistics have evidence to indicate that the Malaysian graduates severely lack the competencies to generate new ideas. This finding has been reinforced by the observation that Malaysian graduates in graphic design have often been criticized for their lack of imagination and innovation in their work, thus adversely affecting their work performances. Having competent critical and creative thinking would help these graphic design learners to improve their individual problem-solving and decision-making skills.

Problem Statement

At any time, education curriculum and industry demands are inseparable. One of the core education missions is to prepare learners for future employment. According to Crosling (2017, p.26) "More and more graduates are facing unemployment in Malaysia". The article reported that based on Education Ministry's 2017 Graduate Tracer Study, 21 public universities and 38 private universities collectively produce approximately 51,000 graduates annually, but 60% of the graduates were unemployed a year after graduation. Every year, Malaysian undergraduates entering the workforce require more than disciplinary knowledge. In fact, it is evident that 21st Century learners must require all types of knowledge during their course of study at university…". Crosling (2017) added, the higher education should focus on the development of specific competencies and general attributes among graduates due to employer concerns regarding the transferable skills of graduates. As such, this researcher further suggested that to ensure graphic design graduates with high employment opportunities, newly revised instructional framework is needed.

Graphic design has been taught at universities for a long period of time, but there have not been many research studies that look specifically at how the processes of design problem solving are taught to students at the university level. It is important that examines these processes to determine if there is a need for improvement in design education. While most of Malaysian education courses are still focusing on skill-based education, the world trends now gradually moving towards competency-based pedagogy education. Crosling (2017, p.24) also stated that advances in technology and competitive higher education environments necessitate institutions to adapt to the complexities placed before them. Giridharan's report (2017) suggested that there is necessity to update curriculum to prepare the students for upcoming challenges, especially in IR 4.0. In order to encourage graphic design pedagogy to become more inclusive, a newly revised teaching instructional framework is needed to stimulate active learning with thinking skill infusion.

P21 Learning Framework (Ananiadou and Claro, 2009) has been discussed worldwide to propose a new model with prioritized learning objectives. However, Chu et al. (2019) suggested that the limitation of this P21 model was mentioned to educators without offering any effective instructional formulae to achieve those upgraded objectives. According to Chu et al. (2019) investigation, most educators today are still struggling to find an effective instructional approach to achieve those prioritized learning objectives. Therefore, this research investigation aimed to investigate and develop the effective way of the teaching instruction, as well as the areas to assess and recognize all graphic design learner groups. Referring to Giridharan's report (2017), this researcher suggested that for graphic design courses, new instructional approaches could be introduced to replace the traditional models.

Henard and Roseveare (2012) has agreed that students today seem to be more aware of the equality of treatment and call for provision of equal teaching and learning opportunities, and to be assessed fairly in order to get the education they deserve for employment and social inclusion. Crosling (2017, p.32) mentioned that "The globalized and interconnected world has an impact on the higher education system worldwide, resulting in greatly increased student diversity over the past few decades. The diversity includes international students, from non-English speaking background, 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 programmes and henceforth in the assessment as well. Students of the Gen X and Gen Y hold values and expectations that differ from the previous generations of students". 21St Century graphic design students are coming from various background with wide range of intelligences. Traditional curricular instructions have always neglected individual differences in group learning especially 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 creativity development. Therefore, revised assessment tools are needed to satisfy those achievements from different perspectives.

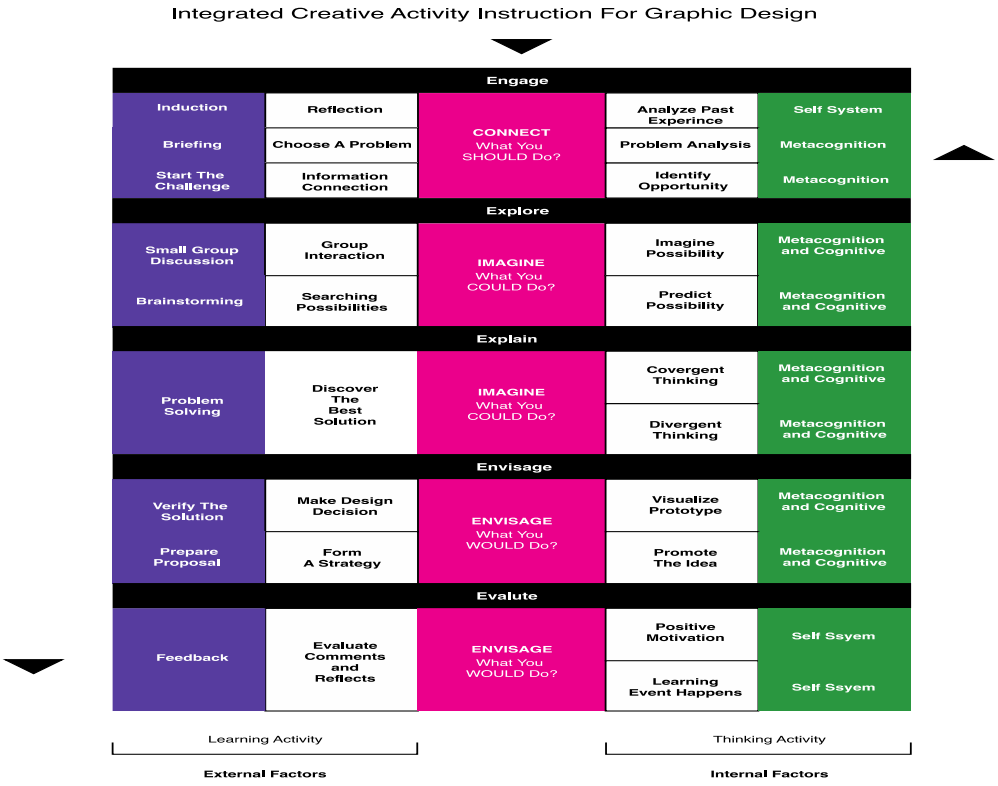
Crosling (2017) also suggested that assessment tasks should require students to think flexibly, to self-reflect, solve problems and use creativity stated in P21 Learning framework. Creativity development and the ability to solve real-world problems in graphic design curriculum are two new constructs to transform graphic design curriculum into competency-based program. Due to recent globalization in graphic design trend and profession,

critics of current studio-based pedagogy suggest that graphic design curricula should be upgraded to improve students' learning experience and satisfaction.

Summary of Study in ICAI Framework

This research study is aimed to develop a new improved framework for graphic design learning in 21st Century. The newly proposed ICAI framework (refer to Table A) helps to define the gaps in comparison to TM model. The controlled variables are graphic design undergraduate student samples from 'University T'. The research study also planned to prove effectiveness of ICAI towards high, average and low achiever groups in graphic design learning. High achievers are recognized as those highly self-motivated and self-regulated students in graphic design learning, with better time management skill and thinking skill. However, high achievers are only a minority in a study group while average and low achievers are the majority. TM model do not usually help average and low achievers as they commonly lack self-confidence and are inactive in class activities. As a result, majority of students from those two groups do not progress well in traditional graphic design project-based learning challenges.

Table A: ICAI Framework



The ICAI framework designed to enhance academic performance, creativity development and learning satisfactions; aimed to cultivate average and low achiever groups to learn effectively with the assistant of thinking skill infusion. The data collected has proven that thinking skill infusion approach is able to activate graphic design students in both critical and creative thinking activities to solve real-world problems. Weekly practical guide has proven to provide step-by-step guidance to graphic design learners to understand how they have started design thinking with key word simulations. Design workbook documentation was designed to help graphic design learners to create better reflection habits to understand their thinking processes during graphic design learning. Small group discussion was designed to encourage graphic design students to work in a group, to help each other in brainstorming, and to exchange ideas with group members.

ICAI framework was designed to have nine learning events (refer to Table A) in one academic semester: i) Induction/ Reflection; ii) Briefing/ Choose a problem; iii) Start the Challenge/ information connection; iv) Small Group Discussion/ group interaction; v) Brainstorming/ searching possibility; vi) Problem Solving/ discover the best solution; vii) Verify the Solution/ make design solution; viii) Prepare Proposal/ form a strategy and ix)

Feedback/ evaluate comments and reflects. These nine learning events were inspired and developed based on Gagne Nine Instructional Events (Gagne, Brigg & Wager, 1992). The purple color columns listed under nine learning events with instructional activities; magenta color columns are labeled as learning activities under Affordance Theory by James Gibson (1986) and green color columns are labeled as thinking activities under Robert Marzano New Thinking Taxonomy (2000).

All the weekly class learning activities were planed and designed by course instructor to stimulate learner's thinking with individual desirable destinations. Problem-based learning has been the key instrument in ICAI framework to cultivate 21st Century of graphic design learning effectiveness with thinking skill infusion as the vehicle. There are two learning events under ICAI framework: the external factor inspirations and internal factor thinking processes. Referring to Table 1, the five stages under Nine Events of Instructions are responsible to structure individual learning under ICAI framework.

The Engage stage- graphic design students are engaged by 'what you should do' during first day of course briefing. Students are guided to focus on their thinking to alert of self-strengths and weaknesses. Graphic design students then are given the flexibility to choose their preferred case study assignment brief and group members for better learning experience. The project-based learning challenge started with research problem identification, and students are learning by thinking simulations with self-system and meta-cognition. Those active thinking help to activate self-reflection and connecting past experiences to search for the unique opportunity. The thinking processes in graphic design contexts could described as a small research activity.

The Explore stage- graphic design students continue their learning journeys by creative thinking exploration under ICAI framework. Graphic design students take part in small group discussions and brainstorming activities to search for the best possible idea and solution. The challenges at this stage are 'what you could do' to evaluate all the possibilities with information. The evaluation processes involve a complex thinking development with imaginations and predictions under meta-cognition and cognitive.

The Explain stage- graphic design students continue their learning journeys by problem-solving. Graphic design students are monitored by weekly practical guide in small group discussion. The challenges at this stage are 'what you could do' to resolve all the visual problems with scientific analysis based on individual ability to discover the best solution in the area of graphic design. This internal thinking processes involve continuity of convergent and divergent thinking, and the two thinking events continue until the best solution found under meta-cognition and cognitive.

The Envisage stage- next challenge was idea verification. Graphic design students are required to verify their solution by functionality, practicality, marketability, cost effective and market demand. Graphic design students are trained to make design decision to finalize visual prototypes with a comprehensive design proposal. The challenges at this stage are 'what you would do' to verify the final solution as creative strategy. Again, this internal thinking processes are helping graphic design students to envisage the possible impacts in graphic design solution under activation of meta-cognition and cognitive activities. The design proposal with final visual prototype helps to list all the important points to promote the viability of project.

The Evaluate stage- graphic design students are assessed by panels in final presentation during end of semester assessment. The ability to sell creative ideas involved complex self-system activation. The challenges at this stage are 'what you would do' to get the constructive feedback and comments from panels. During this stage, graphic design students are learning their thinking patterns through workbook documentation and presentation feedback. It helps to generate positive motivation and satisfaction for the completion of graphic design learning.

Referring to conceptual framework, dependent variables are students' performance, creativity and learning satisfactory. In TM, graphic design students are assessed by semester-end portfolio assessment as key performance measure. This is insufficient since it is a single-perspective evaluation system. According to 21st Century Learning framework, creativity development and individual learning satisfaction are two additional important tools apart from semester-end assessment to measure graphic design students' learning progression with project-based task. Whereas independent variables are the comparison between Traditional Method (TM) and ICAI as research finding gaps. Graphic design learning involves complex contextual issues and require

learner to solve real-world problems with convergent thinking and divergent thinking. This revised integrated graphic design framework is designed for 21st Century of quality teaching and learning with positive alignment in both pedagogical aspects and students' learning satisfaction to meet desirable learning outcomes as below.

ICAI framework offers a complete set of research instrument to activate graphic design students' learning, as well as in PBL monitoring and individual assessment. Multiple data were set in this research study as Design-Based Research (DBR) to discover an in-depth understanding of the learning events and hope to provide a triangulated data which are countable and reliable. Those findings were collected from a series of survey, semi-structured interviews, observation, reflective design journals, and portfolio artifacts. This integrated creative activity instruction model exercises infusion of thinking skills in graphic design learning with problem-based learning approaches. Reflective workbook documentation, guided learning and cooperative learning are among the supporting components.

ICAI framework comprises three key elements, the instrument, monitoring tool and assessment method. ICAI key instrument is problem-based learning approach. There are four components to support ICAI: case/ problem with thinking skills infusion, weekly practical guide, small group discussion, and workbook documentation. Students are working in small groups to discover solutions to the problem. Students are beneficial by the ability to identify what they know and most importantly, what they don't know yet. ICAI instructor would then infuse thinking skills during small group discussion by asking constructive questions to activate learners' thinking in order to convert those creative ideas into a tangible solution.

ICAI key monitoring tools are: design workbook, weekly practical guide, Problem-Based Learning (PBL) participation and small group consultation. Design workbook encourages graphic design learners to compile all design thinking activities including research, mind-mapping, idea development sketches and peer comments. By the end of the semester, learners would be able to understand and read their own thinking processes from the start right to the end of semester. This meta-cognitive documentation allows students to be aware of self-weaknesses and strengths through reflections. In the ICAI framework, graphic design students are given small group consultation with problem-based questioning approaches. During the face-to-face consultation, personal coaching addresses on student progression in project-based tasks problems. Such feedback in small group consultation aims to provide explicit suggestions for improvement through action points which helps students to narrow the gap between own achievement and expected learning outcomes.

ICAI key assessment methods are: Torrance Test of Creative Thinking (TTCT), focus group interview and semester-end portfolio assessment based on Association of American Colleges and Universities (AACU) rubrics. The world today and the future in which graduates will operate and to which the educational program and forms of assessment need to be aligned is the globalized and interconnected knowledge society. Those information and knowledge would be helpful to devise new solutions to emerging society through immediate information sharing and learning internationally. The student-centered nature of assessment tasks requires students to be active in their learning, developing students' independence in their learning and reduce being dependent on teachers. Independence underpins students' ability to solve problems and think rationally besides being creative.

Summary of Main Findings

At the first stage of this study, Needs Analysis has reported that thinking skill has not been emphasized in Malaysian Higher Education of Institutions. ICAI Focus Group Interview reported that graphic design students did not learn well in thinking skill subjects since the curriculum contents did not connect directly to design related contexts. Research reports from Hashim (2004, 2015) and Graphic Design Educators' Interview (interviewees 1-4) have revealed that majority of the graphic design instructors are teaching without proper education training, and they lack knowledge in thinking skill infusion delivery at tertiary level. The Needs Analysis in 2015 also reported that graphic design students doubted the curriculum design and many of them complaint graphic design courses are offering too many subjects with heavy workloads. Graphic design students are happy with the quality of delivery but admitted lack of ownership in assignment brief since it was always done based on instructors' interest. Graphic design students are happy with the practical coursework experience but not with the thinking processes.

At the stage two of Pilot Test, newly proposed instructional framework has been tested in Creative Communication Design (CCD) classes and all the instructions, tools and instruments have been refined before moving to stage 3, ICAI evaluation. At evaluation stage, semester-end assessment was completed with the help of 3 assessors from 'University T' to minimize bias. In this context, the ICAI instruction model implementation has shown the significance of positive effectiveness to average and low achiever groups during semester-end assessment. Thinking skill infusion has proven it was effective in helping graphic design students to perform and to improve individual creativity, especially to average and low achiever groups. All three groups of different ability reported positive results after ICAI implementation.

Overall, the results above have confirmed that the academic performance and creativity improvement are not parallel to the graphic design learning. Relationship between creativity in thinking, learning satisfaction and academic performance are inseparable. When the individual performance recorded a higher score, creativity measure would follow, and the learner would get satisfaction in the graphic design learning. However, the high academic achievers might not always enjoy similar achievement in creativity due to their intrinsic and extrinsic motivation. From the ICAI evaluation stage, half of the high achievers failed to continue their high academic performances in creativity when brilliant ideas did not come consistently. High level of creative execution needed a complete thinking process development, rather than just technical skills with good attitude.

Creative thinking development is an art, as well as a scientific case-study analysis in graphic design. ICAI strategy activates average and slow learners by PBL and small group discussion. In certain cases, the low achieving group members did better than the high and average achievers in creativity, due to burden-free thinking freedom in their fresh mind. As a result, the high academic scorers were not able to consistently demonstrate high creativity. The low achievers also had the possibility of recording high creativity scores with imagination, creative thinking ability and prior experiences advantages with positive motivation simulations. What the average and low and achiever groups need are self-confidence, group recognition and equal attention from instructors or tutors in graphic design learning. ICAI framework is an open instructional method to fulfil different needs from different types of graphic design learners' background. First, ICAI framework allows learners to choose their preferred problems by individual interpretation under four separate cases-studies as assignment brief. When the graphic design students are given such flexibility, they will be motivated with greater learning satisfaction. Second, graphic design learners are activated with questioning strategy during small group discussion with workbook reflections. Those active learning activities under ICAI are helping learners to gain confidence and positive interactions with each other. Graphic design learners are encouraged to develop creative thinking under ICAI, rather than focusing on skills alone. Compared to the TM, ICAI allows graphic design students to choose one of the preferred assignment briefs according to their interest under project-based learning; and ICAI also allows students to work with their preferred group members under small group discussion. During the small group interactions and weekly practical guide, average and low achievers are given more chances to learn effectively with proper guidance. ICAI framework is able to offer higher ownership in active problem-based learning approaches under cooperative learning theory. Workbook reflection has also been proven to be effective to activate graphic design thinking with the greater awareness about self-strengths and weaknesses. The reflections helped graphic design students to learn how their thinking patterns have started, as well as how it ended under graphic design contexts. All four ICAI components have developed based on 21st Century Learning framework suggested by P21.

The Impact of Thinking Skill in 21st Century of Graphic Design Learning

Analogical thinking involves mapping of knowledge from a base domain to a target domain to facilitate one-to-one correspondence (Paul, 1995; Gentner, Brem, Ferguson, Wolff, Markman, and Forbus, 1997). Thinking skills are the key driver to help learners to connect meaningful information and creative mindsets with creativity. Thinking skill becomes vital prerequisite for the next generation learners to improve academic performance at tertiary education. However, in Malaysia many educators are still facing problem to teach thinking skills to ensure teaching and learning effectiveness. McGuiness report (1999) and Raja (2000) have all stressed the importance of thinking skill and the possibility of thinking skills infusion in education, but it is yet to be introduced in graphic design courses. However, Schraw and Gutierrez (2012) and Zulkpli, Abdullah, Kohar, and Ibrahim (2017) have respectively reinstated the impact of thinking skills infusion in teaching, and it has become

ICAI framework's formulation indirectly. This research study has confirmed the significance of all the four components in ICAI framework creation; critical thinking, communication, collaboration and creativity are key foundation to 21st Century of graphic design curriculum design.

Due to the rapid technological development in the fields of thinking skill infusion , the world is witnessing major changes in the field of education. Humanity is currently experiencing a technological revolution that is transforming every aspect of life (AlKasasbeh & Amawi 2024), with the true wealth of nations rooted in the intellectual contributions of thinkers advancing knowledge (Al-Said, et al. 2023). This revolution highlights the importance of visual processing, as research reveals that the brain processes up to 36,000 images per minute, and 80-90% of the information it receives is visual, underscoring the brain's preference for visual data (Amer & Al-Masry 2016). Zulkpli, Abdullah, Kohar, and Ibrahim (2017) have also reinstated the impact of thinking skills infusion under Malaysian education development. This research study has proven that thinking skills infusion technique is workable for graphic design courses. The results from this research finding have proven that those suggestion from researchers are true and relevant. Thinking skill infusion for graphic design learning is possible and is effective in helping students to improve their overall performance. From the Needs Analysis stage, academic managers and educators agree that thinking skills components and infusion technique are both important to contribute to the next generation graphic design learning, and ICAI proposal was designed according to those suggestions. In this research study, hypothesis two has proven that newly proposed ICAI framework is able to help graphic design students to perform better. And with ICAI stimulation it enables graphic design students to improve individual creativity with thinking skills infusion.

Jeffries and Hancock (2002) recognized thinking skills were impacted to solve real-world problems in education. Whereas Wegerif (2006) suggested effective thinking skills helped to enhance and differentiate individual design quality. Thinking skill components in ICAI framework were critical and creative thinking, problem solving and decision making. Critical thinking is essential skill for graphic design students to categorize information, identify new problems and improvise the possibilities for best solutions in graphic design. The thinking process then progress according to the contextual analysis. Under ICAI framework, active communication helps to interact, brainstorm, convince and present original ideas to peers along with creative processes; collaboration encourage quality leadership and team player flexibility to accept new ideas and verification; and creativity enhance problem-solving and decision making in graphic design complex thinking activities. This researcher study suggested that next generation graphic designers needed to be widely recognized with new thinking ability to enhance individual professionalism in new areas like e-commerce branding, interface design and virtual communications with high speed 5G technology. Graphic design profession has great potential in the future to be recognized as those traditional professions like engineering, medicine and law. However, it is important for all the graphic design course stakeholders to work hard together to produce innovative next generation designer.

This research further his opinion that current academic managers and educators must be the front-liners to offer an evolutionary graphic design course curriculum in order to re-position and rebrand current graphic design profession. Research findings at Need Analysis stage have revealed that majority of graphic design programs in Malaysia are yet to offer thinking skill as a subject even though Malaysian government has listed thinking skill as one of the six pillars in New Malaysian Education Blueprint 2015-2025. Nonetheless, Rosnani & Suhailah, (2003) report has given the reverse progression. The research report mentioned that many studies have begun to reveal symptoms of decline in students' ability to think well, especially when Malaysian schools begun to focus on the mastery of subject content rather than the processes of deriving the products. The report also mentioned that due to situation of lecturer shortage in teaching thinking skills, the effort to offer critical and creative thinking among local institutions have not met expectation. Therefore, graphic design learners at a tertiary level struggle to learn effectively in order to connect knowledge, and skills gained in their problem-solving exploration. Learning-by-doing pedagogy is still the common pedagogy among the Malaysian HEIs, especially at Diploma level. Many researchers have shared their concerns of thinking skill infusion possibility for future graphic design learning. However, over the years, the number of research publication to investigate the possibility of thinking skill infusion in graphic design learning remain small and discouraging. From literature review, the common trends of design pedagogy in Malaysia are to still focus on the training of practical skills rather than thinking development in graphic design learning. This is the time for educators and academic managers to work hand-in-hand with Minister Of Education (MOE) to introduce a newly revised pedagogy like ICAI framework to uplift

graphic design course perception among Malaysian and hope those efforts would be able to attract more talented young generations in future.

This research study aims to fill in the gaps and hope to help all the graphic design learners to learn effectively by solving real-world challenges. Students were learning well at separate subjects but failed to apply the given task in the assignments at tertiary education. One of the key factors contributed to this situation was the spoon-feeding type of education system. Thus, this research study has suggested that students should master most of the basic necessary skills at high school prior to higher education at universities and colleges. A graphic designer profession needs to be evaluated with multiple levels of assessments through PBL and research projects at the higher education level. From the literature review, cooperative learning is one of the proven effective education methodologies in 21st Century due to its high success rate. It has been proven that students who worked cooperatively show dramatic increases in academic achievement, self-esteem and positive social skills. In ICAI framework, cooperative learning has been named as small group discussion, as one of the four tools designed to trigger positive learning outcomes in graphic design courses. Those positive learning outcomes are listed as higher-level of reasoning; ability to transfer learning contents; greater motivation to improve creativity; and enhanced social cognitive development for greater learning satisfaction. Additional ICAI framework products include better time management, reductions in design stereotyping, greater appreciation of diversity in thinking, development of social skills and improvement for positive learning motivation. Communication and collaboration are among the highly regarded components in graphic design learning, while emphatic and social skills are carrying those significant values.

Problem-based learning, small group discussion and thinking skill infusion techniques under ICAI framework are categorized as cooperative learning. Co-operative learning has proven effective in shaping positive PBL learning environment for average and low achiever groups, particularly in graphic design learning. Both average and low achiever group students need learning guidance and leadership quality from high achiever for active learning, especially in group brainstorming and thinking related activity. High achievers are set to learn together as they are working collaboratively on authentic project-based assignments and develop skills by teaching their peers in a group. In the future workplace, graphic designers are expected to engage in highly networked collaborations, separated from colleagues by considerable distance and situated far from the physical location of information resources. In 21st Century, learners should adapt to remote working comfortably with technology, and those interactions should be simulated in education, such as WhatsApps, Facebook, WebEx, Zoom and many other new communication tools.

Marzano New Thinking Taxonomy suggested all three cognitive constructions are playing key roles in thinking process development. Self-system stimulates reflections, meta-cognition helps to connect with meaningful information, whereas the combination of both to ensure problem-solving and decision making ended with a tangible solution. During the ICAI implementation, thinking skills can be thought of as a broad term to describe a wide range of design thinking development, especially those specific skills relating to creative and critical thinking; problem-solving; idea development processes; the use of open questions to extend and improve pupils' thinking and procedures for helping students to reflect on their own thinking. ICAI framework has also suggested that active thinking process could help to reconstruct knowledge and understanding among students, and ICAI framework has taken those suggestions in proving that active learning is able to activate students' learning effectiveness, especially among average and slow learners in graphic design. These activities are usually named as gathering information in the early stage of graphic design research. Problem-solving and critical and creative thinking involve processes in problem identification, identifying a valid problem, selecting a strategy, implement the strategy and evaluate the solution. These processes are essential skills for graphic designers in brainstorming stage. Meta-cognitive processes refer to thinking about one's thinking, inclusive of reflective thinking to discover individual's strengths and weaknesses. Reflection is a universal term in graphic design and one of the important vehicles in ICAI pedagogy.

Learners' Satisfaction Among the Key Drivers for Better Outcomes

Long (1985), and Chang (2012) have all emphasized the importance of learners' satisfaction in 21st Century learning today. Therefore, this research study suggested that one of the three assessment tools in ICAI should be learning satisfaction. ICAI framework is set to be an integrated graphic design instructional approach in which

creativity development, problem-solving skill and learning satisfaction are all included to provide a multi-dimensional graphic design assessment system. Under ICAI framework, investigation towards students' satisfaction is crucial to justify the learning excellence as a record keeping track on how graphic design students have rated their learning pathways along with the thinking process.

From this research study, hypothesis three has proven that the newly proposed ICAI is effective to help Malaysian graphic design students to perform with positive learning satisfaction at undergraduate level. Long (1985), Chang and Chang (2012) have both recommended that learning satisfaction is crucial to measure the success of learning event that has taken places effectively. However, it has not been included in graphic design as part of official post-semester evaluation for teaching and learning effectiveness. Learning satisfaction has been described as the superior emotional complex that decide the level of joy a person experiences when learning by researchers around the world (Johnson, Top, & Yukselturk, 2011; Fransen, Kirschner, & Erkens, 2011; Ku, Wei Tseng, & Akarasriworn, 2013). The two major goals, activity participation pertaining to the learning outcomes would not be met in complete with the lack of learning satisfaction. Current teaching survey evaluation does not help to allow academicians and educators to understand the level of students' satisfaction in graphic design learning. Current evaluation system which relies heavily on studio-based evaluation lack the interactions between the authority and learners to raise their problems and exchange opinions for improvement. 360-degree type of post-semester survey is recommended to rectify learners' problems in future. In ICAI framework, problem-based learning approach taken from medical case-study has proven effective to activate graphic design thinking processes. Course instructors and tutors should prepare a series of active questions to monitor graphic design learning with guided step-by-step instructions as ICAI strategy. Learning is seen as an active interaction between learner and graphic design contexts. Within real-world contextual explorations, graphic designers would be able to analyze information and search for the possibilities to convert those creative ideas into tangible solutions in business. Positive active learning is a process that helps to develop learners' strong characteristics and to improve the willingness to explore. Positive learning witnessed the importance of individual motivation with learning satisfaction in graphic design. Positive peer interaction, learning happiness, the sense of achievement and group recognition are all contributed as motivation in graphic design learning. In this regard, learning satisfaction mechanism as the feedback implies in specific curricular activities designed to fulfil the learning needs initially felt by the student.

Considering the variety of learning needs among graphic design students, different learning activities should be well-designed and well-implemented to provide high level of learning satisfaction. This research study has proven that learning satisfaction is always associated with the individual's feelings and attitudes towards the education process and the perceived level of fulfillment in connection to the individual's desire to learn, caused by the learning motivation. They are many factors behind positive learning satisfaction. High achievers can perform well in academic results due to their highly self-motivated learning spirits. Whereas average and low achievers might lack the attention from instructor, lack financial support, or are battling family issues, or sickness. ICAI framework has proven that high achiever is not guaranteed with high creativity in TTCT test. Many average and low achievers could also score high in creativity during pre and post ICAI treatment in comparison to the high achievers. With the equal attention of ICAI instructions to all the students, average and low achievers stand a better chance to improve their performances with active group participation. Referring to ICAI project-based learning of graphic design, high achiever group has always been classified as smarter based on their academic results. High achievers are usually better in self-discipline and are able to follow instruction, that equip them with greater learning skill in acquiring knowledge and thinking skills including analytical and problem-solving skills. And high achievers are usually highly self-motivated at intrinsic and extrinsic learning environments. Intrinsic motivation refers to intrapersonal and interpersonal skills that allow them to think effectively and reflect within themselves, as well as within their peers group. However, positive motivation is also influenced by family issues, social issues, classroom setting, geographical climate, facility, equipment, personal health; and the most important motivation came from module instructor. Many research discussions have been mentioned in literature review chapter and creativity has summarized as one of the key competencies that enable graphic design students to learn effectively. Creativity is a skill that helps graphic design students to convert innovative and imaginative ideas into tangible solutions, in the form of product or service.

Employment with career satisfaction is always the desirable outcome in education. It has been proven in many research that those graduates with high satisfactions usually able to grab a career. Amaible (1998) from Harvard Business School suggested that three major components in creativity are responsible to help learners to convert creative ideas into tangible solutions in business. The three components in creativity are listed as prior knowledge and individual expertise; creative thinking skill and motivation. Internal motivation serves as intrinsic motivation and the willingness to learn, whereas external motivation comes from the environment, the peers and instructors. The finding of this research proves that high creativity improvement is parallel with high learning satisfaction level in graphic design learning. When learning processes are reported positively satisfied, creativity and academic performance will be heading to a positive direction too. In tertiary education, learning is a process to help learners to change the way they think in order to achieve their career goals. Aesthetic evaluation will not guarantee the completeness of the learning event. TM methodology in graphic design learning might be able to produce world class artist with the ability to produce beautiful layouts and visuals, but the results might not be sufficient for higher level of graphic design execution in 21st Century. Therefore, creativity and learning satisfaction in graphic design learning have been introduced in ICAI proposal to improve the quality of next generation graphic designers. Creativity development helps to improve graphic design students' ability to create original ideas by thinking and learning satisfaction assurance helps to provide a meaningful journey in searching for career destinations. Effective learning would not happen without happy experiences. Since graphic design has a wide career opportunity to specialize, effective learning with satisfaction will help graphic design learners to seek for a matching career. In general education, any student could learn effectively with good efforts, but not in graphic design. In graphic design, not all learners are gifted with creative thinking skill. ICAI measuring tools are crucial to provide prediction and evaluation whether a student is suitable to choose the course, based on self-interest and creativity assessment. As mentioned earlier, talented graphic design students should be recognized because they are always neglected in traditional education system. Graphic design talents should be given the opportunity to improve their performances with appropriate instructional approach, particularly in thinking skills. From the research hypothesis two, ICAI model has been proven to help and improve low and average achieving groups in graphic design learning. The researcher suggested that it is necessary for graphic design instructor and facilitator to understand how to help average and low achievers to learn and assess effectively. Since graphic design students vary from one batch to another one, instructional strategy must adjust to cater different types of average and slow learners in graphic design. Project-based assignment briefs and small discussion group also need to be modified to encourage tailor-made instructional approach to activate students' learning.

Needs Analysis report stated that in graphic design class, average and low achievers are often neglected by instructors and facilitators even though they are the majority in the group. At 'University T' bell-curve classification system, average achievers consisted of 60% to 80% of the class as compared to high and low achievers. Yet, due to the time constraint, usually more personal attention by instructors have been given to active high academic scorers compared to average and slow learners. However, this research has proven that some of the average and slow learners have performed better in TTCT test than high achievers. It has been proven that average and low achievers could perform better when creativity development has been emphasized to give more room for them to think and explore with the assistance of small group discussion stimulation and weekly practical guide. The research findings have proven that academic performance and creativity scores are not parallel in graphic design learning. Low achievers could very much score high in creativity under ICAI framework. Average and slow learners deserve more attention in 21st Century of graphic design learning, this research has proven that large percentage of average achievers surprisingly performed well in Abstractness and Resistance constructs from TTCT evaluation, whereas slow achiever group has recorded highest percentage improvement in Originality. That means low and average students are proven to be more open in producing unique and innovative visuals in comparison to high achiever. This research study has also proven that there are many factors from intrinsic and extrinsic motivations to perform well in graphic design learning besides prior skill, knowledge and creative thinking abilities. Health, relationship, family issues, financial stability, weather, social stability and living environment could play a significant role as creativity motivation.

Hypothesis two has proven that the newly proposed ICAI is effective to help Malaysian graphic design students to perform with positive learning satisfaction at undergraduate level. Learning effective with satisfaction are two important destinations for all the educators and learners in education. However, the biggest challenge now that

educator can never ignore is how the current education has failed majority of average and low achievers in the system. In this research, ICAI framework has proven that it was effective to help average and slow learners to learn with better satisfactions in graphic design learning. Zohar & Dori (2003) research has expressed their concerns of the average and slow learners. The researchers believed that the production of 'High Road' development in graphic design has been neglected. This research finding has proven that average and low achievers are only underrated by current education system, especially in graphic design courses. During class observation, all the graphic design students have their area of specialization according to the study of Gartner's Multiple Intelligence. Current exam-based evaluation system is killing the talent of those average and low achiever groups in graphic design learning. The ICAI evaluation has also provided the evidence that most of the average and low achievers have great opportunity to develop their creativity through effective ICAI implementation in graphic design classes. Guided practical module, PBL and small group discussion are designed to help average and low achievers to excel according to their individual creativity.

Under ICAI formulation, average and low achievers are given a greater opportunity to extend their learning motivation through weekly practical guides and design workbook reflections. Weekly guided learning will help average and low achievers to learn design thinking step-by-step with PBL questions and keywords tips. Whereas design workbook helps average and low achievers to reflect and learn how their thinking processes have taken place. The reflective thinking processes also help them to identify their strengths and weaknesses in graphic design exploration and execution. Small group discussion will help average and low achievers to seek for assistant when they need extra opinions and interactions in cooperative learning methodology.

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