

T-Shaped graduates: Developing cognitive and metacognitive (socioemotional) skills in a science, technology, engineering, and mathematics-aligned course using project-based approach in an online learning environment

Santos, Rafael ✉

University of Asia and the Pacific, Philippines (Rafael.santos@uap.asia)

Bae, John Brylle

University of Asia and the Pacific, Philippines (johnbrylle.bae@uap.asia)



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Abstract

This mixed method study investigated the impact of a T-shaped model in the teaching of a course that is aligned with science, technology, engineering, and mathematics (STEM) using a project-based approach in an online context. Manifestations of knowledge and metacognitive/socioemotional skills were examined. In particular, the use of the proposed teaching paradigm tested the development of cognitive, interpersonal, and intrapersonal competencies. After the completion of each of the nine tasks, respondents (n=113) representing all students enrolled in Media and Information Literacy (MIL) rated their development of the applicable skillsets via a Likert Scale survey. Activities involving all three T-shaped skillsets scored high, indicating significant enhancement of skills. All the projects did not test significantly in the ANOVA single-factor analysis, recording p-values of more than 0.05, suggesting that the T-shaped skills were equally engaged and capacitated. Projects involving two competencies scored high as well and tested negatively using ANOVA ($p > 0.05$). Triangulation through interviews of 10 students using purposive sampling corroborated the findings. Results point to the need to integrate T-shaped skills in education. A T-shaped model in the teaching of STEM and humanities subjects is presented. This research delved on intentional integration of skills development in MIL, one of the core subjects in Philippine senior high schools (SHS) in response to employability issue among SHS and college graduates within the confines of a junior college in Pasig City, Metro Manila. Finally, the entire manuscript is original and is a result of an experiment and analysis of available literature.

Keywords: cognitive skills, interpersonal skills, intrapersonal skills, socioemotional skills, T-shaped skills, technology

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1. Introduction

The modern trends of globalization and technological revolution necessitate a highly capacitated and holistic manpower. Unlike in the past where technical skills were deemed sufficient, the modern economy demands both technical know-how and soft skills (Deming, 2017; Majid, Eapen, Aung, & Oo, 2019; Mathur, 2017; Remedios, 2012; Succi & Canovi, 2020; Vandana, 2018). Also known as metacognitive or non-cognitive, these abilities are said to determine career success and wealth accumulation (Blanden, Gregg, & Macmillan, 2007; Farkas, 2003). Additionally, acquisition of cognitive skills is dependent on a person's non-cognitive capabilities (Billing, 2007). However, because of the technical skills-orientation, knowledge transfer is afforded more attention in education (Campbell, 2009). London (2006) rejects such instructional tendency as "partial, disjointed, [and] inauthentic" (p. 8). Because socioemotional potentials are not prioritized, a greater deficit on the soft skills side occurs (Heckman & Rubinstein, 2001; Subedi, 2018). This skills gap is unfortunately commonplace in the Philippines where, according to a World Bank study, inadequate workforce skill is increasingly becoming a concern among businesses (Acosta, Igarashi, Olfindo, & Rutkowski, 2017). In fact, the number of companies that cited the widening skills mismatch as the main obstacle in doing business increased by 60% since the survey was last conducted in 2009, which recorded a 10.1% increase then. Acosta and colleagues report that socioemotional competencies were considered as the top skills required by businesses. This shows that metacognitive skills have overtaken the technical-cum-cognitive proficiencies in the hierarchy of needs of local companies. For instance, managerial and leadership skills, which belong to the socioemotional category, topped the skills most sought after by industries at around 75%, followed by work ethic and communication while technical skills, which fall under the cognitive milieu, comprise the bottom end of the list at about 15-30% only.

The World Bank study faults the inadequacy of academic training in schools for such imbalance. It observes that although the country has "achieved remarkable progress in raising the education level of its labor force, the...years of formal schooling...is increasingly inadequate as a measure of workforce skills", resulting in unfilled "vacancies because of a lack of applicants with requisite skills" (Acosta et al., 2015, xiii). The team of researchers explains that required skills have nothing to do with "academic knowledge or technical acumen but rather socioemotional skills", stressing that in the global economy, non-cognitive skills "are increasingly crucial to the types of jobs being created" (xiii). It appears, therefore, that a proper and balanced education is key to employability.

The World Bank observations regarding the education-employment connection do not come as a surprise since the more economically advanced Singapore, as a matter of illustration, overhauled its educational agenda several times in the past decades. Notable was the enhancement of pedagogical approaches that used to emphasize critical thinking, creativity, communication skills, and collaboration on top of the integration of information, communication, and technology (ICT) and life and career skills (Partnership for 21st Century Learning, 2019; Muthmainnah et al., 2021, Tan, Koh, Chan, Costes-Onishi, & Hung, 2017). As a case in point, an overhauled curriculum that integrated character formation was implemented in 2005, requiring the institutionalization of values formation together with the development of social and emotional competencies. Eventually, these so-called 21st century competencies paradigms (21CC) were further augmented with citizenship, global awareness, and interpersonal skills that trained children about "respect, responsibility, care, resilience, and harmony" among others (Ministry of Education Singapore, 2018, pp. 1, 7; Wei Li, 2013).

While Singapore has successfully bridged the disconnect between scholastic training and employability

through its industry-responsive educational agenda (Global Delivery Initiative, 2020), the Philippines is yet to hurdle the challenge as proven by the unemployability due to latent competencies. Besides the skills issue involving college graduates, we also see this predicament in the case of our senior high school finishers. Data show that 1.3 million senior high school (SHS) students graduated in 2018, and the figure was projected to be duplicated in 2019 (Nelz, 2018) and onwards. Despite the expanded curriculum courtesy of the K-12 program aimed at raising educational standards and boosting the chances of career placement, many SHS graduates cannot secure jobs (Pascual, 2019). Although lack of opportunities is one of the factors, the quality of education is seen as the major culprit, echoing the World Bank study. In short, there exists a disconnect between the classroom and the real world. Conversely, pedagogical goals are not being achieved since batches of grade 12 finishers from 2018 to 2021 could not pass the hiring process (Añago, 2021; Hernando-Malipot, 2018). We note, therefore, the inadequacy of The Enhanced Basic Education Act of 2013 which envisions “every graduate...[to be imbued with] creative and critical thinking, and the capacity and willingness to transform others and oneself” (“Republic Act No. 10533,” para. 4). The same law requires the inculcation of “essential competencies, skills and values for both life-long learning and employment” (para. 5). Aligning ourselves with such frameworks as the 4 C’s or critical thinking, communication, collaboration, and creativity (National Education Association, 2012; Trilling & Jossey-Bass, 2005) is one thing, but actual practice is quite another. Said differently, these educational ideals are yet to be fully implemented and realized.

Zeroing in on the Media and Information Literacy (MIL) curriculum in senior high school, we point to a tendency to highlight learning of concepts (Santos, 2019; Santos, 2020; see Pitagan, Adres, Plaza, Rotor, & Villanueva, 2016). Additionally, we have not come across any fully innovative strategies in whole person pedagogy that integrate metacognitive skills, at least in the teaching of media and technology. The absence of a responsive teaching paradigm reflects what Tan, Choo, Kang, and Liem (2017) call as a “knowledge gap” (p. 427). The growing demand for new pedagogical frameworks that can form competent and well-rounded graduates is not novel at all as pointed out in the preceding paragraphs. It is, and has been, a perennial problem which deserves a more careful thought and study. Thus, we pursued this study in response to this great need. We endeavored to determine the efficacy of our proposed curriculum, first tested in the academic year, 2018-2019 and 2019-2020, that intends to develop cognitive and metacognitive skills among Junior College students enrolled in a media and technology course.

1.1 Media and Information Literacy Curriculum Revision and Experiment in the Past

Cognizant of the need for holistic formation (McSweeney, 2015), an experiment on a new approach in the teaching of MIL was conducted in the academic year 2018-2019. The skills-based strategy resulted from a review of the government-endorsed core curriculum which emphasized the development of cognitive skills while putting the non-cognitive competencies in the back burner (Santos, 2020). It was argued then that a revitalized course that is responsive to the times was a matter of necessity. The same problem entailed more than just transmission of knowledge but of pertinent skills that would make learners employment- and future-ready (Kwek, Hung, Koh, & Tan, 2017; Tan Choo, Kang, & Liem, 2017; Tan, Koh, Chan, Costes-Onishi, & Hung, 2017). Given the limitations of the prescribed curriculum, its scope and intended learning outcomes were revised, augmented, and replaced with outputs that addressed the imbalance between cognitive objectives and socioemotional skills. Subsequently, the new MIL model was used during the school year 2019-2020. With the implementation of the revised instructional plan, a follow up research was recommended. As initially proposed in the exploratory 2019-2020 study, the current research is pushing for the overhaul of the MIL curriculum at an institutional or national level. Additionally, we are convinced that the present study could provide data regarding cognitive and socioemotional skills development in a Covid-19 pandemic scenario. As schools respond to globalization, digitalization, and other societal factors, there is a need to evaluate instructional efforts or methods, determine their effectiveness, and consider new pedagogical approaches that are more relevant to the learners and their future careers.

In the second semester of academic year 2020-2021, the 11 projects used in the preliminary study were

maintained, but the number was reduced to nine in the present study. These are group presentations (a simple research on the media and technology use of others), LMS-based tests (quizzes and major exams), media fasting and reflection (reduction of media use), text analysis (ascertaining the validity and reliability of the material), audio production (podcast), history interview with paper (the role of media in local history over the years), visual design (poster, invitation, and brochure), responsible media/gadgets use (a test of students' ability to practice self-regulation in their use of media and gadgets), and digital design portfolio (a collection of articles and featuring visual design) (see Santos, 2019; Santos, 2020). It is our belief that these tasks are aligned with our proposition to build cognitive and metacognitive abilities, which we collectively refer to as T-shaped skills.

1.2 T-Shaped Thinkers and the T-Shaped Pedagogical Paradigm

The genesis of the T-shaped paradigm may be traced to a study on scientists turning managers that Johnston conducted in 1978 (Conley, Foley, Gorman, Denham, & Coleman, 2017). The model envisioned the ideal professional as someone who is able to apply their expertise across different situations (broad skills) and possess functional disciplinary skills that are concentrated on their chosen field (deep skills) (Conley et al., 2017). The concept gained more prominence recently among information and technology (IT) schools particularly in America such as Georgia Institute of Technology (GeorgiaTech). Getting inspirations from Johnston, higher education institutions (HEIs) saw a shift toward a teaching paradigm in science, technology, engineering, and mathematics (STEM) as well as other allied and non-allied courses by championing the T-shaped approach, with cognitive, interpersonal, and intrapersonal skills development as the goal of education (GeorgiaTech, 2019). Ultimately, it is meant to ensure that HEIs produce graduates who are adept in their fields and can navigate into other spheres of expertise (Reeves, 2014). This strategy eventually evolved into a whole person schema, this time attempting to humanize STEM curricula by emphasizing the nurture of both the mind and the heart (Kwek, Tan, Loh, & Sim, 2017). T-shaped thinkers are deemed multi-disciplinarians who can function and thrive in other professional fields such as in the area of language use and/or communication. The same model also suggests a person's flexibility and other internal attributes crucial in collaboration and other workplace demands. Through the years, the paradigm was further refined to encompass not only the ability to collaborate with those coming from different educational and business perspectives but also to include social (or people) and interpersonal skills.

The T-shaped model in education represents three categories: cognitive, interpersonal, and intrapersonal skills. The first category refers to knowledge and technical skills teaching and learning while the second group deals with interpersonal and workplace communication. The last cluster represents internal attributes that need to be cultivated, at least initially, through classroom instruction. The cognitive-interpersonal-intrapersonal taxonomy is attributed to Nehring, Charner-Laird, and Szczesiul (2017) who posited that these three skillsets must characterize a whole person education. Georgia Tech (2019) describes their whole person educational framework—also relying on the taxonomy of Nehring and colleagues—as the T-shaped model, which we adopted in this study. The GeorgiaTech schema provides 13 cognitive skills which are summed up in this paper into three: problem-solving, critical thinking, and creativity. We define problem-solving as the ability to identify challenges and finding possible solutions to address them. Critical thinking is being the analytical or evaluative and includes the ability to deduce content and implications. Creativity here does not only refer to the artistic milieu but also to the ability to translate certain content into something concrete. The real test, therefore, is whether the learners can produce something tangible such as text as well as visual, audio-visual, and multi-media products.

Under the interpersonal category, 16 skills are listed, but they are reduced into three in this research: communications, leadership, and teamwork. Three skills were also adopted but interpersonal communication was used instead. We characterize interpersonal communication as the confidence and facility in interactive situations in addition to clarity in the transfer of information. Leadership is defined in this paper as the natural talent to move or mobilize others. Finally, teamwork, as far as we are concerned, reveals one's capacity to collaborate with others in various contexts borne out of an intent to prioritize the welfare and betterment of the team.

Georgia Tech lists 19 skills under the intrapersonal domain and are summarized into five: adaptability, initiative, discipline, ethics, and persistence. Out of these inward characteristics, three skills were adopted in this research: persistence, responsibility, and moral judgment. We consider the first as referring to consistency and the ability to endure especially in academic rigors and is synonymous with hard work. Responsibility is expanded to mean discipline and initiative. It involves formulation and completion of ideas and overcoming obstacles in the process. Ethics is replaced with moral judgment, which to us encompasses honesty, integrity, service, citizenship, and the like.

To help Filipino students and would-be graduates to be ready for work and the world, the preceding sections hint at the building up of T-shaped skills, and this trajectory can commence early, if not in the elementary stage, it can be considered in the SHS level. In making this a possibility, we feel that a project-based approach in teaching T-shaped skills would be a helpful strategy.

1.2.1 Locating Project-Based Method in Online Learning within the T-Shaped Approach

The onset of the pandemic in early 2020 disrupted schooling with the restrictions on physical activities such as the conduct of in-person classes. New alternatives that are based on technology became the default models called distance learning, which uses various technological tools that provide a substitute to face-to-face arrangements (Greenberg, 1998; Teaster & Bliezner, 1999). There are two types of distance learning—synchronous and asynchronous—the former referring to an academic set-up where interaction is conducted real-time while the latter referring to a learning environment where instructional materials are accessed outside the scheduled sessions (Simon, 2021). Advantages of such mode of delivery include enhancement of the learner’s flexibility, adaptability, and accessibility as well as savings in time and money. Disadvantages include constrained interaction and limited opportunity for immediate feedback. To address these limitations, various approaches are adopted by educators across the world via the use of the project-based approach, a scheme that “trains students in finding practical solutions to specific problems”, mirroring the three areas being developed in T-shaped education (Nurhayati, Rizaldi, & Fatimah, 2021, p. 48). Under this system, the teacher’s role is to facilitate while the students employ high-level skills in accomplishing the requirements set. Adoption of this strategy has been proven effective. In Indonesia, for instance, researchers found that the application of project-based teaching, which consisted of planning, action, observations, and reflections, brought fun and meaningful learning experience, among other findings (Nurhayati et al., 2021). In an experiment employing this approach in Biology instruction for teachers, similar conclusions were reached (Yustina, Syafii, & Vebrianto, 2021). Findings revealed that the creative skills of the teachers who learned through the project-based style were more effective in the execution of their roles as educators compared to others who did not go through the same approach.

Project-based learning can be driven by technology, and social media significantly enhances the “reflective-evaluative, collaborative, and searching-creative” skills of the students, according to Bilotserkovetz, Fomenko, Gubina, Klochkova, Lytvynko, et al. (2021, p. 251). The three skill domains that they examined were also reflective of the three T-shaped skill clusters of cognitive, interpersonal, and intrapersonal competencies. Their case study shows that project-based learning can strengthen the T-shaped skills of students. The reason for the parallelism between the T-shaped schema and the project-based learning lies in the very design of the latter. The projects serve as vehicles for learning concepts and development of skills including the T-shaped abilities. In this approach, higher-order thinking skills are needed as students learn to collaborate, engage in a variety of communication, and solve problems (Buck Institute for Education, n.d.). Project-based learning has seven key design elements: (1) challenging problem or question, (2) sustained inquiry, (3) authenticity, (4) student voice and choice, (5) reflection, (6) critique and revision, and (7) public product. All these elements tap at least one or a combination of the three T-shaped skills, as shown in table 1.

Table 1*The Project-Based Learning Design Elements and T-Shaped Skills*

Elements	T-shaped Skills
Challenging problems or questions	Cognitive and Intrapersonal skills
Sustained Inquiry	Cognitive and intrapersonal skills
Authenticity	Intrapersonal skill
Student Voice and Choice	Intrapersonal skill
Reflection	Intrapersonal skill
Critique and Revision	Cognitive, Interpersonal, and Intrapersonal skills
Public Product	Cognitive and Interpersonal skills

Experts believe that any 21CC approach—and that includes our proposed T-shaped model—is viewed as more effective in the context of task-based teaching which we highlight in this study. Herman, Dinicola, Armentrout, and Ross (2019) argue that students learn best in a “project-based learning” environment particularly in transmitting 21CC skills (p. 3).

2. Research Questions

This study determined the impact of the teaching of T-shaped skills in MIL curriculum using project-based approach, delivered in an online context. The specific questions are:

1. To what extent did the respondents develop cognitive, interpersonal, and intrapersonal skills in the completion of nine media and technology projects based on their survey responses?
2. To what extent did the respondents develop cognitive, interpersonal, and intrapersonal skills in the completion of nine media and technology projects based on the online interviews?
3. Are there are significant differences among the average cognitive scores, average interpersonal scores, and average intrapersonal scores?

3. Materials and Methods

This study employed a mixed methods approach. The “synergistic” characteristic of the quantitative-qualitative hybrid is considered more effective because it promises “a fuller understanding of the research problem” or “complementarity” (Hesse-Biber, 2017, p.275). This “convergence” also makes the investigation more credible (p. 275). Participants were all the Junior College (Grade 11) students from four MIL sections (n=113) from the University of Asia and the Pacific located in Ortigas Center, Pasig City. Respondents were surveyed during the second semester of 2020-2021 amidst the pandemic to determine the manifestations of cognitive and metacognitive skills. The non-probability sampling (purposive or judgmental sampling) was utilized. The goals of the experiment were explained to the students, and participation was voluntary. To ensure that ethical standards were observed, participants were requested to sign an informed consent form, detailing among others the protection of their privacy and identity. In addition, respondents were assured that they could opt to discontinue their participation by informing the researchers. According to Ferguson, Yonge, and Myrick (2004), educators may conduct research involving their students in cases that are considered “essential... as in issues of program evaluation or pedagogy” (p. 64). In this study, we used “generic descriptors” to protect confidentiality (p. 65). Finally, we ensured that so-called “power inequities” between the students and the faculty did not come into the picture, again, by making participation voluntary and refraining from giving any incentives (p. 56).

Instruments used were a survey questionnaire and a set of interview questions. To assess the effectiveness of each activity in building the T-shaped skills, we designed a self-assessment post-activity questionnaires using Google Forms survey. The questionnaires were pilot tested days before the conduct of the first survey to determine their validity. The interview questions were also validated by students of the same age and level.

Responses from pilot tests confirmed the validity and reliability of the instruments.

The 5-point Likert scale survey asked participants to rate how the given statements testing their acquisition of skills applied to them. The 1-point rating represents the lowest applicability (“Strongly Disagree”) and the 5-point rating represents the highest applicability (“Strongly Agree”). To complement the survey results, we interviewed pre-selected participants consisting of five (5) students who performed excellently and five (5) others who scored low on Canvas (those with INC or 3.00 grade or who required remediation). Interview forms were sent via email and responses were received also via email. We then analyzed the students’ self-assessment of their cognitive and socioemotional skills. The ratings assigned for the statements were grouped in accordance with the skills cluster where the competencies belong to. Similarly, the scores were grouped according to the three T-shaped abilities: cognitive, interpersonal, and intrapersonal skills. From these, average scores were obtained per student: the average cognitive score, the average interpersonal score, and the average intrapersonal score. Note that not all the activities utilized the three T-shaped skills because of the nature of the tasks some of which did not require all of the competencies to be tested. The table below lists the outputs by the number of T-shaped skills employed.

Table 2

The Activities and the Number of T-Shaped Skills Used

Number of T-shaped Skills Used	Activity
1	<i>LMS-based Tests</i> : quizzes and major examinations
2	<i>Media Fasting and Reflection Paper</i> : refraining from media and gadgets use for a period of time, reading of a text, and reflecting on it and the media fast
2	<i>Responsible Use of Media</i> : a self-assessment rating regarding one’s regulation of their media and gadgets use
2	<i>Text Analysis</i> : critiquing of a text using a given set of criteria in analyzing placement of text and the psychology behind it
2	<i>Visual Information Design</i> : designing of a poster or brochure applying design elements and principles
3	<i>Group Presentations</i> : (a) profiling of students concerning their media consumption, creating a presentation, and sharing the same in class, and (b) reading on an assigned topic, making a presentation, and sharing it to the class
3	<i>Audio Production (Podcast)</i> : recording of voice, editing it, and mixing it with other elements such as music, sound effects, and audio effects
3	<i>Interview and Reflection Paper</i> : interview with a media or history teacher on the function of the press during critical periods in Philippine history, and writing of the findings
3	<i>Digital Design Portfolio</i> : a collection of most of the outputs, put together as a magazine-type multi-modal material in digital format as a culminating activity

To assess these average scores, we introduced an index scoring mechanism, a modified version of the Likert Scale wherein the scores were transformed as continuous values. We find such a scoring mechanism advantageous because it can take into account the decimal values that will arise once the Likert Scale scores were averaged. Table 3 shows the scoring mechanism, outlining the range of average scores and their corresponding levels in terms of skills acquisition.

Table 3*The Likert Scale Score Ranges and Interpretations*

Index Value	Interpretation
0.00 – 0.99	Very Low
1.00 – 1.99	Low
2.00 – 2.99	Moderate
3.00 – 3.99	High
4.00 – 5.00	Very High

For tasks that involved one T-shaped skill, the average score was calculated and interpreted accordingly using the interpretations in Table 3. For activities that involved two or all the T-shaped skills, their average scores per skill were calculated and were compared to each other to detect any significant differences using the single-factor analysis of variance (ANOVA). The following hypothesis was tested.

Null Hypothesis (Ho): There are no significant differences among the average cognitive score, average interpersonal score, and average intrapersonal score.

Alternative Hypothesis (HA): There are significant differences among the average cognitive score, average interpersonal score, and average intrapersonal score.

In performing the statistical test, the default 95% confidence level was chosen. Under this confidence level, if the p-value calculated is more than 0.05, then the null hypothesis must be accepted. Otherwise, if the p-value is less than 0.05, the alternative hypothesis shall be taken.

Regarding the interview, questions revolved around the three skills. Respondents were asked how their media class equipped them with the three skillsets. They were also asked to share narratives about remarkable experiences they had in any of the activities. Interview results were analyzed using in-depth textual analysis and used the same for triangulation. To detect any recurring patterns, we also utilized qualitative analysis software.

4. Findings and Discussion

The survey was disseminated to all the four classes that took the course during the first and second semester: sections 1, 2, 3, and 4, totaling 113 students. All of them took part in the survey, representing a 100% overall response rate, which was calculated by obtaining the percentage of those who had responded to the population of a given section. Table 4 shows the breakdown of the number of respondents and the response rate by section.

Table 4*Number of Respondents and Response Rate by Section*

Section	Class Population	Number of Respondents	Response Rate (in %)
1	32	32	100.0
2	29	29	100.0
3	28	28	100.0
4	24	24	100.0
Total	113	113	100.0

A look at the activities involving one T-shaped skill will tell that the average score of the cognitive skill in the assessments is 4.32. This is a very high value, indicating acquisition of cognitive skills during the assessments. The standard deviation, which represents how far the data is spread out from the average, is 0.08. This means that the Likert ratings given for each question are not so dispersed among themselves. (See the average rating for tests in Table 5).

Table 5
T-shaped Skill's Average Likert Score and Index Interpretation for Tests

T-shaped Skill	Average Score	Index Interpretation
Cognitive	4.27	Very High

Activities involving two T-shaped skills received a *very high* rating, with averages exceeding 4, indicating high performance in the skills tested. All the activities did not test significantly in the ANOVA single-factor analysis, recording p-values of more than 0.05. The results suggest that all the activities equally engaged and capacitated the two T-shaped skills concerned. Table 6 shows the significance tests for the activities with two T-shaped skills.

Table 6
ANOVA Single-Factor Test for the Activities Involving Two T-shaped Skills

Activity	Ave. Cognitive Score	Ave. Interpersonal Score	Ave. Intrapersonal Score	F-Statistic	P-value	Significant?
Media fasting and Reflection Paper	4.08	n/a	4.26	3.29	0.071	Not Significant
Text Analysis	4.47	n/a	4.51	0.12	0.736	Not Significant
Visual Information Design	4.57	n/a	4.47	2.55	0.112	Not Significant
Responsible Media Use	n/a	4.65	4.75	1.61	0.202	Not Significant

* $p < 0.05$

Among the projects that involve all the T-shaped skills, the three competencies received *very high* rating, suggesting that the students performed excellently in all the areas tested. However, not all tasks have the same impact across all the skills. Among the four projects, half tested significantly in the ANOVA single-factor analysis: (1) audio production and (2) interview and reflection. This means that these two tasks created an unequal, different impact in at least one of the T-shaped skills.

An analysis of the skill averages of the two activities showed that certain outlier averages account for the significant result. For instance, in audio production, the average for intrapersonal skill (4.50) is significantly lower compared to the cognitive and interpersonal skills (4.70 and 4.74, respectively) which are clustered to each other. The disparity indicates that in this assignment, the intrapersonal skill lagged behind the other two T-skills, an area for improvement. Meanwhile, in the interview and reflection activity, cognitive skills recorded a significantly higher average score compared to intrapersonal and interpersonal skills, indicating that much concentration may have been exerted on the development of cognitive skills. Table 7 shows the single-factor ANOVA significance tests for the activities with three skills.

Table 7
ANOVA Single-Factor Test for the Activities Involving All T-Shaped Skills

Activity	Ave. Cognitive Score	Ave. Interpersonal Score	Ave. Intrapersonal Score	F-Statistic	P-value	Significant?
Group Presentations	4.62	4.57	4.49	2.17	0.115	Not Significant
Audio Production	4.70	4.74	4.50	10.91	0.000*	Significant
Interview and Reflection Paper	4.36	4.15	4.25	3.15	0.004*	Significant
Digital Design Portfolio	4.63	4.60	4.66	0.336	0.715	Not Significant

* $p < 0.05$

4.1 Interview Results

Student interviewees (SI-1 to SI-10) were in consensus that the class boosted their cognitive abilities. For instance, SI-3 found the reflection papers to be helpful in logically constructing her ideas. Further, the instructions in the assessments of choosing not just the right, but the best answer induced her to be more critical in assessing information. Meanwhile, SI-6 said her cognitive skills were enhanced by reading the required articles and reciting during class discussions. One of the most cited activities is the history interview and reflection. SI-4 explained:

“The interview paper definitely [involved] critical thinking because I had to strategize how to phrase my questions...to obtain the proper information I needed for the paper itself. Moreover, I had to synthesize the ideas I got from the interview and [the movie] The Post.”

SI-6 and SI-2 also highlight the development of cognitive abilities, the latter stressing that the activity led her to do in-depth research. Responses confirm the substantially high average cognitive skills score recorded for the history interview paper. While the feedback is highly positive, it is still essential that the other T-shaped skills equally improve alongside the cognitive skills. After all, the main objective is to engage and develop as many of the said skills as possible in each of the class’s activities.

Regarding interpersonal skills, the interviewees believed the activities fostered interactions and collaborations. For SI-3, the group activities allowed her “to get to know my classmates further and build a connection”. The tasks also taught several lessons. SI-2 learned “open-mindedness [and] respect” to her classmates who were struggling to cope with the course’s requirements and the pandemic. Another student, SI-1, when assigned to lead half of her class in a project, learned to “organize and divide work”. Perhaps the most striking story of how the media and technology course helped in enhancing the students’ interpersonal skills is the one shared by SI-5. He narrated:

“The activity wherein I was able to truly test my skills in interacting with other people was the audio recording, because I was partnered with a person who had conflicting interests with me and [kept] on indirectly and unintentionally insulting me. Though I [was] always frustrated with this person, I was able to learn how to be tolerant, patient, and understanding with him.”

On the question of how intrapersonal skills were capacitated, the most common answer was that the group presentations and discussions boosted self-confidence. One student, SI-7, realized “that being shy and scared will not bring you anywhere”. To some, like SI-3, the heavy workload and tight deadlines forced her to be responsible and persistent. Similarly, the requirements taught SI-6 to manage her time. Still to others, the class activities pushed them to develop intrapersonal skills. SI-4 shared:

“I’m actually pretty shy and introverted but being put in a leadership position pushed me to get out of my comfort zone in order to serve others with my performance. This boosted my sense of responsibility and persistence because I felt that it was my duty to help my group mates and those around me.”

For SI-5, the course taught him to be resilient despite his adverse circumstances. He narrated:

“I’ve been struggling for so long to finish all my requirements in time ever since I recovered from Covid-19. Though I often [found] myself stuck and burnt out, I was, fortunately, able to keep on pushing myself to break boundaries and be better. In the end, the class [taught] me to be persistent, passionate, and confident with all my outputs.”

4.2 Analysis of Survey Data and Interview Results

By juxtaposing the survey and interview data, we observed two critical points: (1) across all activities, the

three T-shaped skills were developed or enhanced significantly, and (2) among the projects that involved two or more competencies, all except two achieved equal levels of positive impact in all the skills. This empirical evidence is a welcome development for they all indicate that overall, the activities and requirements in the current MIL curriculum are succeeding in reinforcing the cognitive and socioemotional skills, thus, effectively validating the findings of the 2019 action research. However, certain aspects of the curriculum need to be re-evaluated further. As revealed by the study, some of the activities heavily affected one T-shaped skill over the others, particularly the cognitive domain although this is not a problem. The rationale is to attempt to develop the three skills equally, if possible. Based on the foregoing, further adjustments may be necessary to attain the approximately equal development of all the T-shaped skills in each experimented activity. Nonetheless, a T-shaped model (see Figure 1) is proposed so that the MIL course, and hopefully STEM and humanities subjects help produce multi-disciplinary, employable, and future-ready graduates.

4.3 The T-Shaped Model in Teaching

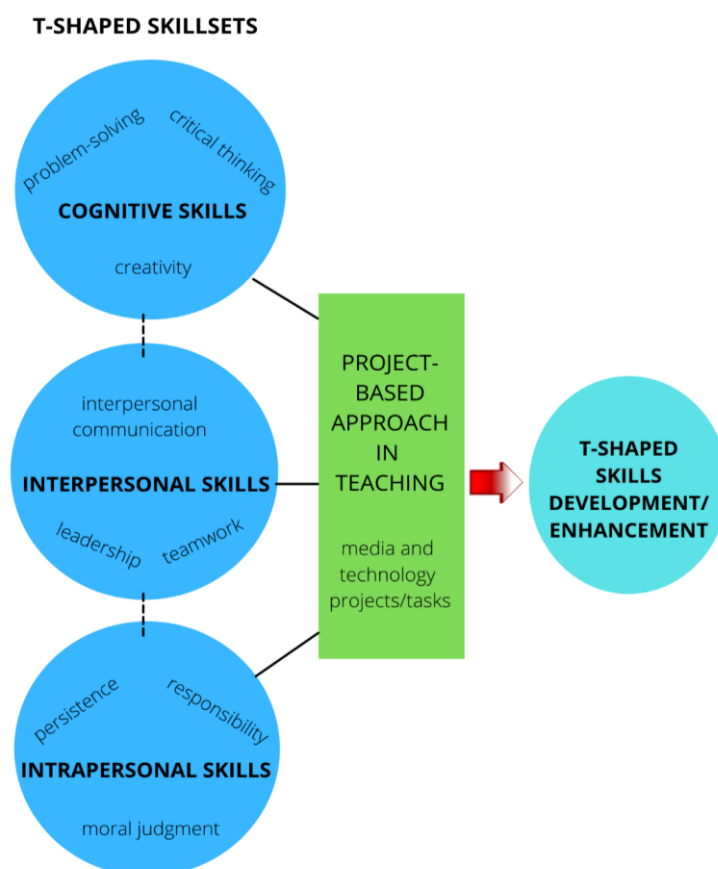


Figure 1. T-shaped Model in the teaching of science, technology, engineering, and mathematics

The T-shaped model, as discussed in the previous sections, captures the integration of three skillsets, namely cognitive, interpersonal, and intrapersonal skills. These skills are supposed to be reflected in the curriculum particularly in the learning objectives, assessments, and other outputs. The ultimate goal is the enhancement of T-shaped skills. See Figure 1 above.

As highlighted in this research, experts coming from various fields such as business and education emphasize the need to cultivate not just cognitive and technical skills, but also socioemotional skills which were divided into two: (a) interpersonal and (b) intrapersonal competencies. To iterate, according to World Bank researchers, the interpersonal and intrapersonal skills have overtaken the cognitive domain when it comes to skills being sought by employers (see Acosta et al., 2015). As also found in a preliminary study (see Santos,

2020), we underscore the need for the adoption of a 21st century pedagogical model such as our T-shaped schema in senior high school, and hopefully, the same framework is utilized in higher education. Note that the use of this model in an online set-up was accidental. In the original plan, the study was intended for students in a physical classroom set-up. However, because of the Covid-19 pandemic and some logistical limitations, a remote delivery was necessitated. In short, we would like to stress that this model, having been used in face-to-face learning from 2018 to 2019 and in an online delivery in 2020 and 2021, is a flexible approach. Ultimately, we stress that it can be adapted by educators and be used in all levels and in non-STEM courses whether in an in-person arrangement or online class.

As the illustration indicates, T-shaped teaching and learning is guided by the overarching idea of cultivating three skillsets. These skills are taught using a project-based approach where the teacher facilitates in the execution of outputs without neglecting knowledge transfer. The eleven projects, nine of which became the focus of the current study, are outputs that test the skills development of students within the scope of the course or key areas as proposed by the government. These, however, could be tweaked or revised depending on the context of the institution. In UA&P, we used a learning management system, something that may not be available in some schools. Alternatives may be considered such as Google Forms and other online platforms. The idea behind these tasks is learning and demonstrating of skills.

5. Conclusion and Recommendation

A key educational principle of the University of Asia and the Pacific (2020) is “the integral formation of the human person, the fullest development of everything human in the individual” (para. 1). Our response and contribution were a unique pedagogical strategy designed to meet the needs and expectations of 21st-century learners who require more than knowledge acquisition but also socioemotional skills. The T-shaped approach was designed from the examination of 21CC-based formulations and our background in media and certain areas in STEM. The result was a project-based method that resulted in the development of T-shaped skills. The efficacy of this innovation was further corroborated by the results of the post-instruction survey. There are three implications. First, educators can and must be proactive in determining the needs of their learners. Second, multiple skills (T-shaped skills) can be developed simultaneously while students are absorbing knowledge. Third, to achieve the first two, educators must constantly review not only content but also delivery and strategy. This ensures student-centered, responsive, and effective pedagogy whether in in-person or online context. The intentional integration of T-shaped skills is recommended in the crafting of a media and technology curriculum nationwide. Further, it could be adopted in other subjects as a foundational reference for similar whole-person curricula in the country and beyond. A study involving a bigger number of students and representing a greater number of courses could provide more conclusive findings regarding the effectiveness of a T-shaped curriculum. An experiment using control and non-control groups, the first being immersed into the T-shaped model and the latter in a non-T-shaped approach, is recommended.

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