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TPACK IN PHILIPPINE STEAM EDUCATION

STEAM EDUCATORS PROFESSIONAL DEVELOPMENT

CHAPTER 6

CHAPTER 6

ABSTRACT

CHAPTER 6
STEAM Educators Professional Development

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If educators wish to continuously excel in the art and science of teaching, they need to undergo professional development to constantly upgrade their professional knowledge, skills, competence and effectiveness. As defined, professional development refers to many types of educational experiences or specialized activity designed for educators to improve and update knowledge, skills, and competence related to the practice of teaching. In this component of the entire STEAM program, sampled Philippine Higher STEAM educators experienced being capacitated in a variety of ways. Training orientation and workshop brought them concomitant, practical experiences of working with other STEAM educators to craft their Lesson Exemplars in their respective disciplines anchored on the details of the Philippine STEAM Education Model.

This activity simulates knowledge generation, where each STEAM educator crafted a specialized flow of enacting a particular STEAM discipline. Knowledge sharing began in the National Forum on STEAM education, where all STEAM educators (core researchers and participants) shared their generated knowledge on these topics: Philippine STEAM education models, Proficiency Indicators and scoring system, designing lesson exemplars, Philippine STEAM educators proficiency, and documentations of the conduct of lesson exemplars.

Keywords: capacity building, forum, Lesson Exemplar, STEAM education

6.1. Capacity Building Program

In contributing to a strong human capital, the Capability Building Program (CBP) of the CHED-funded project/program titled, Technological Pedagogical Content Knowledge (TPACK) in Philippine STEAM (Science, Technology, Engineering, Agri/Fisheries and Mathematics) Education generally aimed to enhance Philippine Higher Education STEAM Educators skill on the teaching and learning domains (pedagogy, assessment and technology integration). Specifically, the CBP is designed to: 1) inform PHE STEAM teachers of general level of STEAM teaching proficiency of the PHE STEAM educators, 2) acquaint PHE STEAM Educators with Philippine TPACK model generated from the CHED-funded research titled, TPACK in Philippine STEAM Education, 3) appraise PHE STEAM Educators with emerging models for Philippine STEAM Education such as Pedagogical Model, Assessment Framework, and Technology Integration Model, 4) enable PHE STEAM Educators to overcome areas of weaknesses, as informed by the general STEAM teaching proficiency level of tertiary teachers, 5) facilitate the development of Lesson Exemplars to exemplify utilization of the models and TPACK framework in Philippine STEAM Education, and 6) provide venue for PHE STEAM teachers and professionals to work together and share their knowledge in teaching approaches and researches that could contribute to quality STEAM education in the country.

The three-day training and workshops highlighted three major events. Day one of the entire training program focused on knowledge sharing of the validated and emerging STEAM Education Models (Pedagogical Model, Assessment Model, Technology Integration Model, and Philippine STEAM Education Model). The second tier validation was also conducted on this day to further polish the presented models. Queries and discussions were featured activities for the first day, just as consolidated comments and suggestions on the validated models informed revisions done soon after. Furthermore, the presentation of the models stressed the research process of the development. This section of the training informed the participants of the general proficiency of STEAM educators, which also identified areas of weaknesses in terms of the TPACK framework. Day 2 of the training program started with a recap of the first day, and oriented participants in discussing the Lesson Exemplar. The organizing team clustered the participants according to their respective STEAM disciplines. Each cluster (Physical Science, Biological Science with Agri/Fisheries, Technology and Engineering, Mathematics), facilitated by the members of the TPACK team, formed groups of five wherein each group developed a Lesson Exemplar on one topic in their respective disciplines. Peer review succeeded the development of the Lesson Exemplar. After two rounds of peer review, the groups revised their lessons, based on the comments and suggestions in the two rounds of peer review. Day 2 ended with decisions and consensus from each cluster, as to which among their Lesson Exemplars would be presented on the third day of the training. Day 3 recapped the second day, presented and critiqued the Lesson Exemplars per cluster. Cluster representatives presented their respective Lesson Exemplars, subjected to panel interview for comments and suggestions on how to further improve their lesson in line with the PHS STEAM model.

Finally, the research team (TPACK) acknowledged the efforts of all the participants in the closing program. It was graced by no less than the Vice President for Research and Quality Assurance of the Lead Institution. Participants shared their impressions on the CPB expressing positive and inspiring comments on their considerable satisfaction for updates in the teaching and learning of STEAM disciplines to help them "become Teachers 4.0 to train the Generation z learners and help craft 21st century-skilled learners, innovative STEAM professionals, and productive Filipino citizens."

6.1.1. Training Design and Implementation

The Capacity Building Program (CBP) featured plenary presentations of the frameworks and models generated for the CHED-funded research titled, *TPACK in Philippine STEAM Education*. Primarily, the CBP acquainted the pre-selected tertiary STEAM teachers on the four major frameworks and models (Philippine TPACK framework, Pedagogical Model for Philippine Higher Education (PHE) STEAM, Assessment Framework for PHE STEAM, and Technology Integration Model for PHE STEAM) crafted as their paradigm and guide in the design of STEAM lessons. Design of lesson exemplars were the focus product of the training program.

6.1.1.a. Objectives of the Capability Building Program

The Capacity Building Program (CBP) is designed to:

1. Inform PHE STEAM teachers of the general level of STEAM teaching proficiency of the PHE STEAM educators.
2. Acquaint PHE STEAM Educators with the Philippine TPACK models generated from the CHED-funded research, *TPACK in Philippine STEAM Educatio*n.
3. Appraise PHE STEAM Educators with the emerging models for Philippine STEAM Education such as Pedagogical Model, Assessment Framework, Technology Integration Model, and Philippine STEAM Education Model.
4. Help PHE STEAM Educators overcome flawed areas, as informed by the general STEAM teaching proficiency level of tertiary teachers.
5. Facilitate the development of Lesson Exemplars to exemplify the utilization of the models, TPACK framework, and the Philippine STEAM Education Model in Philippine STEAM Education.
6. Serve as a venue for PHE STEAM teachers and professionals to work together and share their knowledge in teaching approaches and researches that could contribute to quality STEAM education in the Philippines.

6.1.1.b. The Program of Activities

The activities of the CBP program followed a sequence of providing the participants with the general principles and concepts in Philippine STEAM Education through the presentation of

all the generated models. In succeeding parts, Lesson Exemplars concretized the Philippine STEAM Education Model. Consequently, the participants developed their Lesson Exemplars in their respective clusters following the guideline set by the core team adhering to all the principles of the presented models. These crafted Lesson Exemplars underwent two rounds of peer review and revisions before panel presentation and critiquing.

Table 6.1. Day 1 Program of the Activities for the Capability Building Program

Time	Activities (March 19, 2019)
08:00 – 09:00 AM	Registration
09:00 – 10:00 AM	**Opening Program** Opening Remarks **Dr. Rosemarievic V. Diaz**, Vice President for Research, Planning and Quality Assurance Message **Dr. Maria Antoinette C. Montealegre**, PNU-OIC-President Orientation **Dr. Marie Paz E. Morales**, Principal Investigator
10:00-11:00 AM	**Technology Integration** **Prof. Ruel A Avilla**, Co-investigator Facilitator: **Roselle A. Laureano**
11:00-12:00 AM	**Assessment** **Dr. Celina P. Sarmiento**, Lead Researcher Facilitator: **Jonathan Diokno**
12:00-01:30 PM	**LUNCH BREAK**
01:30-02:30 PM	**Pedagogical Model** **Prof. Jovito C. Anito**, Lead Researcher Facilitator: **Milano O. Torres**
02:30-03:30 PM	**The Philippine STEAM Education Model** **Prof. Jovito C. Anito**, JRU Researcher Collaborator Facilitator: **Maribel D. Ganeb**

Table 6.2. Day 2 Program of the Activities for the Capability Building Program

Time	Activities (March 20, 2019)
08:00 – 10:00 AM	**Recap of the First Day** **Milano O. Torres**

	Features of the Lesson Exemplar **Dr. Ranzivelle Marianne L. Roxas-Villanueva**, UPLB Research Collaborator Facilitators: **Raquel A. Gonzales & Kristent Leo D. Tuscano**
10:00 – 12:00 AM	**Workshop on Lesson Exemplar** **Dr. Caesar P. Palisoc**, Lead Researcher ***GROUPS FOR BREAKOUT SESSIONS:*** **SCIENCE** **Dr. Caesar P. Palisoc**, Lead Researcher **Prof. Benilda R. Butron**, Lead Researcher Facilitator: **Maribel D. Ganeb** **TECHNOLOG AND ENGINEERING** **Prof. Kriztine R. Viray**, PUP Research Collaborator **Prof. Randy D. Sagun**, PUP Research Collaborator Facilitator: **Roselle A. Laureano** **AGRI-FISHERIES** **Dr Ranzivelle Marianne L. Roxas-Villaneuva**, UPLB Research Collaborator **Dr. Felixberto M. Mercado**, MSEUF Research Collaborator Facilitator: **Dennis B. Masangcay** **MATHEMATICS** **Dr. Celina P. Sarmiento**, Lead Researcher **Dr. Levi E. Elipane**, Lead Researcher Facilitator: **Jonathan P. Diokno**
12:00-01:00 PM	**LUNCH BREAK**
01:00-02:30	**Peer Review of Lesson Exemplar** **Dr. Celina P. Sarmiento**, Lead Researcher **Prof. Jovito C. Anito, Jr.,** JRU Research Collaborator Facilitator: **Milano O. Torres**
02:30-05:00 PM	**Workshop on Revision of Lesson Exemplar based on Peer Review** **Dr. Maricar S. Prudente**, DLSU Research Collaborator **Prof. Brando C. Palomar,** Lead Researcher Facilitator: **Raquel A. Gonzales**

Table 6.3. Day 3 Program of the Activities for Capability Building Program

Time	Activities (March 21, 2019)
08:00–11:00 AM	**Recap of the Second Day** **Raquel A. Gonzales** **Presentation & Critiquing** **Dr. Marie Paz E. Morales**, Principal Investigator

	Prof. Thaddeus Owen D. Ayuste, Lead Researcher **Dr. Felixberto M. Mercado**, MSEUF Research Collaborator **Dennis B. Masangcay**, PhD Graduate Student Facilitator: **Raquel A. Gonzales**
11:00–12:00 AM	**Closing Program** **Closing Remarks** **Dr. Rosemarievic V. Diaz**, Vice President for Research, Planning & Quality Assurance (VPRPQA) **Impression** **Distribution of Certificates**
12:00-01:00 PM	**LUNCH BREAK**
01:00-Onwards	**Business Meeting** **Core Research Team and Research Collaborators only**

6.1.2. Lesson Exemplars

6.1.2.a. Orientation to Lesson Exemplars

On March 19 to 21, 2019, the Philippine Normal University (PNU) core team organized and held the Capability Building Program for STEAM Education, projected to develop and produce Lesson Exemplars. The 132 invited participants included the a) field researchers/representatives, b) STEAM teachers that were observed and interviewed, and c) STEAM educator self-survey participants from the 26 visited higher education institutions. On March 20, 2019, the team's University of the Philippines Los Baños (UPLB) research collaborator introduced the features of the team's first draft of the lesson exemplar template and the corresponding rubric and peer review form (Appendix III and IV).

6.1.2.b. Development of Exemplars

The organizing team clustered the participants according to their STEAM disciplines. Each cluster (Physical Science, Biological Science with Agri/Fisheries, Technology and Engineering, Mathematics), facilitated by the members of the TPACK team, formed groups of five wherein each group developed a Lesson Exemplar, using the features of the first draft of lesson plan, on one topic in their respective discipline.

6.1.2.c. Validation of Lesson Exemplars

The validation of the Lesson Exemplar comes in two-tier: Peer Review and Panel Presentation.

Peer Review

Peer review followed the development of the Lesson Exemplar using the Peer-review form presented during the orientation session. After two rounds of peer review within the cluster, groups started their revisions based on the comments and suggestions in the two rounds of peer review, with each cluster deciding and agreeing which among their Lesson Exemplars would be presented in plenary.

Panel Presentation and Critiquing

Critiquing followed the plenary presentation of the Lesson Exemplars per cluster. After presenting their respective Lesson Exemplar, they were subjected to panel interview for comments and suggestions on how to further improve their lesson exemplars following the Philippine STEAM education model. The groups per cluster consolidated all comments based on peer reviews and panel critiquing for the revisions.

On the basis of the peer review, panel presentation and critiquing, an enhanced TPACK lesson plan template was produced and proposed to be used for the final version of the best Lesson Exemplars in each cluster.

Pilot Testing

The core team asked each of the chosen best Lesson Exemplar to test the plan in their respective classes and document, through video and audio recording, the delivery of the lesson and learner's response for presentation in the National Forum for STEAM in Higher Education held on April 25 and 26, 2019, at the Heritage Hotel, Manila.

6.1.3. Training Evaluation

Based on the evaluation of the participants of the Capability Building Program (Appendix V), the organizers received good to excellent equivalent numerical ratings in all aspects of the program (educational content, relevance to practice, questions and discussions, selection of topics). Plenary sessions, workshops, oral presentations, overall event, venue, registration process, administration before the program and organization during the program). The majority of the participants pointed out good assessment of the program. Also, they found the program to have helped achieve the intended purpose of informing them of the trends in STEAM

education and of enabling them to develop their own Lesson Exemplars. However, certain constraints such as ventilation, venue, and the limited time to craft the Lesson Exemplars had to be considered.

6.2. Knowledge Sharing: The National Forum for STEAM in Higher Education

A little knowledge that acts is worth infinitely more than much knowledge that is idle (Kahlil Gibran, 1931). The Lebanese poet's stance supports the need to utilize and apply in real life situations all knowledge created and generated through research to sustain research culture and tradition in the academe. In our knowledge-based society, higher education institutions have eventually evolved to serve as partners of industry, government, and the community in translating the rapid growth of data and technologies produced by research. In fact, a significant role of higher learning institutions in a knowledge-based society (where the growth of data and technologies are rapidly occurring) is the inevitable transition of knowledge generated by and created through research. Thus, the need to manage, collaborate, and disseminate the existing knowledge. Knowledge-sharing covers the range of activities to capture internal knowledge and promote its transfer to and its reuse by others (Trudell, 2006, p.27).

The two-day forum featured three major events. Day one of the entire Forum focused on knowledge sharing of the validated and emerging STEAM Education Models (Pedagogical Model, Assessment Model, Technology Integration Model, and Philippine STEAM Education Model) after the second-tier validation on March 19-21, 2019. The event was graced by the welcome remarks of the Vice President for Research, Planning and Quality Assurance of the Philippine Normal University and an inspirational and motivational message by the Lead University's Officer-in-Charge. Concretizing the theme: Modelling TPACK in STEAM Education, Cr. Custer Deocaris, the Direction of the Research Division of the Commission on Higher Education highlights Industrial Revolution 4.0 vis-à-vis Education 4.0. The organizers and the invited plenary speakers presented all the models in a research presentation format to disseminate knowledge created from the CHED-funded project on TPACK in Philippine STEAM Education.

Day 2 of the National Forum commenced with a recap of the first day, and the presentation of the Pedagogical Model. We culminated the first session of the day with a panel Q and A with the core research team. This session was followed by the presentation of all articles drawn and written from the entire study covering the first component of the research program, with the collaborating researchers and the core team members doing justice to their task. Day 2 also discussed the Best Lesson Exemplars and how the STEAM teachers implemented these exemplars in their respective STEAM classes in four STEAM clusters: Biology and Agri/Fisheries, Physical Sciences, Engineering and Technology and Mathematics. Finally,

some volunteer graduate students–beneficiaries of the research program–presented the emerging Graduate Mentoring Program to share their experiences in the course of the study.

6.2.1. Conference Design and Implementation

Inductive approach influenced the conference design to present and share all the knowledge generated from the CHED-funded research, *TPACK in Philippine STEAM Education*. The core team initiated all presentations of the generated Philippine STEAM Education in a research format to present the current condition of Philippine STEAM education in terms of overall aspect, technology integration, assessment and pedagogy. All presented visions and products link to the global bandwagon (Industrial Revolution 4.0) that dictates the new learning landscape known as Education 4.0, specifically for STEAM Education. These models include emerging versions to capture how the country envisions the Philippine STEAM Education in the technological era. Consequently, the presentation of Lesson Exemplars marked how STEAM educators concretize the generated Philippine STEAM Education Models in the field. They presented (in a research format presentation as well) the validation of the models through perfectly-designed lesson exemplars in the different STEAM fields. Lastly, the conference ended with the presentation of the emerging program of the project–The Graduate Mentoring Program–that initiated a design where graduate students actively joined a commissioned research for the apprenticeship.

Table 6.4. Day 1 Program of the Activities for the National Forum for STEAM in Higher Education

TIME	April 25, 2019 (Thursday)
08:00 – 09:00 AM	Registration
09:00 – 10:0AM	**Opening Program** • Prayer/Doxology • National Anthem **Welcome Remarks** **Dr. Rosemarievic V. Diaz** Vice President for Research, Planning and Quality Assurance **Message** **Dr. Maria Antoinette C. Montealegre** Officer-in-Charge, Office of the University President

10:00 – 11:00 AM	**Keynote Address:** **Dr. Custer C. Deocaris** Chief, Research Management Division, Commission on Higher Education (CHED) ***Facilitator*** **Dr. Levi E. Elipane** Lead Researcher, Philippine Normal University
11:00 – 12:00 PM	**STEAM Education:** **Dr. Maricar S. Prudente** Research Collaborator, De La Salle University-Manila ***Facilitator*** **Prof. Jovito C. Anito, Jr.** Research Collaborator, Jose Rizal University-Mandaluyong
12:00 – 01:00 PM	LUNCH
01:00 – 02:00 PM	**TPACK Framework (Validated and Emerging):** **Dr. Marie Paz E. Morales** Principal Investigator ***Facilitator*** **Dr. Celina P. Sarmiento** Lead Researcher, Philippine Normal University
02:00 – 03:00 PM	**Technology Integration Model:** **Prof. Ruel A. Avilla** Co-Investigator, Philippine Normal University ***Facilitator*** **Prof. Thaddeus Owen D. Ayuste** Lead Researcher , Philippine Normal University
03:00 – 03:30 PM	BREAK
03:00 – 04:00 PM	CASIO (Workshop)
04:00 – 05:00PM	**Assessment Model:** **Dr. Celina P. Sarmiento** Lead Researcher, Philippine Normal University ***Facilitator*** **Roselle A. Laureano** PhD Graduate Student, Philippine Normal University

Table 6.5. Day 2 Program of the Activities for the National Forum for STEAM in Higher Education

TIME	April 26, 2019 (Friday)

08:00 – 09:00 AM	**Pedagogical Model:** **Prof. Jovito C. Anito, Jr.** Research Collaborator, Jose Rizal University ***Facilitator*** **Milano O. Torres** PhD Graduate Student, Philippine Normal University
09:00 – 10:0 AM	**Proficiency Indicator (Articles 1 and 2):** **Dr. Emil C. Alcantara** Research Collaborator, Batangas State University **Dr. Caesar P. Palisoc** Lead Researcher, Philippine Normal University ***Facilitator*** **Jonathan P. Diokno** PhD Graduate Student, Philippine Normal University
10:00 – 10:30 AM	**STEAM Educators Proficiency (Article 3.a.):** Dr. Felixberto M. Mercado, Research Collaborator, Manuel S. Enverga University Foundation ***Facilitator*** **Kristent Leo D. Tuscano** PhD Graduate Student, Philippine Normal University
10:30 – 11:00 AM	**Overall Generation of Lesson Exemplar:** **Dr. Racidon P. Bernarte** Research Collaborator, Polytechnic University of the Philippines ***Facilitator*** **Prof. Randy D. Sagun** Research Collaborator, Polytechnic University of the Philippines
11:00 – 11:45 AM	**Lesson Exemplar 1: Science (Bio and Agri-Fisheries)** • **Lorelie S. Doblado**, Holy Trinity University • **Princess Janine A. Guillermo**, Holy Trinity University • **Rachel M. Itok**, Holy Trinity University • **Mildred P. Palon**, Holy Trinity University ***Facilitator*** **Prof. Thaddeus Owen D. Ayuste** Lead Researcher, Philippine Normal University
11:45 – 12:30PM	**Lesson Exemplar 2: Technology & Engineering** • **Lynda Christine V. Diaz**, Divine Word College of San Jose • **Ariel M. Lorenzo**, University of Saint Louis Tuguegarao • **Ginalyn B. Panghulan**, Polytechnic University of the Philippines Sto. Tomas • **Sander T. Sedano**, University of Saint Louis Tuguegarao ***Facilitator*** **Prof. Thaddeus Owen D. Ayuste** Lead Researcher, Philippine Normal University
12:30 – 01:30 PM	LUNCH

01:30 – 02:15 PM	**Lesson Exemplar 3: Science (Physics and Chemistry)** • **Jesica M. Marfil**, Iloilo State College of Fisheries • **Maria Krisvie Abigale F. Mendoza**, Bulacan Agricultural State College • **Dolores C. Mirabueno**, De La Salle College of Saint Benilde-Antipolo • **Melody Joy V. Mique**, Cordillera Career Development College • **Andy Nestor Ryan Pazon**, De La Salle College of Saint Benilde • **Marilou A. Yadao**,University of San Jose-Recoletos ***Facilitator*** **Prof. Brando C. Palomar** Lead Researcher, Philippine Normal University
02:15 – 03:00 PM	**Lesson Exemplar 4: Mathematics** • **Jeff J. Abanag**, Cordillera Career Development College • **Erovita Teresita B. Agustin**, University of Saint Louis Tuguegarao • **Jean D. Centina**, Davao del Norte State College • **Winnie Beth E. Clemente**, De La Salle University • **Melvin M. Crisostomo**, City University of Pasay • **Merlita C. Medallon**, Lyceum of the Philippines University Laguna ***Facilitator*** **Prof. Brando C. Palomar** Lead Researcher, Philippine Normal University
03:00 – 04:00 PM	**Graduate Mentoring:** **Raquel A. Gonzales** PhD Graduate Student, Philippine Normal University **Milano O. Torres** PhD Graduate Student, Philippine Normal University **Maribel D. Ganeb** PhD Graduate Student, Philippine Normal University
04:00 – 05:00 PM	**Closing Remarks:** **Prof. Ruel A. Avilla** Co-investigator

6.2.2 Presentation of Final Models

Model presentation followed the research presentation format. Each presenter focused on informing STEAM educators with all the major research protocols in developing each of the models. This phase includes coherence of each model development objectives with the corresponding data collection and analysis, and data presentation. Presenters also stressed the vitality and solid foundations of all data collection and analyses, in generating the models. Succeeding such process is the robust process of tiered validation to ensure a solid outcome for the intended Philippine STEAM Education Model(s). Figure 6.1 shows presentation modes of these generated Models.

Figure 6.1. The Presenters of the Final Models

6.2.3. Presentation of Model Lesson Exemplars

Similarly, the presentation of model Lesson Exemplar by purposively selected groups of STEAM educators followed the format of a research presentation. The model Lesson Exemplar presenters stressed how their group generated the model Lesson Exemplar as informed by the Philippine STEAM Education models. While they dedicated the attempt to concretize the variables, dimensions, and indicators of the Philippine STEAM Education, they also demonstrated a methodical aspect in the presentation where they narrated how they pilot tested or validated the developed exemplar for informed reflection and improvement seeking to share whatever knowledge they generated and to help the core research team to provide evidence of success for the developed and validated Philippine STEAM Education model.

Figure 6.2. The Presentation of the Lesson Exemplars

6.2.4. Forum Evaluation

Based on the evaluation of the participants of the National Forum, it received good to excellent equivalent numerical rating (see attached summary of evaluation results-*Appendix VI*) in all aspects of the program (educational content, relevance to practice, questions and discussions, selection of topics). Participants rated highly all plenary sessions, oral presentations, overall event, venue, registration process, administration before the program and organization during the program. In fact, the majority of the participants agreed and/or strongly agreed on the attainment of the all objectives of the National Forum (please see attached results-*Appendix VI*). A great number excellently assessed the National Forum that they planned attending the same forum in the future. They voiced out however, the need for some workshops to complement all plenary sessions and oral research presentations.

6.2.5. Future Directions

Anchoring from the responses on the evaluation form and feedback of the participants in the National Forum on STEAM Education, the following culled items provided the following themes which set the tones and aspirations for future directions of this project:

(1) Provide follow-up training programs on the implications of the STEAM Model. Most of the participants agreed on the significance of the STEAM Education Model as highlighted on the knowledge sharing they experienced on the two-day forum. However, they also recognized the essence of knowledge transfer of these models in their actual learning-teaching discourse. They suggested that participants with training programs focus on: (a) proper integration of technology in teaching STEAM courses (e.g. agri-fisheries and information technology); (b) design, development and utilization of lesson exemplars on specific STEAM courses; (c) mechanism on how the models address current issues and gaps on STEAM Education in the country; (d) promotion and interaction of STEAM disciplines and the community; and (e) processes and techniques in doing STEAM-related research undertakings. Participants also suggested that future trainings be more collaborative, hands-on and observe workshop format for them to be more participative and interactive with the speakers and with each other.

(2) Create collaboration projects and in-depth research undertakings on the quality of STEAM educators. This theme emerged as part of the participants' aspirations to establish collaboration among SUCs described as CHED's Center for Excellence (COE) and Center of Development (COD) on STEAM courses. These responses suggested learning the best pedagogies, technology integration and assessment practices from the aforesaid institution so as to enhance the quality of their local STEAM context. It also explained their vision of establishing linkages and partnerships with the COE and COD institutions. Besides, some participants aspired to conduct research undertakings focused on describing, measuring and developing the teaching proficiencies among STEAM educators, as well as on the current status of both validated and emerging PSE models with TPACK framework. They recognized the value of improving their teaching practices, more particularly on the use of updated and innovative technology applications in teaching STEAM courses and on the conduct of Participatory Action Research.

These concerns served as their response on the challenge of Education 4.0 and other drivers influencing the practices on STEAM education. And,

(3) Improve policies and guidelines on STEAM Education. The models presented in the Forum provided a better understanding on the different practices, processes and variables influencing the quality of STEAM education in the country. Thus, certain realizations on the need of enhancing the current guidelines of delivering STEAM courses by HEIs rose from the participants. These concerns covered the following items: (a) provision of new methodologies in delivering STEAM courses; (b) discussion the proficiency level of STEAM educators; (c) alignment and improvement of physical facilities together with online and offline technological tools used in realizing the objectives of STEAM disciplines; and (d) development of learning environment and practices that foster 21st century skills and research undertakings. These aspirations were considered incremental steps by the participants, as viewed from the institutional and national levels, gearing towards quality STEAM education.

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