

Appendix-Table 1

Processes and Protocols of TPDP (grounded on Participatory Action Research [PAR]) for teacher quality in Philippine STEAM Higher Education

Phases	Participants	Instrument	Data Collection	Data Analysis
Phase 1: TPDP Baseline Data	PAR-Group1	Tertiary standards of teaching, Classroom Observation protocol	<p>Planning: The processes to develop a model of how STEAM teachers in Philippines enact STEAM disciplines and how they envision to improve such</p> <p>Observing and Acting: Country-wide survey, observations and interviews</p> <p>Reflecting: On deduced and analyzed baseline data to develop the visual of how STEAM teachers enact STEAM disciplines and what do they foresee as a good model for STEAM education</p> <p>Discussing: How do the baseline data and the model help the marginalized STEAM teachers in terms of training in pedagogy, content, assessment, and technology integration.</p>	Qualitative analysis (software-aided coding)
Phase 2: TPDP Program Design	PAR-Group 1	Instructional design (TPDP”) program design), PSE model	<p>Planning: Planned the program design for the teacher professional development guided by the developed PSE model in phase 1</p> <p>Observing and Acting: Formalized the planned program design</p> <p>Reflecting and Discussing: Repeated critiquing and evaluating the program design by the members of the group until consensus</p>	
Phase 3: Lesson Exemplar Development through Capability Building Program	PAR-Group 1 PAR-Group 2	Lesson Exemplar, instructional guide and template, Rubric, Lesson Exemplar Peer Review form	<p>Planning: Planned how to implement the TPDP</p> <p>Observing and Acting: Implemented the TPDP as planned with a focus on collaborative development of Lesson Exemplars</p> <ol style="list-style-type: none"> 1. Grouping of teacher-participants per cluster 2. Discussion for consensus of topic for lesson exemplar 3. Inputs for improvement of all instruments (LE template, rubric and peer review form) 4. Collaborative development of LE <p>Reflecting: Self-assessment of the lesson exemplar using the rubric, peer-review form for peer suggestions, and suggestions and comments by other members of the group for this phase of the study</p> <p>Discussing: Reflection and reflexivity of the members of the group in terms of or in the aspects of lesson plan</p>	Qualitative analysis of peer reviews and reflection notes of clusters

development, comments and suggestions by the members of the group and group/cluster consensus on its improvement.

<p>Phase 4: Lesson Exemplar Implementation and presentation in a country-wide forum</p>	<p>PAR Groups 1, 2, 3</p>	<p>Developed lesson exemplars</p>	<p>Planning: Planned execution of the Lesson Exemplar by a selected representative of the cluster in his/her class in his/her home institution</p> <p>Observing and Acting: Implementation of LE using AR</p> <ol style="list-style-type: none"> 1. Implementation of LE 2. Documentation of the implementation using video-recording 3. Analysis of the implementation of the LE using photovoice <p>Reflecting: Cluster reflection on the results of AR</p> <p>Discussing: Sharing of results of AR implementation through presentation to national forum</p>	<p>Photovoice, descriptive analysis of TPDP evaluation, qualitative analysis of responses to open ended questions</p>
<p>Phase 5: TPDP Evaluation</p>	<p>PAR Groups 1, 2, 3</p>	<p>TPDP Evaluation form</p>	<p>Planning: Planning on how TPDP evaluation will be staged</p> <p>Observing and Acting: Implemented TPDP evaluation plan by inserting Q & A section every after sessions. More time spent on sharing every after AR presentation</p> <p>Reflecting: Provided all members and participants time for reflection through the open-ended questions in the TPDP evaluation form.</p> <p>Discussing: Group impressions on the entirety of the program were presented.</p>	

Appendix-TPDP

Course Program: Teacher Professional Development Program (TPDP) on Lesson Exemplar (LE) Development for STEAM

Course Description

This TPDP features Capacity Building Program (CBP), implementation of the products of TPDP (the LEs), and presentation of the documented LE implementation in a National Forum on STEAM for Philippine Higher Education. The CPB will feature plenary presentations of the frameworks and models generated for the CHED-funded research titled, TPACK in Philippine STEAM Education. Primarily, the CBP will acquaint 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 will be the focus of the training program.

Objectives:

The Teacher Professional Development Program (TPDP) 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. Capacitate PHE STEAM Educators on 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.
6. Implement the developed LEs using AR
7. Present the documentation of LE implementation in a National Forum on STEAM for Philippine HEI
8. 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.

Particular Continuing Professional Competency

1. Acquire understanding and appreciation of the general level of STEAM teaching proficiency of PHE STEAM educators
2. Obtain an overarching understanding of Philippine TPACK model.
3. Gain knowledge on Philippine STEAM Education Models (Pedagogical Model, Assessment Framework and Technological Integration Model)
4. Enhance teaching proficiency of Philippine Higher Education STEAM Educators through a Capacity Building Program
5. Acquire skills in developing Lesson Exemplars as directed/guided by the frameworks and models.
6. Establish linkages with professionals in the field of mathematics education.

Content Details

Sub-topics and Time Allotment for every topic (in hours)	Expected Learning Outcomes	Activities to Achieve Learning Outcomes	Assessment Strategies including Assessment Tools	Requirements/ Outputs
STEAM teaching Proficiency and Philippine TPACK Framework <i>Day 1:</i> 10:00-11:00 AM	Acquires understanding and appreciation of the general level of STEAM teaching proficiency of PHE STEAM educators Obtains an overarching understanding of Philippine TPACK model.	Lecture/Talk/sharing	Presentation of the findings of the national survey titled, <i>Philippine Proficiency of STEAM Educators</i> Presentation key concepts, critical issues and innovations from STEAM and TPACK experts	Questions prepared by the participants to demonstrate a deeper understanding of the topic Sharing of best practices.
Model 1 – Pedagogical Model <i>Day 1:</i> 11:00-12:00 PM	Gains knowledge on Philippine STEAM Education Models (Pedagogical Model, Assessment Framework and Technological Integration Model)	Lecture/Talk/sharing	Presentation of key concepts, critical issues and innovations from STEAM experts	Questions prepared by the participants to demonstrate deeper understanding of the topic Sharing of best practices.
Model 2 – Technology Integration Model <i>Day 1:</i> 1:30-2:30 PM				
Model 3 – Assessment Framework <i>Day 1:</i> 2:30-3:30 PM				
Features of Lesson Exemplar <i>Day 2:</i> 8:00-10:00 AM	Enhances teaching proficiency of Philippine Higher Education STEAM Educators through a Capacity Building Program	Lecture/talk/sharing Workshop	Presentation key concepts, critical issues and innovations from STEAM experts	Questions prepared by the participants to demonstrate deeper understanding of the topic Sharing of best practices.

Workshop: Design of Lesson <i>Day 2:</i> 10:00-12:00 PM	Acquires skills in developing Lesson Exemplars as directed/guided by the frameworks and models.	Workshop Facilitation	Facilitation of Workshop on Designing Lesson Exemplars	Lesson submission	Exemplar
Peer Review of Lesson Exemplar <i>Day 2:</i> 1:00-2:30 PM	Acquires skills in assessing developed Lesson Exemplars as peer guided by the TPACK model/framework.	Peer Review Workshop	Facilitation of Peer Review of Developed Lesson Exemplars	Peer Review Form	
Workshop: Revision of Lesson Exemplar based on Peer Review <i>Day 2:</i> 2:30-3:30 PM	Acquires skills in enhancing Lesson Exemplars as per peer assessment/evaluation	Workshop on Revision of Lesson Exemplars	Facilitation of Workshop on Enhancing Lesson Exemplars	Rubric on Lesson Plan	TPACK
Critiquing and Presentation <i>Day 3</i> 8:00-11:00 AM		Presentation and Critiquing	Critiquing and revision of Lesson Exemplars	Presentation and Critiquing of Lesson Exemplars	

LE Implementation

National Forum for STEAM in Philippine Higher Education
(Feature of the Forum: Presentation of Lesson Exemplar Implementation)