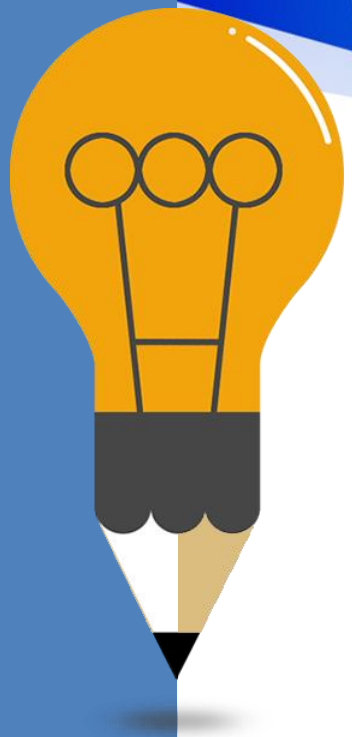
Towards Developing the Technology Integration Model for STEAM Education

Outline



01 **Background**

Rationale and related theories and purpose

02 **Methods**

Design, instruments and analysis

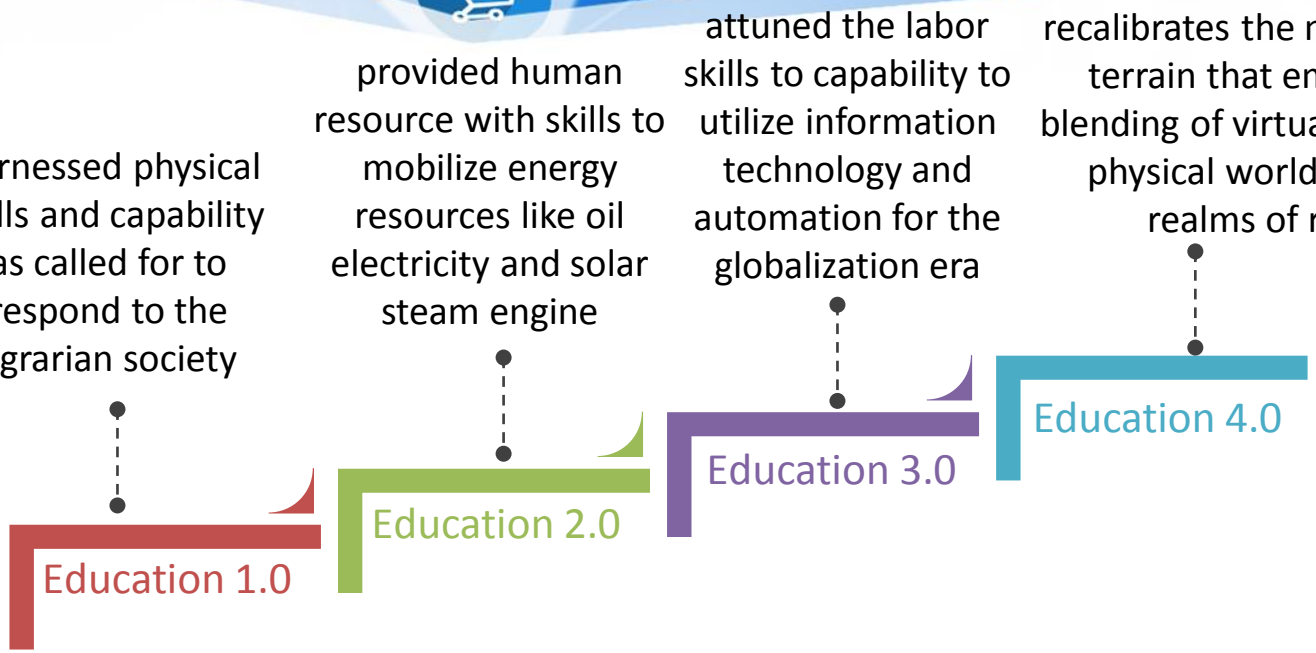
03 **Technology Integration Model**

Pertinent results, including the details of the model

04 **Conclusion and Way Forward**

Concluding statement and further recommendation

Background of the Study



Education 4.0 is a model believed to respond to the demands of IR4.0 (Hussin, 2018)

promotes a new learning vision and novel ways of learning that emphasize collaboration of men and machines (also known as cyber-physical system) (Atkinson, 2018)

Looking back .....

Source: https://www.pinterest.ph/pin/344947652682042269/

- The Philippines is one of many developing nations that have turned to information and communication technology (ICT) as a tool to improve teaching and learning (Rodrigo, 2017)

Barriers of Integration

- *Inadequate financial support and infrastructure
- Human capital
- Management support

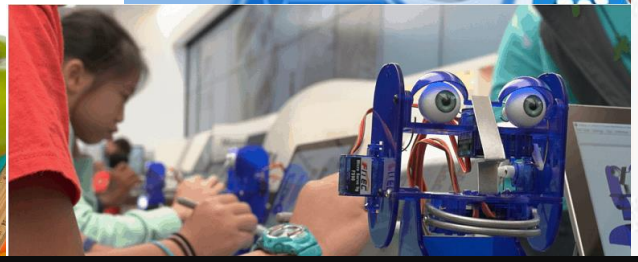
*Datong, De Castro, Dolot & Prenda (2016)

- **Absence of how ICT is used
- Insufficient teacher preparation

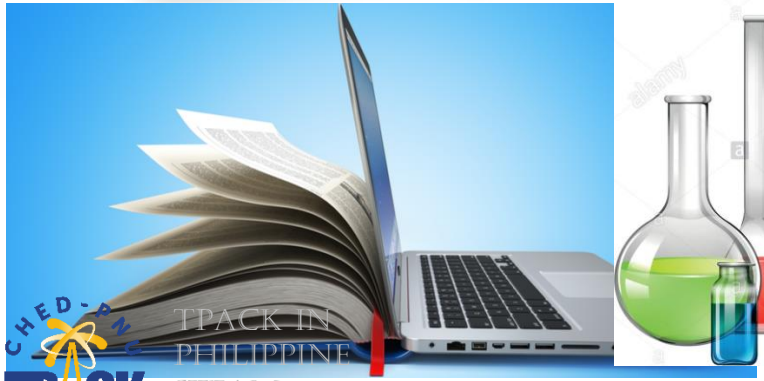
**Rodrigo (2017)

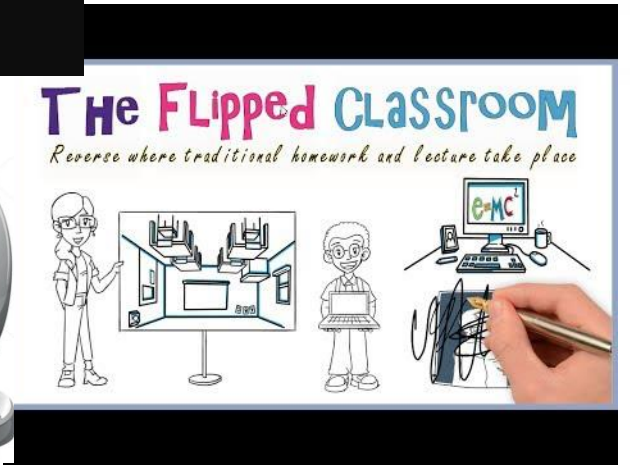
Now, we are . . .

Source: http://www.cetrixtablets.com/21st-century-classroom-advantages-disadvantages/



TECHNOLOGY

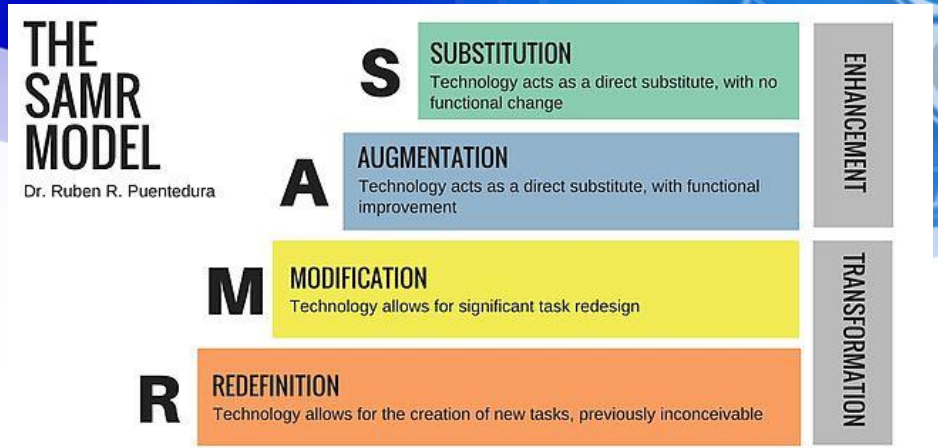


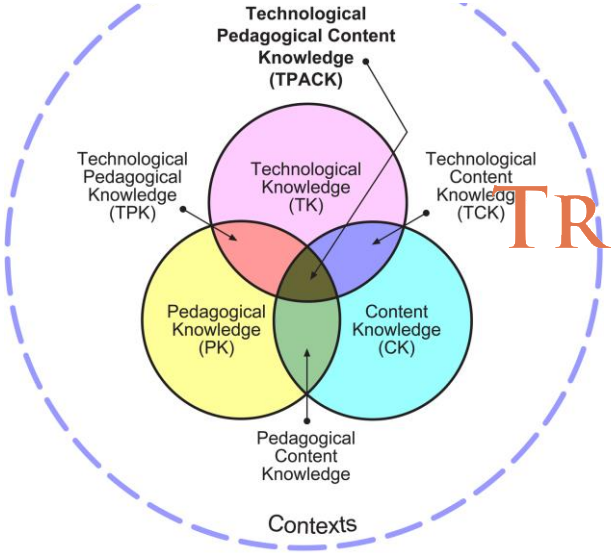


TPACK IN PHILIPPINE STEAM EDUCATION

> Technology integration refers to the use of technology resources -- computers, mobile devices like smartphones and tablets, digital cameras, social media platforms and networks, software applications, the Internet, etc. in learning, in daily classroom practices, in teachers' major and other duties, and in the management of a school (Edutopia, 2007; Education4site, 2011).

Technology Integration





Extend

Enhance

Engage

Triple E Framework

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Purpose of the Study

develop and validate the technology integration model for Philippine STEAM Education

Methods

Design

Exploratory qualitative

Instruments

STEAM Classroom Observation Protocol

Participants

A total of 106 STEAM teachers

*Dean/Head for interview

Data Analysis

Transcribed all recordings

Subjected all transcripts to coding system using MaxQDA

Thematic analysis to derive themes and its descriptions

Region	Number of Schools	Number of STEAM teachers
National Capital Region (NCR)	5	10
Cordillera Administrative Region (CAR: Kalinga-Apayao)	1	4
Region 1 (Ilocos Sur)	2	5
Region 2 (Batanes)	1	4
Region 3 (Aurora, Bulacan, Pampanga)	3	15
Region 4 (Laguna, Quezon)	3	16
Region 5 (Camarines Sur, Camarines Norte, Masbate)	3	9
Region 6 (Negros Occidental, Iloilo	2	10
Region 7 (Bohol, Siquijor)	2	4
Region 8 (Southern Leyte)	1	5
Region 9 (Zamboanga del Norte)	1	5
Region 10 (Camiguin, Misamis Occidental)	2	4
Region 11 (Davao del Norte, Davao del Sur)	2	7
Region 12 (North Cotabato)	2	8
Region 13 (Agusan del Norte)	1	0
Total	31	**106**

Instruments

1) STEAM Classroom Observation Rating Scale (a 48-item, 6-point Likert scale tool);

2) Classroom Observation Notes (includes questions clustered into the dimensions of TPACK designed for use of the researcher for qualitative observations);

3) TPACK interview Protocol (6-item, main questions with corresponding probing questions clustered in themes);

4) Technology Integration Checklist (12 items in a checklist format with either a presence or absence in the classroom by ticking on the box across the pre-selected technology and three open-ended items); and

5) Assessment Checklist.

☐	CB	(Chalkboard/whiteboard/SMART board)
☐	OP	(Overhead Projector/Opaque Projector)
☐	PP	(PowerPoint or other digital slides)
☐	CL	(Clicker Response System)
☐	D	(Demonstration Equipment, e.g. could include Chemistry demonstrations of reactions, physics demonstrations of motion or any other material being used for the demonstration of a process or phenomenon)
☐	DT	(Digital Tablet or any technology where the instructor can actively write on a document cameras as well as software on a laptop that allows for writing on PDF files)
☐	M	(Movie, documentary, video clips, or YouTube videos)
☐	Si	(Simulations that can be digital applets or web-based simulations and animations)
☐	WEB	(Website which includes instructor interaction with course website or other online resource other than YouTube videos. This can also include using website for student responses to questions in lieu of clickers)
☐	LDEM	(Use of equipment (e.g. lab equipment, computer simulation to convey course content)
☐	IAE	(Improvised apparatus or equipment)
☐	LA	(Learning applications, e.g. Kahoot)

What are your basic intentions of using or integrating these technologies?

What were your major considerations in choosing or integrating these technologies?

What part of the lesson do you use these identified technologies?

Source: Morales, M.P.E., Abulon, E.R., Anito, J.C.,Jr., Avilla, R.A., Palisoc, C.P., Elipane, L.E., & Castilla, N.A. (2018). *TPACK in Philippine STEAM Education: STEAM Classroom Observation Protocol*. Manila, Philippines: Philippine Normal University. ISBN: 978-971-568-044-8

Reasons of using or integrating these technologies

TO ENSURE LEARNING AND ENSURE UNDERSTANDING AND MASTERY OF CONCEPT

To increase the level of comprehension of the students and maintain their interest in the topics discussed

1.) TO ENCOURAGE ACTIVE PARTICIPATION OF THE STUDENTS DURING CLASS SESSION 2.) TO CATCH THEIR ATTENTION

To be quipped and familiarize the student in this technology (scientific calculator) to come up with the correct computation.

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Validation

Two-tier validation stage

- Validation workshop (February 27-28, 2019)- attended by collaborators
- Capacity building program (March 19-21, 2019)- attended by STEAM teachers

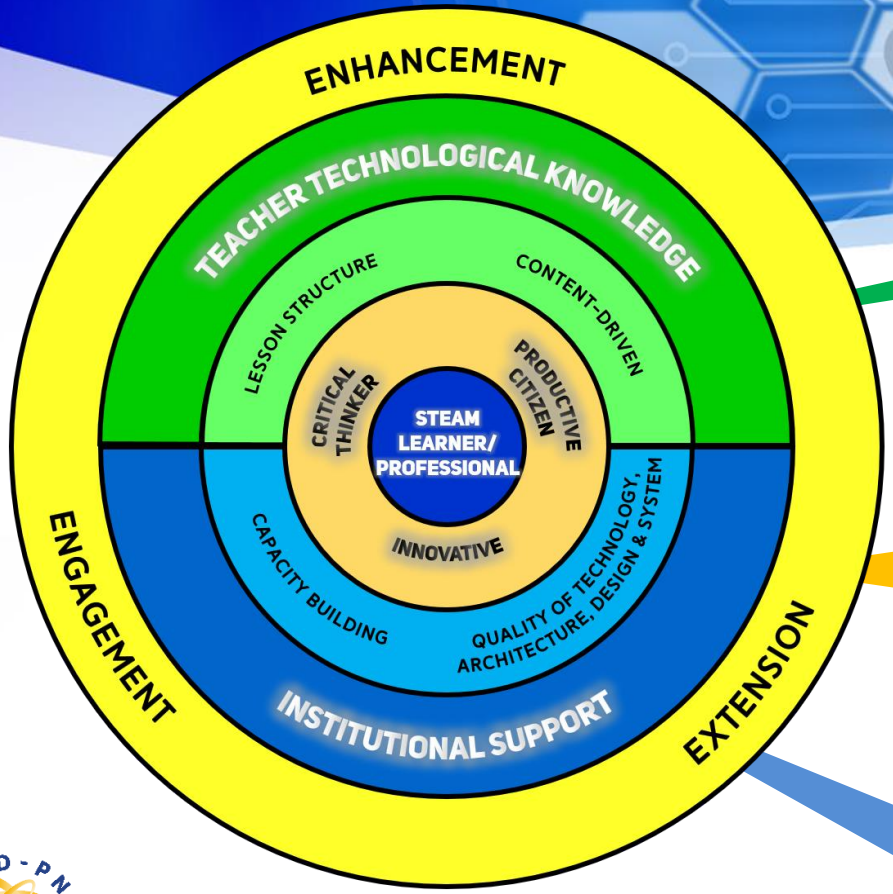
Validation Results

Organization from general to specific	Considered 3Es outermost circle across all
Provide clearer definition of “Technology”	Based on the Triple E framework, the 3Es is not ladder-like. Each E is distinct and different.
Include context-based as one dimension under TCK	Considered different font size for the variables and dimensions
Merging of quality of technology and technological architecture, design and system	

Major Findings

- Institutional Support
- Teacher Technological Knowledge
- Outcomes

Technology Integration Model



Teacher Technological Knowledge

understanding of teachers about technology

Outcomes

produce STEAM learner/professional

Institutional Support

assistance and other forms of support given by the institutions and its administration.

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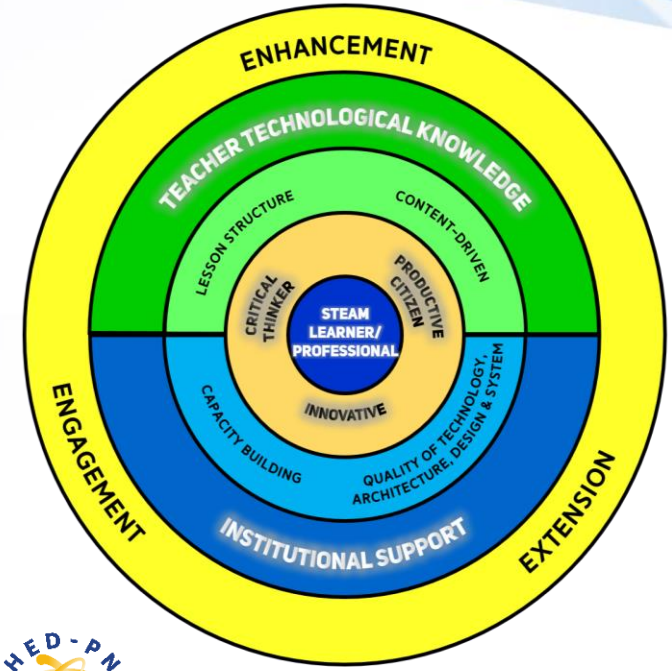
Technology Integration Model



Institutional Support

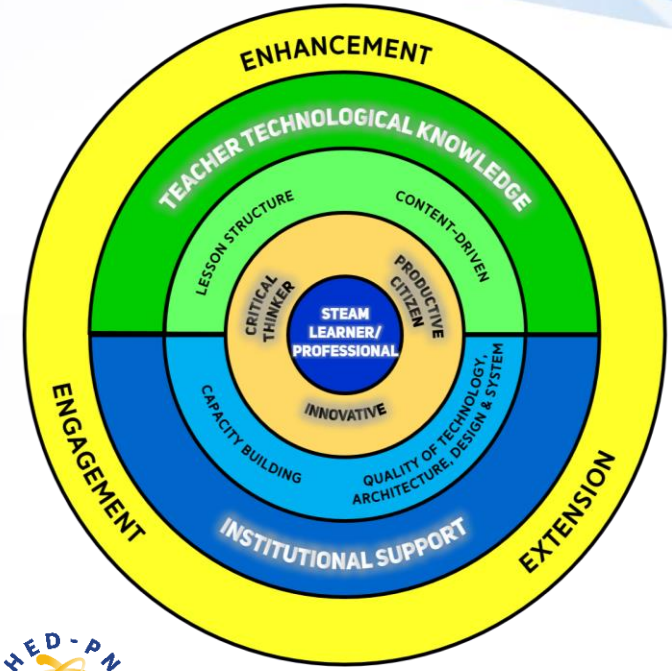
- Capacity building

enhance technological literacy of teachers in the appropriate use of technology for specific purpose

- Quality of technology, architecture, design and system

various software, applications, devices and other instruments that the teachers need to carry out the teaching-learning process; approximated by the affordability, availability and appropriateness of the technology used in instruction and/or assessment

Technology Integration Model



Teacher Technological Knowledge

- Lesson structure

pertains to the integration of technology in specific parts of the lesson, at most, for faster lesson delivery and better presentation

- Content-driven

use of technology in instruction specifically applicable to courses on which the content of the course is bound to technology use

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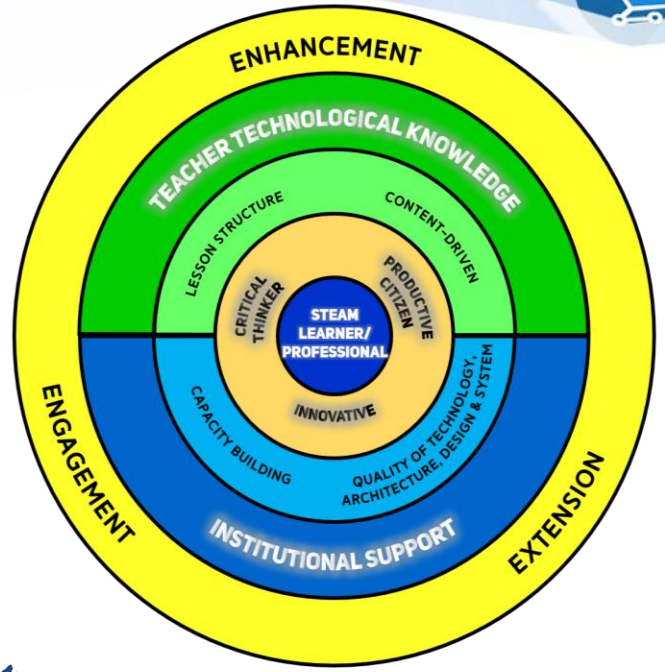
Technology Integration Model



Outcomes

- Critical Thinker
- Innovative
- Productive Citizen

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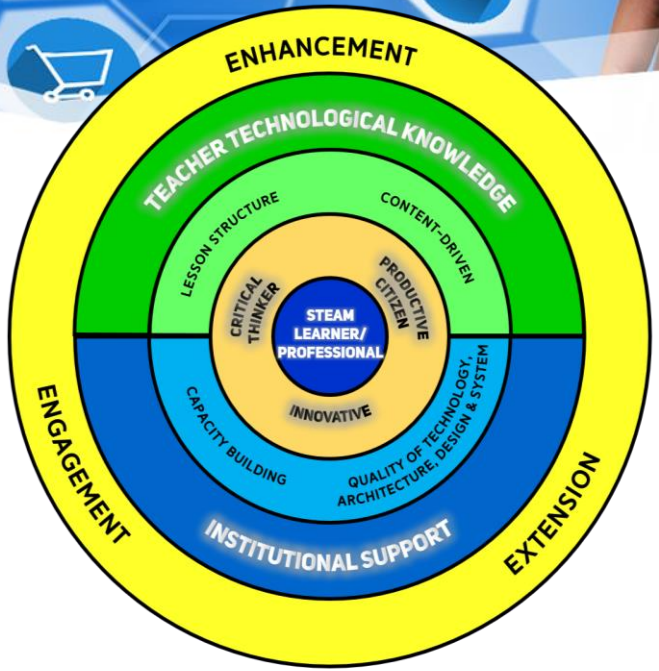
Technology Integration Model

Enhancement



Extension

Engagement

DOES THE TECHNOLOGY TOOL AID STUDENTS IN DEVELOPING A MORE SOPHISTICATED UNDERSTANDING OF THE CONTENT?

FOCUS

ENGAGEMENT

ENGAGING STUDENTS IN TIME-ON-TASK ACTIVE SOCIAL LEARNING IN ORDER TO MEET **LEARNING GOALS**

MOTIVATE

DOES THE TECHNOLOGY MOTIVATE STUDENTS TO START THE LEARNING PROCESS?I

DOES THE TECHNOLOGY CAUSE A SHIFT IN THE BEHAVIOR OF THE STUDENTS, WHERE THEY MOVE FROM PASSIVE TO ACTIVE SOCIAL LEARNERS?

ACTIVE

DOES THE TECHNOLOGY TOOL AID STUDENTS IN DEVELOPING A MORE SOPHISTICATED UNDERSTANDING OF THE CONTENT?

SOPHISTICATED

ENHANCEMENT

ENHANCEMENT OF **LEARNING GOALS** THROUGH TECHNOLOGY IS WHEN THE TOOL IS SOMEHOW AIDING, ASSISTING, SCAFFOLDING LEARNING IN A WAY THAT COULD NOT EASILY BE DONE WITH TRADITIONAL METHODS.

SCAFFOLDS

DOES THE TECHNOLOGY CREATE SCAFFOLDS TO MAKE IT EASIER TO UNDERSTAND CONCEPTS OR IDEAS?

DOES THE TECHNOLOGY CREATE PATHS FOR STUDENTS TO DEMONSTRATE THEIR UNDERSTANDING OF THE LEARNING GOALS IN A WAY THAT THEY COULD NOT DO WITH TRADITIONAL TOOLS?

CAN'T WITH TRADITIONAL

DOES THE TECHNOLOGY CREATE OPPORTUNITIES FOR STUDENTS TO LEARN OUTSIDE OF THEIR TYPICAL SCHOOL DAY?

OUTSIDE

EXTENSION

TECHNOLOGY AIDS OR ENHANCES THE ABILITY TO EXTEND **LEARNING GOALS** IN ORDER TO CONNECT WITH THE STUDENTS' REAL-WORLD

BRIDGE

DOES THE TECHNOLOGY CREATE A BRIDGE BETWEEN SCHOOL LEARNING AND EVERYDAY LIFE EXPERIENCES?

DOES THE TECHNOLOGY ALLOW STUDENTS TO BUILD GRIT SKILLS, THAT THEY CAN USE IN THEIR EVERYDAY LIVES?

EVERYDAY SKILLS

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Source: https://www.tripleeframework.com/engagement.html

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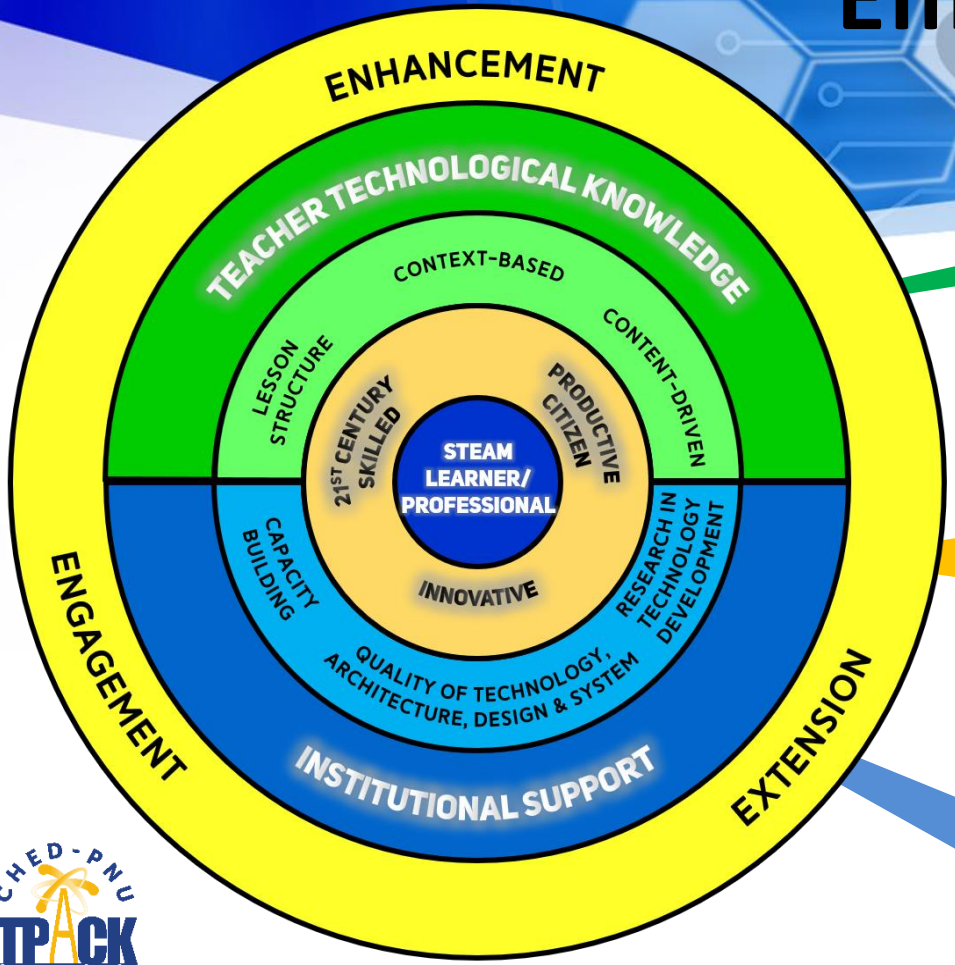
EmergingTechnology Integration Model



Teacher Technological Knowledge

- Context-based

Outcomes

- 21st Century skilled

Institutional Support

- Research in technology development

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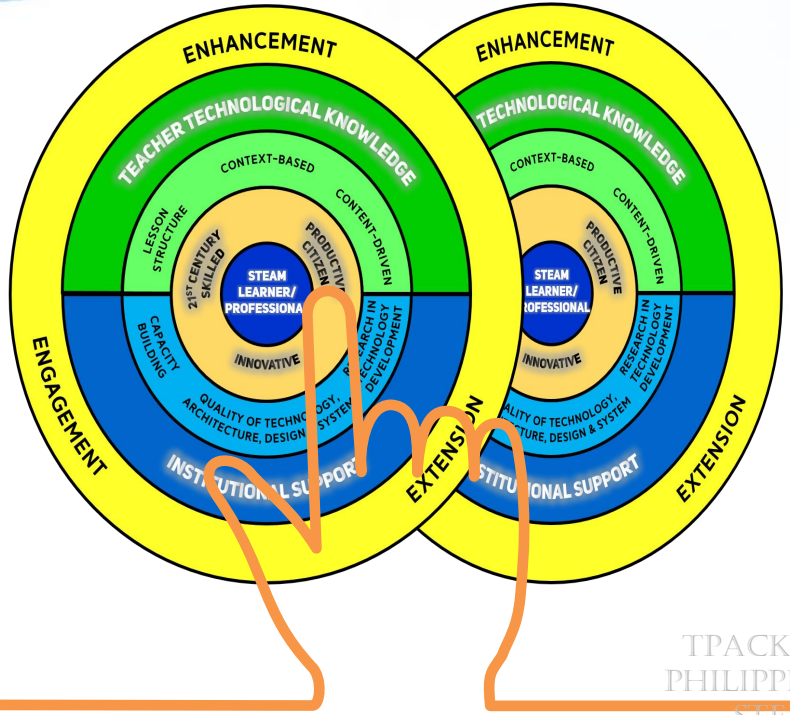
Purpose of the Model

Students' Learning – Cognitive and Affective

Improve academic achievement , meaningful learning, interactive/effective discussion,
Encourage active participation
Gain attention/confidence and motivation

Teacher Quality

update/adapt to new technology
Improve teaching
Innovative teaching strategy



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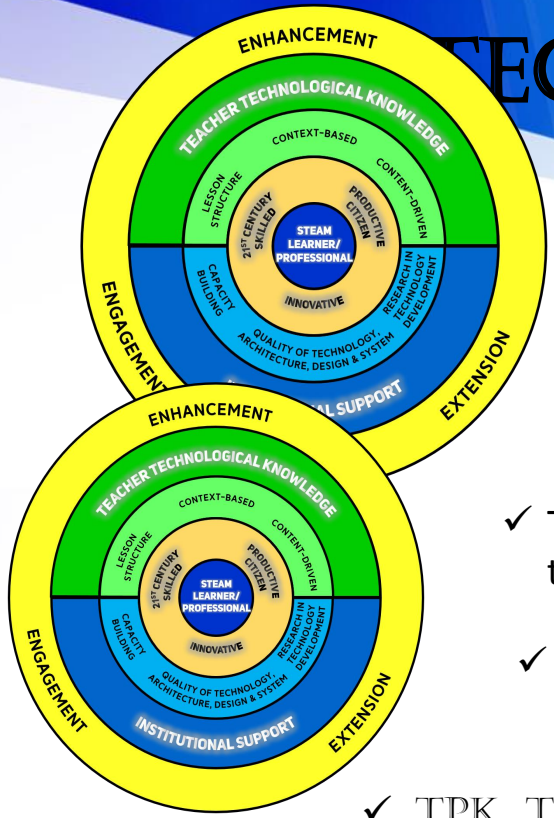
TPCK AND TECHNOLOGY INTEGRATION MODEL



The core components of teaching with technology are content, pedagogy and technology, and the combination of these (Koehler & Mishra, 2009).

- ✓ TPCK can be seen in the teaching and learning experience while TPK focuses on Teacher's understanding of the affordance of Technology.
- ✓ TCK is observed in the laboratory and simulation activities, applicability to the topic and lesson objectives.
- ✓ Single core components TK, CK, PK are shown in teachers' Knowledge on the different types of technology, discussions and teaching objectives respectively.
- ✓ TPK, TCK and TK are evident in the training on the effective use of technology, provision of laboratory room and installation of lab room for instruction and research

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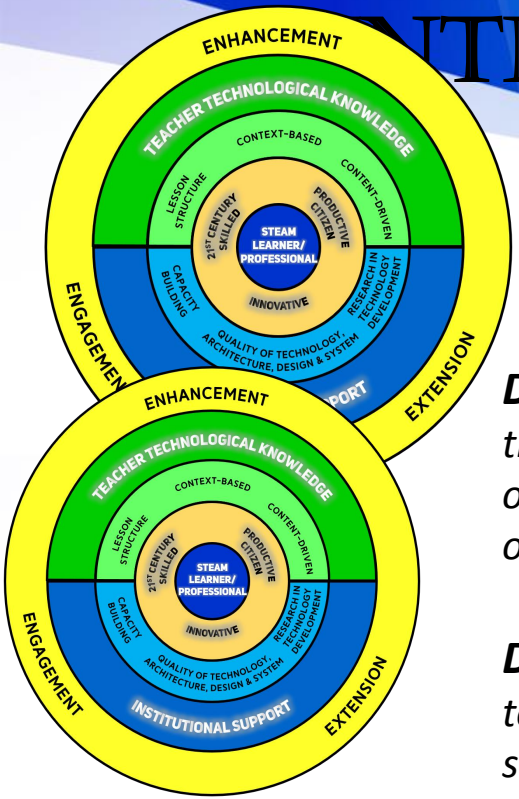
PPST AND TECHNOLOGY INTEGRATION MODEL



PPST intends to help teachers reflect and assess their own practices (Department of Education - Teacher Education Council, 2017).

Domain 1 - Content Knowledge and Pedagogy *- states that skill in the use of technologies is needed to promote high quality learning outcomes. Specifically, strand 1.3 states that there should be a positive use of ICT.*

Domain 4 – Curriculum and Planning *- expects teacher should be able to apply their professional knowledge and curriculum content to a well - structured and sequenced lessons. Strand 4.5 points out that ICT should be part of the teaching and learning.*

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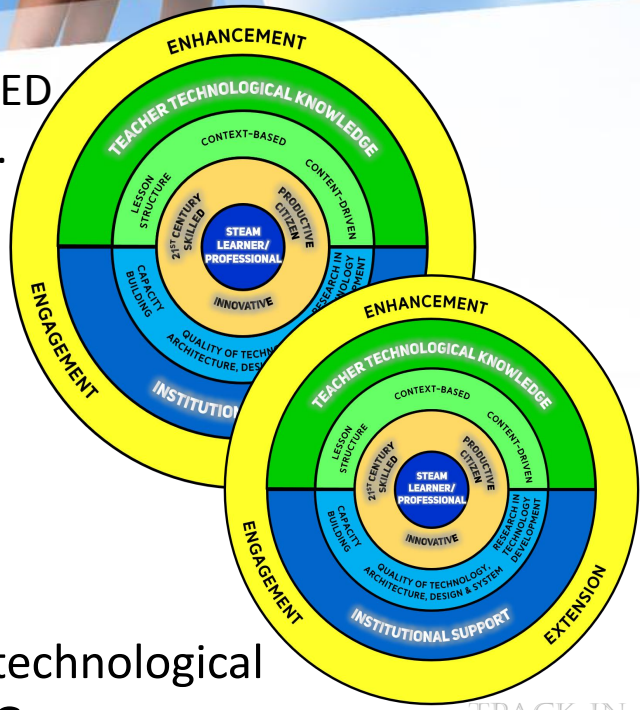
PSGS AND TECHNOLOGY INTEGRATION MODEL

PSG is a program-based quality assurance mechanism set by CHED (Pijano, 2010). A specific PSG is set for every particular program.



- ✓ General education courses should have basic computer literacy
- ✓ Learning resources are needed for the delivery of the curriculum
- ✓ Laboratories are to supplement and complement the attainment of learning outcomes prior to actual experience

STEAM educators should possess and could demonstrate technological knowledge to effectively deliver what are stated in the PSGs

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Conclusion and Way Forward

The technology integration model:

- provides opportunities to capacitate STEAM educators
- outlines the significance of technology integration to produce quality STEAM learners
- agrees with the PSGs
- assists PPST
- strengthens TPCK

Conclusion and Way Forward

The technology integration model:

- may provide insights to reforms and policies to further technology integration in STEAM education

Core Team

Technology Integration Model

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- Field Researchers

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- Dennis Masangcay – *PhD Student*
- Nica A. Castilla – *Technical Staff*

Thank you

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