# The Pedagogical Model for Philippine STEAM Education

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**Caesar Palisoc**, *Graduate Studies, Philippine Normal University*

# The Pedagogy Team

## Core Researchers

- Jovito C. Anito Jr.
- Marie Paz E. Morales
- Caesar P. Palisoc

## Research Assistants

- Milano O. Torres
- Maribel D. Ganeb
- Raquel A. Gonzales

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Theme: "Modeling TPACK in Philippine STEAM (Science, Technology, Engineering, Agri-Fisheries, Mathematics) Education"

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# Scope of Presentation



STEAM and STEAM Education in the Philippines



The Pedagogical Model for Philippine STEAM Education

- Method
- Model Elaboration



Future Directions

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- Ushers learners towards understanding the world as a whole rather than parts – Interdisciplinary, Multidisciplinary, and Transdisciplinary

  - *Understanding how Science, (&) Technology, (are interpreted through) Engineering, (&) Agri-Fisheries, (based on) and Mathematics shape each other.*

  - *Loosening one's exclusive identity - #STEAMatized*

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# STEAM Education

## Advances Sustainable Economy and Technology

- We owe all innovations and inventions [primarily] to STEAM practitioners and educators

## Drives the FIRe (Industry 4.0)

- Hard-to-fill jobs are in STEAM (e.g. software engineers, agricultural engineers)

## Requires **STEAM-Competent** Teachers

- **STEAM**atic!!!
- **STEAM**ing!!!
- **HOT**!!!

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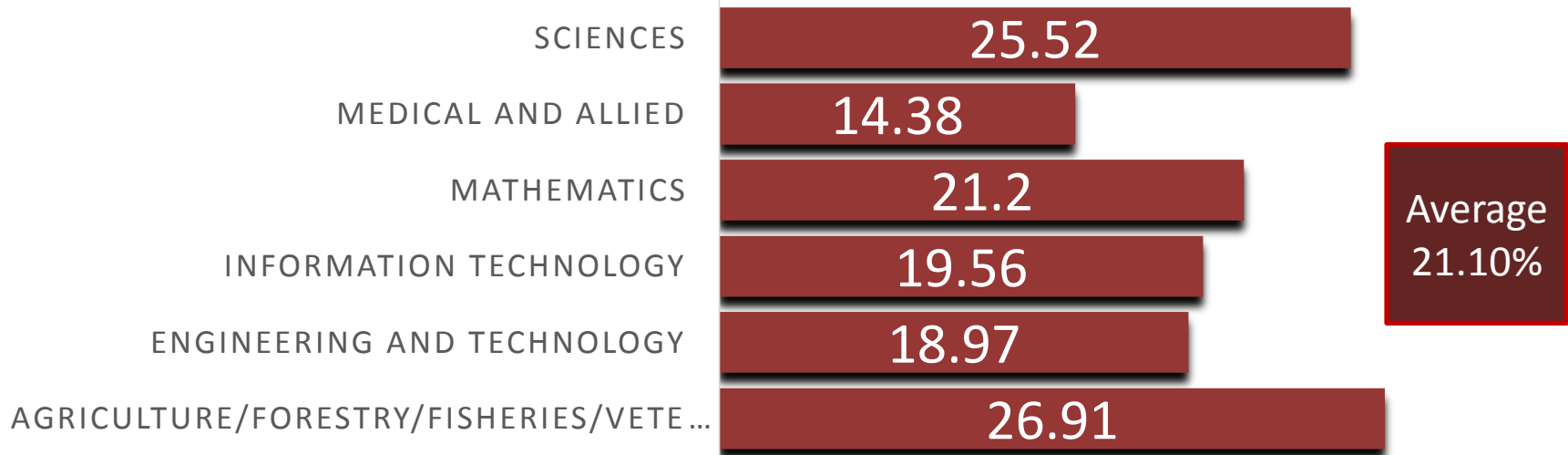Jovito Anito Jr., Marie Paz Morales, Caesar Palisoc

# STEAM in the Philippines

- We don't have sufficient number of scientists

- **Ratio of Scientist per Million Population**
  - UNESCO Recommendation: 380 per million
  - Philippines: 189 per million
    - South Korea: 6,900 per million; Malaysia: 2,100 per million; Thailand: 974 per million; Vietnam: 674 per million

- We don't have sufficient STEAM graduates

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# STE**A**M in the Philippines

- **Agricultural Productivity (Total Factor Productivity)** – *Agricultural Resources (land, labor, materials, etc...) versus total crop and livestock production (USDA Data)*
  - Philippines: 1.87% ; Malaysia: 2.85%; Vietnam: 2.53%

- **Agricultural Trade** – export versus import (UN Trade Map)
  - Philippines: -$5B; Thailand: +$26.5B; Malaysia: +$9.3B

- We don't have sufficient STE**A**M graduates

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# STEAM in the Philippines

**COMPLETION RATE (%) ACROSS STEAM AREAS**
**(AVERAGE CHED 5-YEAR DATA UNTIL 2016-2017)**

| Area | Completion Rate (%) |
|------|---------------------|
| SCIENCES | 25.52 |
| MEDICAL AND ALLIED | 14.38 |
| MATHEMATICS | 21.2 |
| INFORMATION TECHNOLOGY | 19.56 |
| ENGINEERING AND TECHNOLOGY | 18.97 |
| AGRICULTURE/FORESTRY/FISHERIES/VETE… | 26.91 |

Average 21.10%

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- Research points to (blames!!!) the Quality of STEAM Teachers.

  - Increase in number of STEAM-Competent teachers increases the number of students going into STEAM fields (Business-Higher Education Forum, 2010)

  - STEAM proficiency of teachers affect students' STEAM proficiency (e.g. Gordon, Kane, & Staiger, 2006; Hanushek, 2002).

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## COMPETITIVENESS

Upgraded capacity for directed R&D and extension Programs to Serve Socio-Economic Goals

## RESEARCH & DEVELOPMENT

### DEVELOPED NICHE AREAS

A. Food Production and Security

B. Environment, Disaster Risk Reduction and Response, Climate Change and Energy

C. Marine Resources/Systems: Ecosystem, Biodiversity and Conservation

D. Smart Analytics and Engineering Innovations

E. Health Systems

F. Education for S.T.E.A.M.

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# STEAM in the Philippines



**TECHNOLOGICAL**
**PEDAGOGICAL**
**ASSESSMENT**
**CONTENT**
**KNOWLEDGE**
in **STEAM Education**

CHED-PNU
TPACK
STEAM EDUCATION

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# Pedagogy Team: Objectives

- To model current STEAM pedagogical practices of Philippine HEIs.

- To document best practices of STEAM pedagogy from extant literature.

- To identify practice gaps in STEAM pedagogy between Philippine HEIs and extant literature.

- To validate a model of STEAM pedagogy for Philippine HEIs.

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- Key Informant Interviews

- Focus Group Discussions

- Classroom Observation

- 3-tiered Qualitative Data Analysis

- Audit Trail and Validation

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# Method: Key Informant Interviews

- HEI Administrators

- STEAM Administrators (Deans, Coordinators)

- STEAM Teachers

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# Method: Focus Group Discussions

- HEI Administrators

- STEAM Administrators
  (Deans, Coordinators)

- STEAM Teachers

- Researchers

- Collaborators

- Field Researchers

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# Method: Classroom Observation

- STEAM Teachers
  - *Classroom Observation Checklist*
  - *Lesson Plan*
  - *Qualitative Survey*

- Researchers
  - *Observation Notes*

# Method: 3-Tiered Qualitative Data Conceptualization

- ## MaxQDA v10

- ## Level 1 Coding: *Interview Transcripts; Observation Notes*

- ## Level 2 Coding: *Level 1 Memos (Emerging Model)*

- ## Level 3 Coding: *Predefined Code System from the Emerging Model; Lesson Plans; Qualitative Survey*

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# Method: Audit Trail and Validation

- Memos

- Literature Review

- Validation Workshops
  - *Among Core Researchers*
  - *Tier 1: With Research Collaborators (February, 2019)*
  - *Tier 2: With Research Participants (March, 2019)*

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# The Philippine STEAM Pedagogical Model
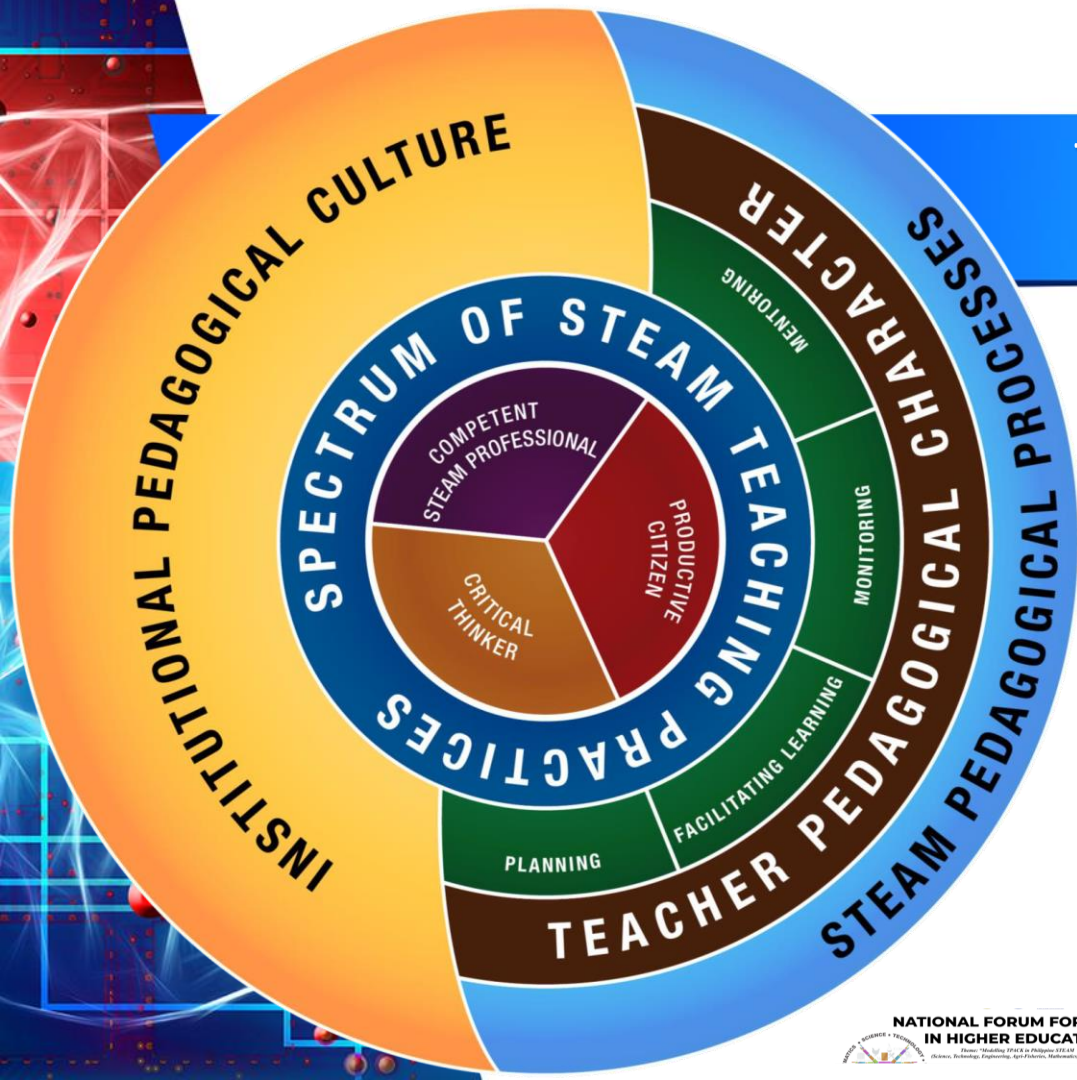
- Institutional Pedagogical Culture

- STEAM Pedagogical Processes
  - Teacher Pedagogical Character
  - STEAM Teaching Practices

- Outcomes of STEAM Education

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# Institutional Pedagogical Culture



- Planning the Pedagogical Processes

- Disseminating Pedagogical Processes

- Evaluating the Pedagogical Processes

- Promoting Research-Teaching Nexus
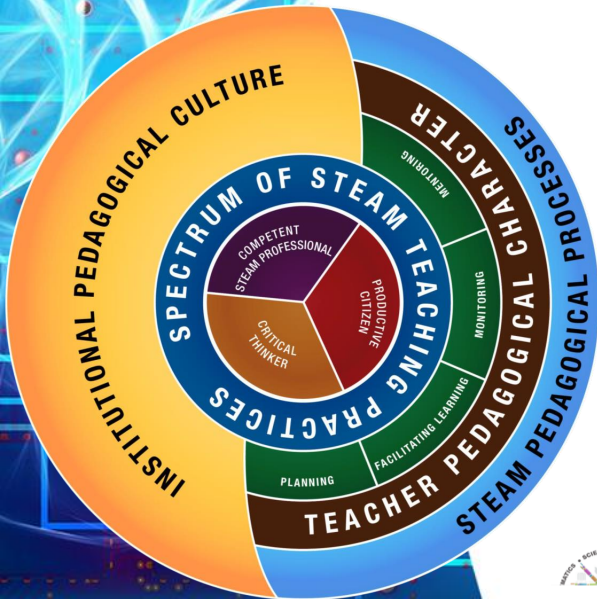
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# Institutional Pedagogical Culture
## Planning the Pedagogical Processes
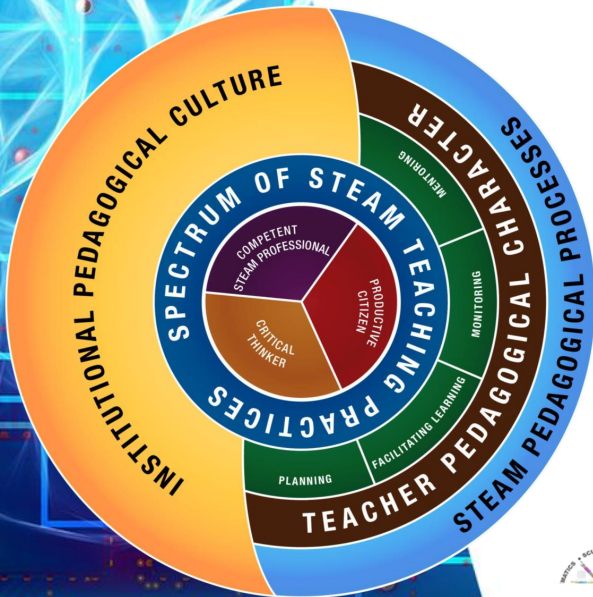


- Alignment of Learning Objectives and Activities

- Alignment of Faculty Specialization and Content

- Ensuring School-Industry Partnership

- Emphasizing Relevance of STEAM to Community

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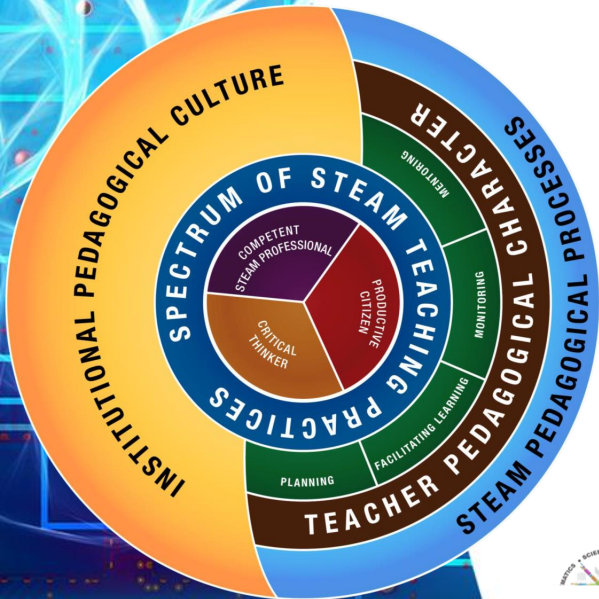
# Institutional Pedagogical Culture
## Evaluating the Pedagogical Processes

- Institutional Review of Curriculum

- Evaluation of Teachers' Pedagogical Processes

    - Ranking and Promotion

    - Continuing Professional Development Programs

- Evaluation of Pedagogical Culture

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# Institutional Pedagogical Culture
## Institutional Pedagogical Support



- Provision of Funds for Continuing Professional Development Initiatives for Teachers

- Mentoring Program (among Faculty members)

- Collaboration with Reputable STEAM HEIs

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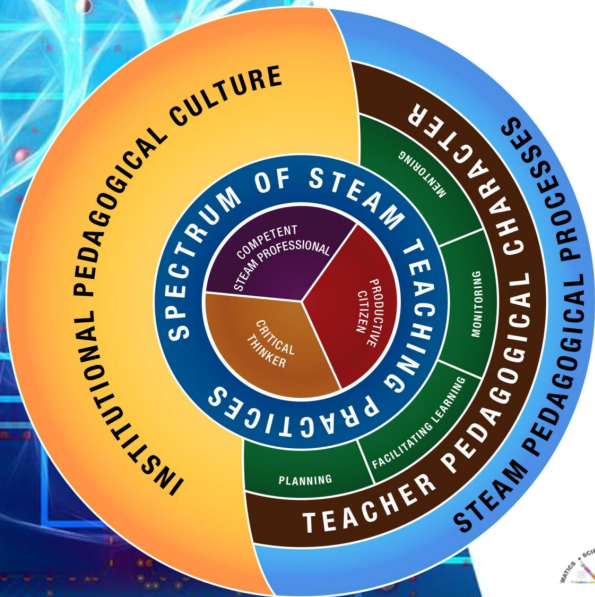
# Institutional Pedagogical Culture
## Promoting Research-Teaching Nexus



- HEI administrators as researchers

- STEAM administrators as researchers

- STEAM teachers as researchers

- STEAM pedagogical processes are informed by researches for institutional development
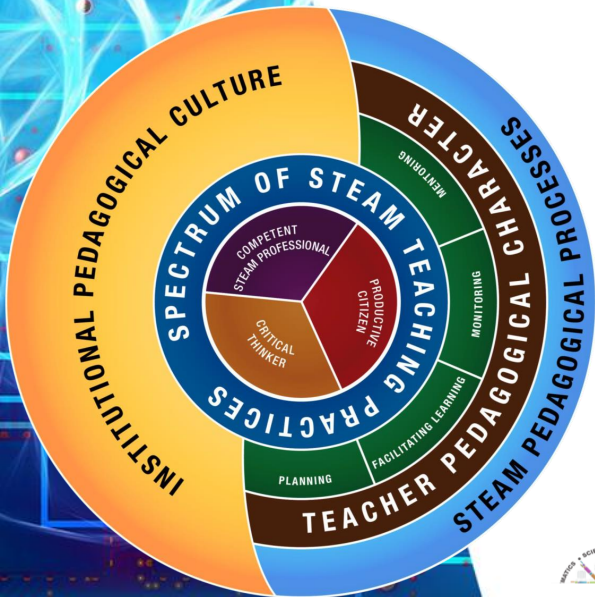
# STEAM Pedagogical Processes



- Lecture Method (as a component of IBL)

- Output/Product-Based Learning

- Inquiry-Based Learning

- Research for the Improvement of STEAM Pedagogical Processes

- Ethical Conduct of Pedagogical Processes
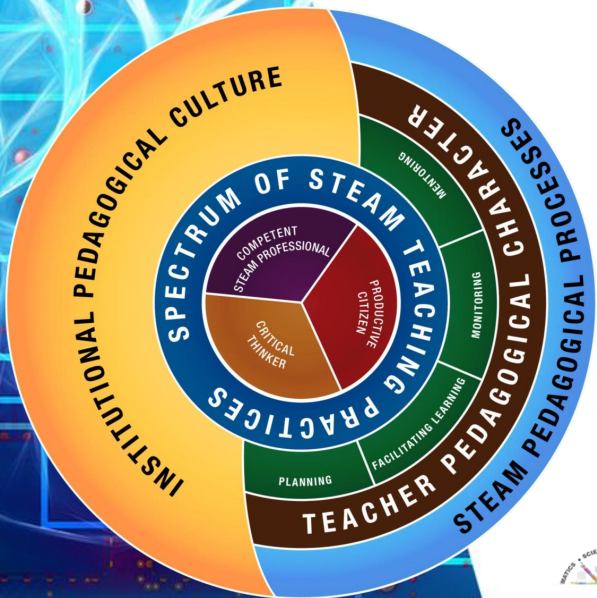
# STEAM Pedagogical Processes

- Lecture Method
  - Allows teachers to underscore significant content

- Output-Based Learning
  - Emphasizes that STEAM is highly output-driven
  - STEAM programs focus on products and outcomes

- Inquiry-Based Learning
  - Scaffolding and GRR
  - Modeling
  - Real-Life Applications - *simulations, experience, examples (local, national, global), values integration, development of solutions to pressing societal problems.*
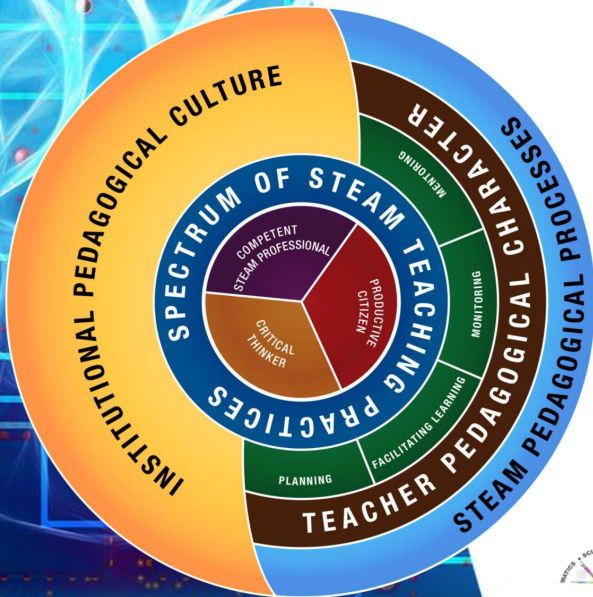
Monitoring the Pedagogical Processes

– Designing Assessment -diagnostic, formative, summative (including discipline-based summative assessment requirements)

– Making Sense of the Assessment Results - *communicating results and advising, drawing implications for improvement*

– Being transparent with the learning objectives

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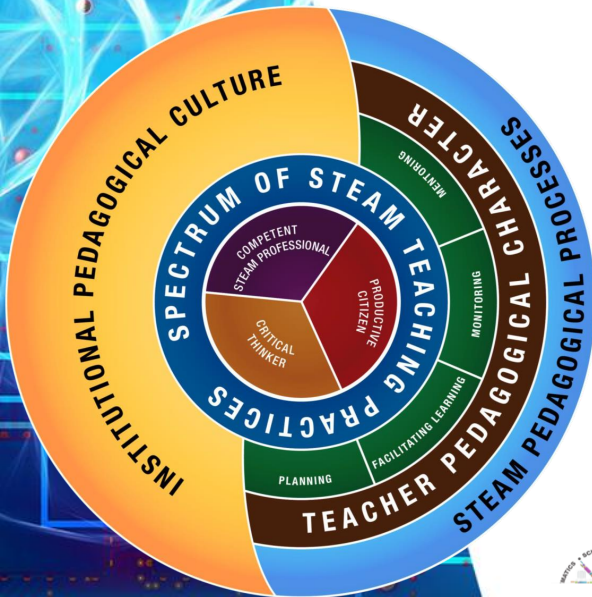
# STEAM Pedagogical Processes



- Mentoring - Addressing learners' difficulties
  - Mentoring Mechanism - schedule, facilities, and resources
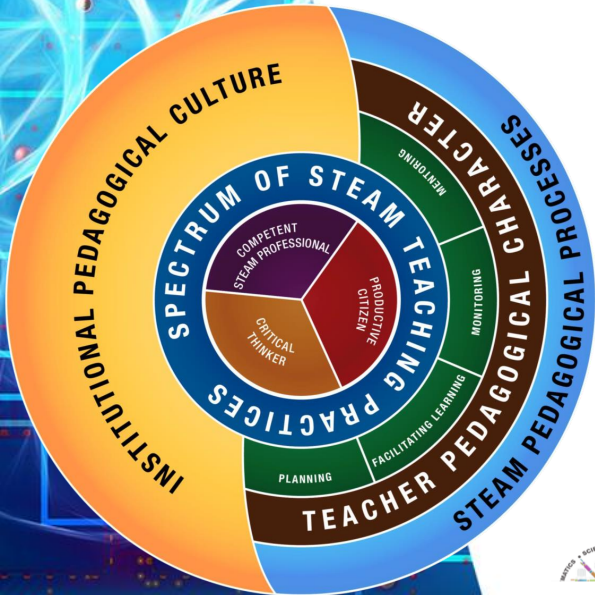    - Open mentoring (borderless and non-program specific)

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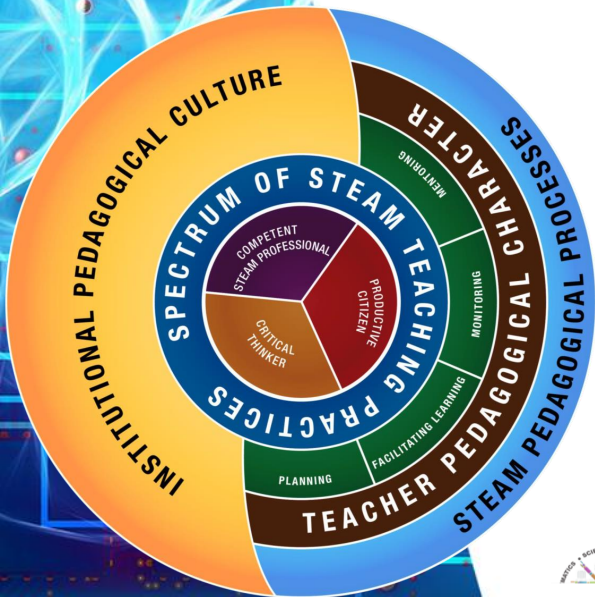
# STEAM Pedagogical Processes



- Managing Classrooms

  – Organizing the Classroom: Delegating tasks and responsibilities

  – Promoting positive relationship with learners

  – Promoting a positive learning environment

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# STEAM Pedagogical Processes

- Planning the Pedagogical Processes

  - Alignment of Learning Objectives, HEI goals, and activities

  - Alignment of Faculty Specialization and Content

  - Emphasizing Relevance of STEAM to Community



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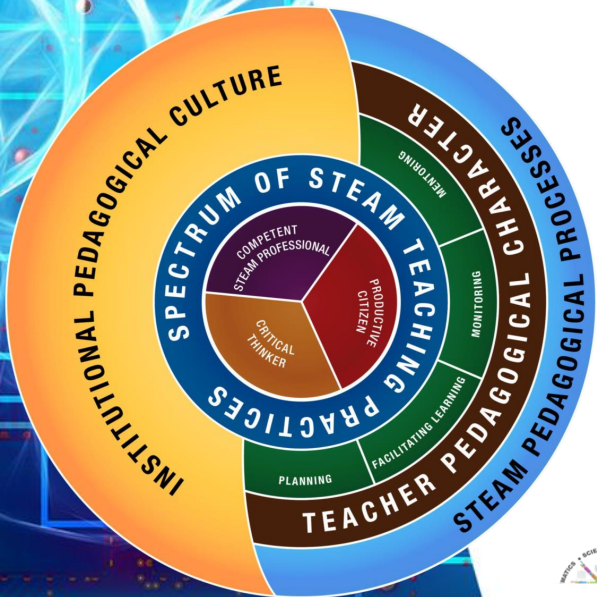IN HIGHER EDUCATION
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# Teacher Pedagogical Character



- Epistemological Beliefs
  - *Any teaching strategy is effective ONLY at that very moment it was found effective - domain dependence and context dependence of teaching strategies*

- Pedagogical Practices
  - *Modelling Learning (modelling one's own experiences, linking practice and teaching, demonstrating critical and reflective thinking through quality questioning techniques)*
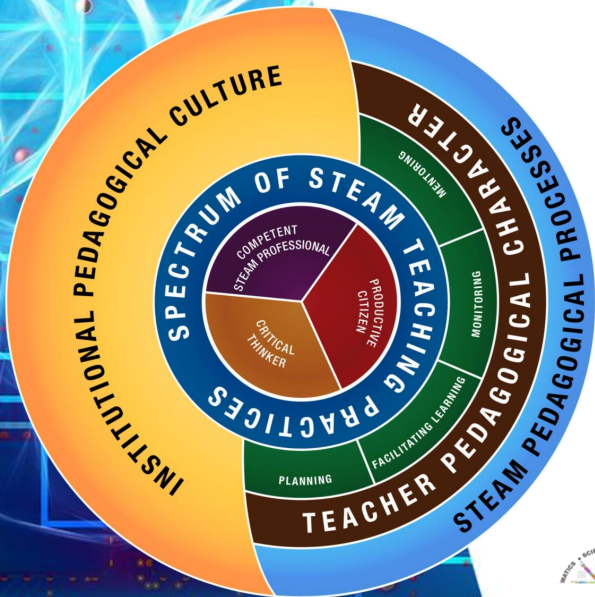
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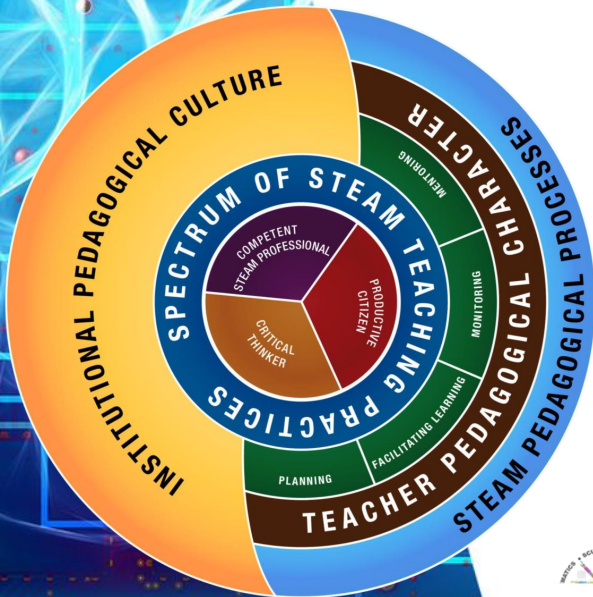
# Outcomes of STEAM Education



- Competent STEAM Professionals
  - Achieved the discipline-based requirements
  - Tendering significant contributions (solutions to societal problems) to improve the quality of life
  - Life-long learner
- Productive Citizens – engaged in research
- Critical Thinkers (ability to contribute solutions to societal problems)
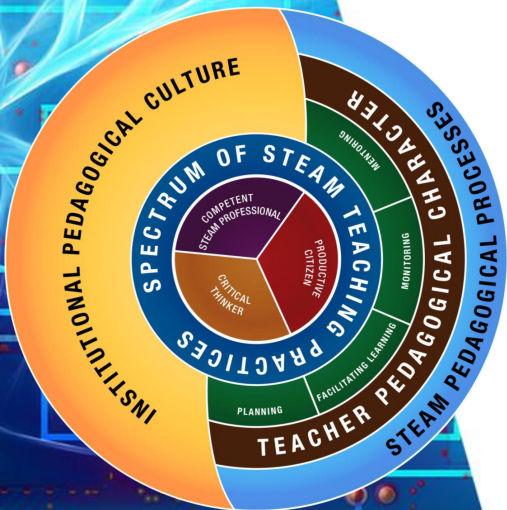
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# Model Continuum

- Novice

- Proficient

- Highly Proficient

- Distinguished



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# Model Continuum:
## Distinguished STEAM Educators



nurture a **culture of support** to institutional mechanism in planning, implementing, and evaluating pedagogical processes, towards **ensuring alignment** of learning objectives and activities, advancing **school and industry partnerships**, emphasizing the **relevance of STEAM to society**, and instituting **continuous improvement** in curricular policies and practices.
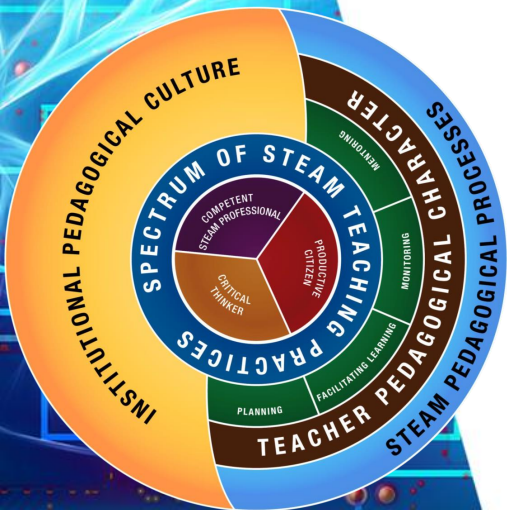
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- lead and inspire other STEAM educators in exemplifying **learning-by-modeling**, and demonstrating **critical and reflective thinking**.
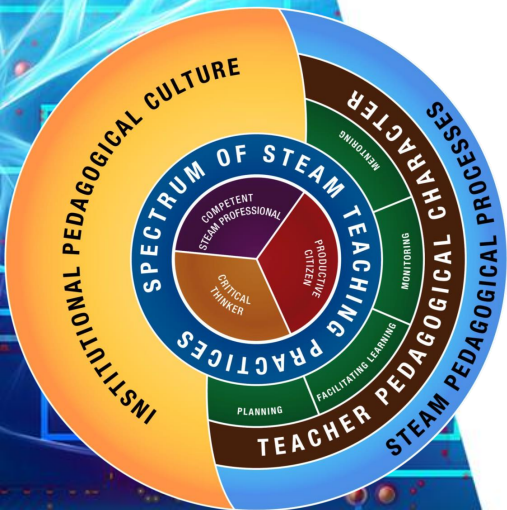
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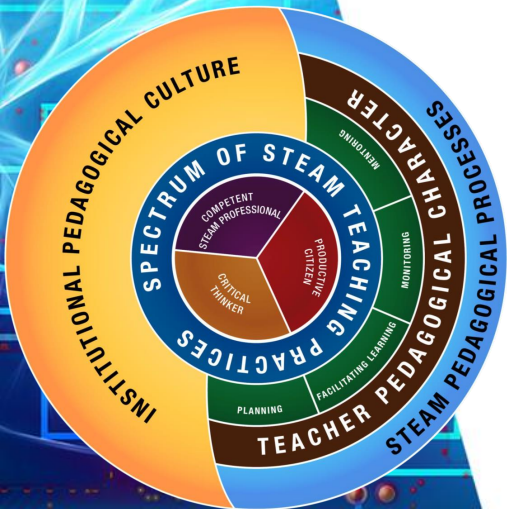
# Model Continuum:
## Distinguished STEAM Educators

- champion modelling and mentoring of **research-based pedagogy** that promote inquiry, problem- and product-based learning, curriculum planning, management of learning, and valuable use of technology to create **lifelong impact** in the lives of other STEAM professionals, colleagues, diverse learners/students and the community.
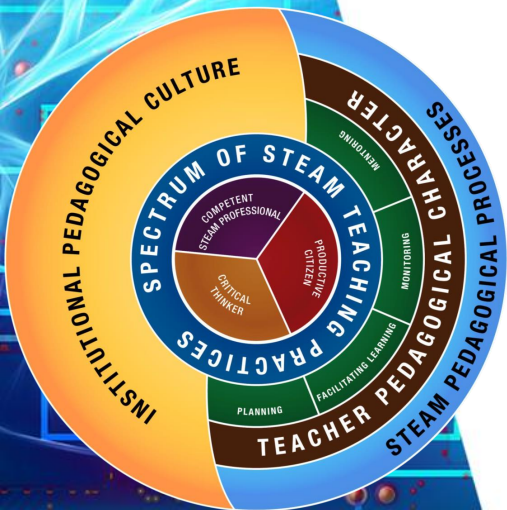
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# Model Continuum:
## Distinguished STEAM Educators

- mentor other STEAM Educators on the **effective use of assessment strategies, monitoring and evaluation, and feedback system** consistent with the curriculum requirement, as well as the **effective use of assessment data** to address challenges in implementing effective teaching and learning practices
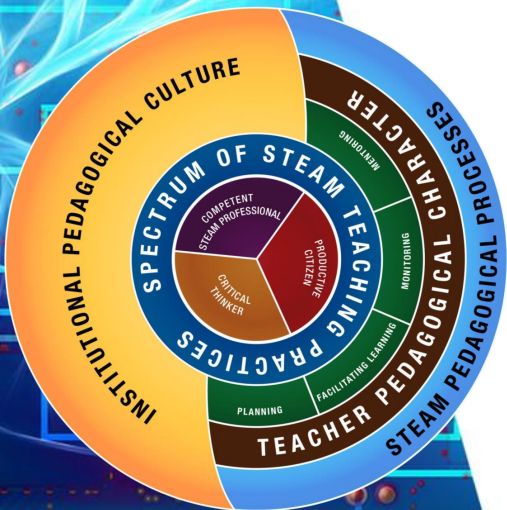
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# Model Continuum:
## Distinguished STEAM Educators

- mentor colleagues on the effective conduct of academic consultation as evidenced by the learners' improvement

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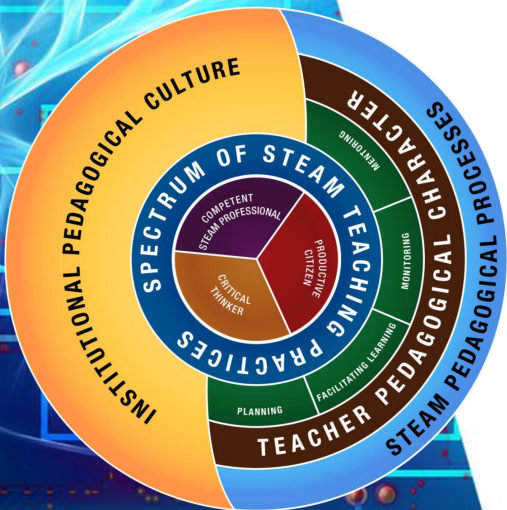# Model Continuum:
## Distinguished STEAM Educators

- inspire other STEAM educators to promote **positive relationship with learners** in an environment conducive for learning, thereby inspiring learners to aim for excellence

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## Model Continuum:
## Distinguished STEAM Educators

- inspire colleagues to conscientiously **plan the pedagogical processes** towards effective utilization of knowledge, skills and values to support the STEAM teaching and learning process
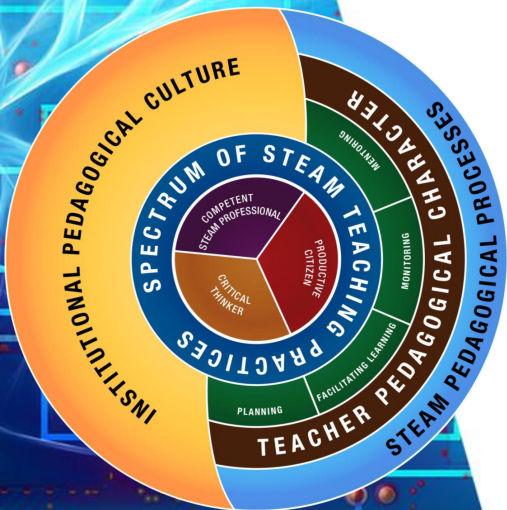
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- inspire other STEAM educators to model pedagogical processes that put premium on **acquisition, demonstration, and evaluation of critical thinking** among learners
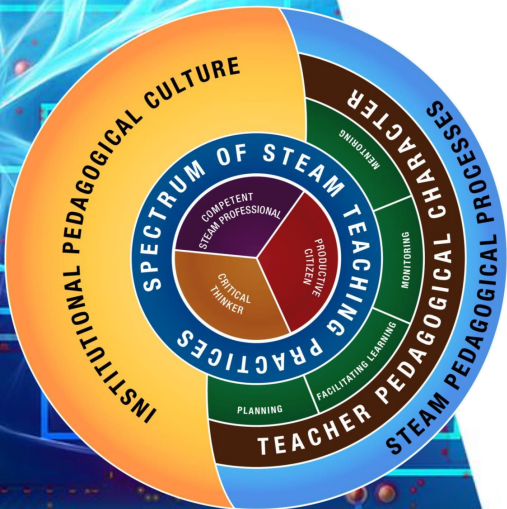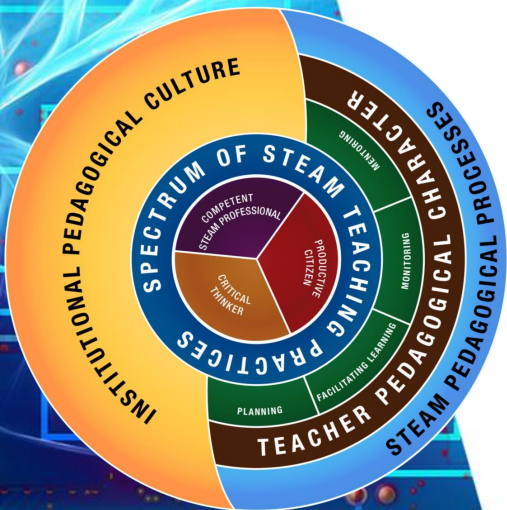
- mentor other STEAM educators  the conscious integration in the pedagogical processes, whenever reasonable and relevant, the development of knowledge, skills, and values that could help prepare learners pass the licensure examination

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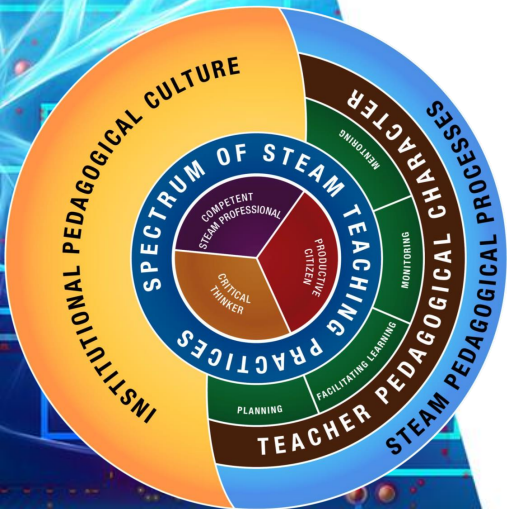Jovito Anito Jr., Marie Paz Morales, Caesar Palisoc

- mentor other STEAM educators on prioritizing the development of skills, knowledge, and values required of the profession thereby **enhancing employability and employment success** of graduates

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# Who are the STEAM Educators?

#STEAMatic
#STEAMing
#HOT

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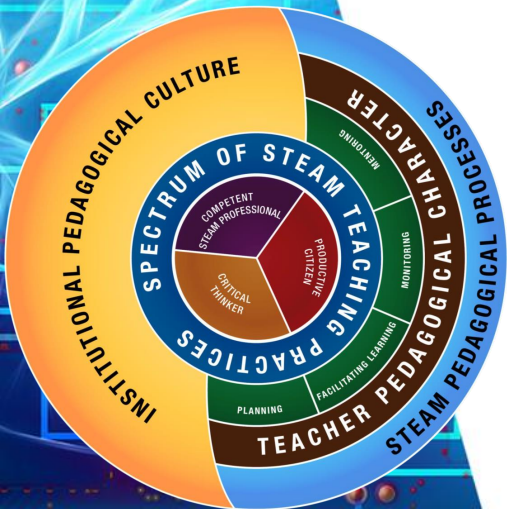
# What's Next…



- Development and Validation of a Scale on Pedagogical Practices

- Integration with the Proficiency Indicators Scale for STEAM Educators *(Morales, Anito, Avilla, Abulon, Palisoc, 2019)*

- Investigating the Philippine STEAM Pedagogical Culture

- Pipelining and Triangulation



**NATIONAL FORUM FOR STEAM IN HIGHER EDUCATION**
Theme: "Modelling TPACK in Philippine STEAM (Science, Technology, Engineering, Agri-Fisheries, Mathematics Education)"

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# Thank you for your kind attention

# THANK YOU!

## Stay HOT...
## transcend boundaries...

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