Culture and Language Context - Physics
Overview and Template

It is intended that Culturally-Sensitive Curriculum Materials in Physics (CS-CMIP) which will be developed on the bases of (1) cultural indices of the specific ethnic groups in the Philippines and (2) learners' views or perspective on the use of culture and language in the teaching and learning process of physics concepts. With the framework that cultural and language context Physics learning will enhance meaning making and transfer of physics ideas to students, CS-CMIP may eventually lead to a successful concept attainment or enhancement.
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“Culture determines what is considered worthy of study. Learning involves learning and within culture.”

- Jordan, Carlile, & Stack (2008)

It is a further claim by Jordan and others that formal education reproduces culture. This implied that students’ cultural perspective influence how they construct knowledge. Their cultural background influences their cognitive style and motivation. The manner in which they learn is highly dependent on the traditions, ethnicity, culture, and even language of the learners. Aikenhead (2001) argued that cross-cultural strategies or cultural integration provides opportunities for students to learn Western science content taught in the context of local community’s traditions. They adhere to “autonomous acculturation” that emphasizes learning western science content but still embracing one’s culture and tradition.

On language aspect, UNESCO (2005) provided sufficient researches that claimed rational and credible basis for use of child’s home language in bilingual education. General findings suggest that mother tongue is an essential foundation for all learning. It is therefore important that all children use their mother tongue when they enter school for the first time. Learning through the mother tongue helps children learn about the nature of language as well as about how to use the language to make sense of the world. International research findings show, on the other hand, that bilingual education starting from the mother tongue provides many pedagogical advantages. Interdependence hypothesis can generally claim that academic language proficiency transfers across language. This suggests that students who acquired proficiency in L1 (first language: Mother-tongue) will make stronger progress in L2 (second language: English).

With language- and culture-based learning, educators can probably reap the benefits of achieving set goal of acquiring scientific and technological literacy. These language- and culture-based learning may be an extension of UPNISMED’s (2005) integration of “community-based” enhancement of concept and skill attainment through the Science and Mathematics curriculum enhancement to achieve scientifically and technologically literate Filipinos.

A new effort on the theme “learning according to cultural and language background” that promotes sustainability and preservation of indigenous knowledge is foreseen by DOST-SEI to be the future track or roadmap to better scientifically literate Filipinos (Brawner, 2011). This attempt also follows the major goals and aims of the 21st Century Framework which includes three (3) key elements to learning: (1) 21st century Interdisciplinary themes; (2) Learning and Innovation Skills; and (3) Information Media and Technology Skills. With these efforts, DepEd’s vision of providing curriculum for the development of local culture and tradition may be realized. K-12 curriculum outlook to be RESPONSIVE (flexibility to local needs) may be concretized with DOST-SEI’s future track and the integration of culture and language paradigm.
**TERMS AND DEFINITIONS**

**Indigenous Science Knowledge**
- Culturally-dependent collective rational perceiving of reality. (Ogawa, 2004)

**Culture**
- Cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving.

**Scientific Literacy**
- The level of understanding of science and technology needed to function in a modern industrialized world. (Miller, 2007)

**Ethnicity**
- The learner’s group, category or classification according to values, beliefs, traditions, and culture.

**Language**
- The learner’s mother tongue or lingua franca

**Instructional Congruence Theory**
- It is a model that presents a process of mediating the nature of academic content with the students’ language and cultural background. (Lee, et.al. 2007; Johnson, 2005)

**Cross-Cultural Strategy**
- A model which is aimed at the development of culturally sensitive instructional strategies and curriculum materials that support student learning within any particular community.
In the quest to attain scientific and technological literacy, many researches delved on a lot of strategies and approaches to make science more appealing and interesting to students. With the appeal and interest on the table, learning science and achieving literacy is much more realistic and doable.

From a constructivist perspective, being aware of the students’ cultural background in order to understand how they construct knowledge and make sense of the world is one thing. Another thing is using this knowledge on students’ cultural background in planning effective lessons in cultural perspective of the students. Many researchers were able to attain success with this framework. Aikenhead’s (2006) Cross-Cultural Studies, Aikenhead’s (2001) Project Rekindling Traditions; Beckert’s (2001) Conversion and Context in Physics Education; and Anand’s (2008) School in a Box are some examples of educators who were able to achieve conceptual understanding and skill development.

UPNISMED believed that community-based approach may lead to better science teaching and learning. Foreign authors and educators, on the other hand, suggested the use of culture and language for instilling positive view of science. They believed that students are better with the cultural and language integration in understanding science concepts and theories. Further studies on this aspect promoted the development of indigenous science knowledge. As an extension of community-based approach, it is then perceived that culture-based and language-based approach will go miles when used in the teaching and learning processes of science concepts particularly physics concepts. In this viewpoint, physics and other science lessons will be designed community – based, culture-based and language-based extracting all the benefits of the three frameworks in one curriculum design.

In the design, instructional congruence framework plays a significant part. Instructional congruence is the process of mediating the nature of academic content with the students’ language and cultural experience (Lee, et.al. 2007; Johnson, 2005). In addition, cultural experiences are the knowledge that students have obtained from their community. Whereas students’ language experiences are the languages used in their daily life. As reiterated by Layks & Lee (2005), when the knowledge of science incorporates with students’ language and experiences, students will be more engaged in the learning process and science will be easier, meaningful and relevant to students. Learning environment that puts emphasis on instructional congruence could make students become bicultural, bilingual and bi-literate person not only in terms of knowledge, values and practice in science, but also in aspects of their language and culture.
Accordingly, the 4 main characteristics of Instructional congruence (Lee & Fradd, 2001; Johnson, 2005) are as follows:

- **Role of Teacher.** Instruction provides an emphasis on teachers’ assessment and approaches to meet the students’ needs and use the students’ language and funds of knowledge in learning science. Thus, the teacher needs to identify what the students need. Their culture and their daily language use. These are to be integrated in the instructional design.

- **Instructional congruence is subject-specific pedagogy of teaching model based on particular cultural model.** Lee & Fradd (2001) said that in learning science, the model forms on congruence between scientific knowledge and the inquiry process, with students’ language and cultural experience. Johnson (2005) added that teachers need to give similar emphasis between scientific knowledge and the actual inquiry process with the students’ language and cultural experience. Further teachers are expected to teach science in the context which allows students to create connections between their languages so that science content will be easily understood, meaningful and relevant to students.

- **Learning Science and Learning Literacy is believed to be able to improve students’ mastery of writing skills, encourage more discussion and allows more sharing on cultural experience.**

- **Instructional congruence is constructivist in approach.** Students develop knowledge by integrating their experiences with the environment which also promote academic achievement in science and literacy (Cuevas, et.al, 2005; Lee, et.al. 2006). In this aspect of Instructional Congruence, the role of the teacher is to ensure using students’ funds of knowledge and language that are relevant to interact with their environment, and relate science with their respective funds of knowledge and environment. Finally, instructional congruence also emphasizes scientific values and attitudes in learning science, such as curiosity, interest, honesty, open and critical mind, reasoning, argumentation, questioning etc.
Localized Physics

- Language-based
  - Mother tongue
- Culture-based
  - Ethnicity, values, mores
  - Subject-specificity
  - Teacher-facilitator role
  - Constructivist Approach
  - Learning Science Learning Literacy
- Community-based
- Instructional Congruence
PHASES OF CULTURAL AND LANGUAGE CONTEXT PHYSICS CURRICULUM

Cultural and language context physics curriculum is a highly specialized and localized curriculum that integrates the ethnicity, tradition, culture, and the mother tongue of the learner. It is believed that with this framework, learners will be learning the concepts and skills in physics according to their cultural and language background. This gives them the opportunity to expound the concepts of science particularly physics in a more localized manner preserving as well their cultural heritage and language. However, the framework offers provision for culture and language shift to adhere to the standard but still instill academic proficiency on the part of learning physics concepts.

Localization of the curriculum will be achieved through survey. Thus, the first task of the curriculum designer is to distinguish the specific learning characteristics of the learners influenced by their cultural and language background. From these characteristics, design of the curriculum will be highly influenced by the Instructional Congruence Framework (ICF). To come up with a blueprint of a curriculum, the designer will have to undergo 3 major stages: (1) Preliminaries; (2) Design; and (3) Evaluation.

PRELIMINARIES

In this stage, the designer would need to administer the Value Survey Module 2008 (VSM 08) to the intended learners to identify the cultural profile of the learners. These cultural profiles in 5 indices were described by Hofstede (2001) as (1) Power Distance Index (PDI), (2) Individualism (IDV), (3) Masculinity (MAS), (4) Uncertainty Avoidance (UAI), and (5) Long-term Orientation (LTO). After administration, data will be processed as prescribed by Hofstede’s data processing indicated in the module. An attachment of the module and the guidelines is included as Appendix A. Cultural profiling as a preliminary portion is needed to distinguish the distinct cultural learning background of the students or the learners.

Part of the preliminaries to the design of the culturally enhanced curriculum is the administration of the Culturally Sensitive – Physics Learning Environment Survey (CS-PLES)-Appendix B. The purpose of which is to pair or match the cultural indices with the expectations of the learner on a culturally-influenced physics learning environment. Additionally, being aware of how students would perceive a learning environment that injects culture and language may bring better foundation in the design of curriculum materials. With such indexed characteristics of the learners, instructional designs can be anchored on models that focus on the use of local community’s traditions while learning the Western science content.
DESIGN

The design stage comes in 3 phases: (1) Introductory Details; (2) Phase 1 – Setting the Learning; (3) Phase 2 – Assessing Learning; and (4) Phase 3 - Facilitating Learning. Details of the different phases will be discussed in the succeeding pages.

Part of the design is the production of the pair student module. This student module should feature the distinct cultural learning characteristics of the learners. The student module should also be presented as a guided module where the teacher will still serve as the facilitator of the learning process. The key element of the student module is the localization of the discussion and the activities. This will be coupled with the use of mother tongue both as the language of the module and the language of the teacher facilitator.

EVALUATION

The evaluation of the designed curriculum is composed of 2 major stages: (1) Validation by experts and (2) implementation design. Validation by experts will be done using the instrument known as the Culturally-Sensitive Curriculum Material Evaluation Tool (CS-CMET) – Appendix C. Revisions will have to be done after this first stage. Implementation of the module or the curriculum will be executed. Success of the module will highly depend on how well it can elevate or enhance the scientific skills and physics concept attainment of the student-participants.
The cover page must be presentable. The images should show indigenous products, local traditions or beliefs, language of the learner or mother tongue of the learner, and local materials. In this page, the designer should also show the different lessons or topics included in the module e.g. Impan kokoneta’y Physics and Panagsukat tan Sukat. From this page, the teacher user would know that there are 2 lessons in this particular module.
ENERGY IN SOCIETY

This unit is concerned with the importance of energy resources and energy use in the development of the society as a whole. Students should be able appreciate local resources and practice proper utilization of energy for sustainability.

Competencies

At the end of the unit, students should be able to:

1. Explain the role of energy in the development of human society from the industrial age to the knowledge-based society.
2. Discuss examples of the interaction among energy, technology and society [e.g., effects of energy in the environment, economic growth and energy demand, energy resources and energy crises, etc.]
3. Infer that the total mass-energy in the universe is constant.

**Unit Details**

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<thead>
<tr>
<th>Unit Details</th>
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<td>Unit Title</td>
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<tr>
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<td>High School Physics</td>
</tr>
<tr>
<td>Grade Level</td>
<td>Fourth Year High School (Grade 10)</td>
</tr>
<tr>
<td>Time Frame</td>
<td>1 week (5 sessions)</td>
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<td>Ethnic Group</td>
<td>Pangasinan</td>
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<tr>
<td>Region and Province</td>
<td>Region 1 – Pangasinan</td>
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<tr>
<td>School</td>
<td>Pangasinan National High School</td>
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<tr>
<td>Mother Tongue (Language)</td>
<td>Pangasinan</td>
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<tr>
<td>Developer</td>
<td>Marie Paz E. Morales</td>
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</table>

This is the first page of the Teacher’s module. This will come after the cover page. It includes details about the lesson and about the learners. The first part of which is an introduction of the unit provided by the curriculum designer. Then the competencies are listed after the introduction. The designer can include the distinct characteristics of the learners in this part of the module. Finally, the unit details will be specified as shown in the sample.
This is phase 1 entitled “Setting the Learning”. This phase emphasizes the goals and objectives of learning. The focus here is to make sure that our goals are structured in terms of important accomplishment reflecting understanding.

Culture and tradition of the group of learners are intertwined with the lesson and are expressed in terms of goals of understanding. The goals here wish to attain making meaning and individual transfer through culture and tradition.

In order for students to make sense of the lesson, making meaning would entail relating the facts and concepts with real-life situations. Such will be played by the integrated culture and language. “Transfer” refers to the ultimate desired accomplishment: what, in the end, should students be able to do on their own with all this ‘content’ if this and other related units are successful?

Part of this phase is the identification of the skills that will be enhanced by the student module. This will be expressed as science inquiry and manipulative skills.

Finally, as guide in the attainment of our goals to make meaning and attain transfer, key questions are necessary.

Below are important queries to consider in the design process:

- What should students be able to do on their own (transfer)?
- What understandings should they leave with?
- What big ideas should anchor and organize the content, framed as Key Questions?
- What do common/predictable misunderstandings suggest what the desired understandings ought to be?
This phase emphasizes planning assessment strategies that will help the teacher realize the set goals in phase 1. This will include diagnostic assessment, formative assessment and summative assessment. Diagnostics tests included are in the form of pre-tests or pre-activities. Formative assessments, on the other hand are in the form of paper and pencil test, seatworks, exercises, and authentic or performance test.

A key feature of this phase is the inclusion of performance task. Assessing for understanding requires evidence of the student’s ability to insightfully explain or interpret their learning - to “show their work” and to “justify” or “support” their performance/product with commentary.

Assessing for understanding also requires evidence of the student’s ability to apply their learning in new, varied, and realistic situations - transfer - in which they must “do” the subject as opposed to merely answering pat questions.

The framework has adopted UBD’s 6 Facets of Understanding believed to provide a helpful structure for building appropriate assessment tasks:

- **Explain**: the student generalizes, makes connections, has a sound theory, can put in theory own words
- **Interpret**: the student offers a plausible and supported account of text, data, and experience
- **Apply**: the student can transfer, adapt, adjust, and address novel issues & problems
- **Perspective**: the student can see from different points of view
- **Empathy**: the student can walk in the shoes of people/characters
- **Self-understanding**: the student can self-assess, see the limits of their understanding, and reflect metacognitively

**GRASPS** is an acronym to help designers construct authentic scenarios for performance tasks:

- **Goal**: the goal or challenge statement in the scenario
- **Role**: the role the student plays in the scenario
- **Audience**: the audience/client that the student must be concerned with in doing the task
- **Situation**: the particular setting/context and its constraints and opportunities
- **Performance**: the specific performance or product expected
Formative Assessment

WORKSHEET

Activity 6: Refraction na Sila

Problem/Situation

1. Walay sayo ya ray na siley na sannub ed tapew na Langyen gulf ya say angle of incidence to ed tapew na danum et 35°. Kompute ya ko duley na refracted angle no say index of refraction na dayat et 1.33.

2. Dimalan si siley ya light ray ed dagen insan ed siley lamet ya medium ya ag tayo anta no saato masu ya medium. Say incident angle et 23° tau say refracted angle et 14°. Anto no index of refraction to yam ag tayo antan medium?

Sasay Detalye:

\[ \theta = 30.8° \]

Sasayanapeyn: \( n \)

Sasay Detalye:

\[ \theta = 10° \]

Sasayanapeyn: \( n_1 \)

Sasay Detalye:

\[ \theta = 25° \]

Sasayanapeyn: \( n_2 \)

Sasay Detalye:

\[ \theta = 14° \]

Sasayanapeyn: \( n_3 \)

General Directions:

- Give me your ray diagramming insan ya ko describe no anta'yu isura na imahe.
- Go to your menu ray ok na visayas. 
  - Real virtual, akadalog, akatumbu, borelalog, 
  - Mommely, parchon sukat ed samay kaugusan

Ray Diagramming

<table>
<thead>
<tr>
<th>Real</th>
<th>Ballktdad</th>
<th>Mas melag</th>
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<tr>
<td>Real</td>
<td>Ballktdad</td>
<td>Mas baleg</td>
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<tr>
<td>Real</td>
<td>Ballktdad</td>
<td>Parchon kabaleg</td>
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Izuru'y Imaje

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The focus in **PHASE 3** is to make sure that what we teach and how we teach follows logically from and aligns with phases 1 and 2. The learning events are designed to address three interrelated goals: Acquisition, Meaning Making, and Transfer.

Teaching for understanding requires that students be given numerous opportunities to draw inferences and make generalizations for them (with teacher’s help). Understandings cannot be simply told; they have to be actively “constructed” by the learner.

**Teaching** -

- should reflect the instructional approaches most appropriate to the goals (not what is easiest or most comfortable for the teacher)

- should employ resources most appropriate to the goals (not simply march through a textbook or commercial program)

- be responsive to differences in learners’ readiness, interests, and preferred ways of learning.
In this phase there are several features: (1) Activity Sheets; (2) Work sheet; (3) Teaching Tips; and (4) Journal Log Sheets

**Activity sheets** will be designed customized to the learners’ cultural profile; learners’ mother-tongue; and content standards & competencies. It should be noted that the activity sheets are set of activities that will help the teacher facilitate inquiry and meaningful learning of physics concepts. These activity sheets will be a major part of the student module which will be designed as a guided module for the students. Mother-tongue of the learner will be the medium for the activity as it is believed that they will be able to easily grasp the meaning and plot of the activity.

**Work Sheets** will be accompanying the Activity Sheets. These should be specifically designed to fit preceding activity. Spaces for details of the activity and the learners or group of learners are provided. Appropriate spaces for activity objective and observations are also provided. Table templates will also be available if necessary.
Teaching Tips Box will be provided for each of the activity sheet and the corresponding worksheet. This is intended to help the teacher plan the execution or delivery of the lesson.

Suggestions on how to conduct the pre-activity as well as the post activity are also provided in this box. Safety precautions during the conduct of the activity are also clear so as to insure the safety of the students while experiencing hands on science.

Finally, a way of integrating culture and tradition is also provided to guarantee a localized and meaningful physics learning experience.

Journal Log Sheets will be provided after the lesson. This is part where students are to reflect on what they were able to assimilate from the different activities provided in a particular lesson.

Questions are provided in the log sheets to serve as guide in the reflective or metacognitive activity of the students. The questions here include the benefits if any of the integration of culture and language to the learners.

After the journal, you may include an “end of lesson notes”. This will provide a sample strategy on how wills the teacher “wrap up” the lesson.
The student module includes several lessons covered in the physics unit specified in the Philippine Secondary Schools Competencies (PSSC). The module comes in different parts: (1) overview of the module; (2) title page of the lesson; (3) introduction to the lesson; (4) lesson proper – introductory discussion, activity, post discussion of activity; (5) summary of the lesson; (6) journal log sheets; (7) end of module summary; (8) references and websites; and (9) note pages allotted for students’ consumption. It is to be noted that the whole student module will be written in the learner’s mother-tongue. However, technical terms are maintained during the discussion parts of the module.

**Unit Overview** will need to express the content of the whole module. It will have to show the full content of the module including the activities that will be used while studying the module. The number of lessons can be mentioned and the expectations of the students can also be included. One feature of the overview is how the lessons in the unit are introduced and at the same time connect these lessons with the culture, tradition and mother tongue of the learners. Another key part of the unit overview is the inclusion of the key questions of the unit as planned in the teacher’s module or design. These key questions are the guide to the big ideas that are needed to be transferred to the consciousness of the learners.

**Title Page** of the lesson should attract the interest of the learner. The image that will be included will need to show how you will localize the study of the topics in this lesson to the context of the community. The image should also be so close to the lessons that will be presented. The example shows a mirage image of Lingayen Gulf. Mirrage formation is a major topic in the lesson.
Introduction to the Lesson page. This page will have to further capture the interest of the students through the title and the magnificent image included. Again as the curriculum designer, you will have to note what local materials, tradition or culture may be integrated in the introductory statements. The example provided made use of the image of sunset of Lingayen Gulf to show the pride of Pangasinan. Introductory statements also include a run through of the topics within the lesson.

Lesson Proper includes (1) introductory statements which feature a local product or tradition and belief of the learners; (2) activity sheets; and (3) post discussion. The post discussion is a summary of the supposed concepts that are assimilated by the learners. The summary is usually linked to or connected to the introductory statement and the activity outputs or expected results. This provides a validation of how culture connects with the physics concepts.
Summary of the Lesson. This page will have to relate all the introductory discussions, activities and post discussions of the lesson. It wraps up the whole lesson providing connectivity of the 1st activity to the last activity while featuring the local tradition and beliefs of the learners as well. The basic concepts for transfer are mentioned and some of the discussions contributes to making sense of the learning by the learners.

Journal Log Sheets will be very helpful in facilitating the development of metacognitive skills of the learners. In a way, the teacher-facilitator will be able to deduce information on how the students were able to attain understanding of the concepts of physics the integration of culture and language. There are 4 guide questions to help students in the reflective analysis.
End of module summary will try to sum up all the transfer concepts. This will eventually answer the key questions provided at the start of the module. Links between and among topics will be very evident in this part of the module.