



Technical-Vocational Livelihood Education: Emerging Trends in Contextualised Mathematics Teaching

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Abstract: Technical-Vocational Livelihood Education (TVLE) Strategies and Indicators (S&Is) are the strategic procedures needed to come up with a well-informed contextualised learning instruction. This study is aimed at exploring the trends in Technical-Vocational Livelihood Education. The focus of this study is on soliciting relevant strategies and indicators (S&I) that can be utilised to develop a contextualised mathematics teaching module. S&Is in this study are consolidated from various experts in the field of curriculum contextualisation who were purposively selected from various regions representing the DepEd Manila, DepEd Mindoro, Marinduque, Romblon, and Palawan (MIMAROPA), DepEd Bicol region (Region 5), and DepEd Central Visayas (Region 7) recommended by the Department of Education (DepEd) Manila. Formal interviews and coding of consolidated experts' experiences have passed through a qualitative thematic analysis to obtain a profound understanding of the strategies and indicators. After a thorough investigation of the information gathered, related studies, and theoretical reviews, the study resulted in the seven (7) stages of a contextualised mathematics teaching module such as 1) Planning, 2) Assessment of the curriculum guide and resources, 3) Collaboration and Consultative Meeting, 4) Crafting and Developing of the Contextualise Learning Modules/Lessons, 5) Implementation, 6) Monitoring, and 7) Evaluation and feedback. The first four (4) stages are the developmental phase cons Planning, Assessment, Collaboration, and Crafting of the working module (PACC). While, the remaining three stages to implement, monitor, and conducts of evaluation and feedback are on the validation phase. As module, the contextualised mathematics teaching can be utilised as a training guide for teachers in Technical-Vocational Livelihood Education strands of the K-12 curriculum. Further research may be conducted to validate the most appropriate modular approach in teaching specific subjects.

Keywords: Contextualised teaching, K-12 education, mathematics, module, technical-vocational education

1. Introduction

The 21st century period has marked the birth of Contextualized Learning. Contextual Teaching and Learning (CTL) is a method to motivate and challenge learners in the classroom and has been recognized by many experts as an effective method. It is a conception of teaching and learning that assists educators in relating subject material contents to actual circumstances; and persuade the learners to link facts to their real-life as affiliates of a family and citizens of their country (Welter, 2011; Finch and Crunkilton, 1999). As stipulated in the Teachers' Guide for Applied Academic Excellence of the Southeast Asian Ministers of Education Organisation-Regional Centre for Educational Innovation and Technology (SEAMEO INNOTECH), CTL is anchored on the following key principles: (1) Concrete images are easier to absorb and retain; (2) Learning involves the whole mind and body; (3) Learning consists of the creation of meaning, values and actionable knowledge by the learner; and (4) Learning can be fun. Along with these propositions, contextualisation for the subjects in the actual teaching and learning process is an avenue for the teachers and learners to be at ease while acquiring specific knowledge. It tends to defy the common idea that a classroom is a place where one cannot have fun and ease. Learners' attention is attained if the lesson is close to their experiences as this is the meaning of contextualisation.

In a quasi-experiment done by Selvianiresa and Prabawanto (2017), the result revealed that CTL learning was adequate when there was collective communication with learners, a high level of thinking in the lesson (Tee et al., 2020), a link to actual contexts, and addition of content with other areas of abilities. A pre-experimental study was done by Syamsuddin and Istiyono (2018) involving 29 learners in a class as an experimental class to recognise the usefulness of mathematics learning using the CTL approach in Junior High School. The study referred to three measures: the attainment of learning usefulness in the "classical mastery learning," learner actions associated to learning events, and the constructive reply of the learner to the introduction of learning using the CTL approach. The results proved that the CTL approach in mathematics in the three criteria was effective.

Contextualisation promotes learning transfer (Boroch et al., 2007; Stone et al., 2006). In addition, Kaplan, Wiley and Maertz Jr (2011) hypothesised that the connections between situations are crucial, whether in a different setting or an abstract testing condition if learners transmit their knowledge and skills outside the classroom. Understanding when and where to implement earlier learned skills needs metacognition abilities (Lai, 2011). It is believed that connecting basic skills instruction to the genuine content area increases the transferred skills to that particular setting. Wyatt (2015) in her rubrics on the enactment of the contextualisation strategy, suggested the review of the decision-making styles of the six teachers who scored high to understand contextualisation. The theoretical framework she used in her study was the socio-cultural theory, which states that "the human mind, as an artifact, developed out of social and cultural aspects reflects the goals and values of the environment in which it progresses" (Bruner, 2009; Vygotskii, 2012). The study done by Perin (2011) found that skills subjects like reading, writing and mathematics are taught separately from the skills to which they must be applied. She averred that problems would arise if the learner is expected to apply newly learned skills in a very different setting. According to the study conducted by Barnett and Ceci (2002), it would be hard for a learner to learn in a new environment. In addition, learners are not interested in learning the skills taught because they do not distinguish them positively related to their individual educational goals (Cavazos Jr, Johnson, and Sparrow, 2010).

Furthermore, Fisher and Ivey (2005) mentioned that weaknesses in academic abilities might not be given by the teacher whose aim is only to impart the subject material and not the basic skills. If basic skills and content-area instruction could be brought closer together, it would perhaps result in increased proficiency of the learner in reading, writing, and mathematics skills and the ability of the learner to implement the said skills in expressive habits (Baker, Hope, & Karandjeff, 2009; Lee & Spratley, 2010). Embedding educational instructions in corrective content could help due to the significant difference in basic skills demand across different specialisations categories (Goldman & Bisanz, 2002; Stahl & Shanahan, 2004).

In K-12 Mathematics, the goals of the subject to enhance critical thinking and problem-solving skill. However, the actual scenario is contrary to the expected result. The contextual strands are: (1) Content is about number and numbers sense, measurement, geometry, patterns and algebra, statistics, and probability; (2) Skills and processes contain knowing and understanding, computing and solving, visualising and modelling, representing and communicating, conjecturing, proving, reasoning, decision making, applying, and connecting; (3) Values and attitude deal with accuracy, creativity, objectivity, perseverance, and productivity; (4) Mathematical tools are about manipulative objects, measuring device, calculators and computers, smartphones and tablet personal computers, and internet; and (5) Contexts are geared toward beliefs, environment, language, and culture. However, there is no link between them and the learners because the latter's prior knowledge and experiences are not fully realised and utilised. At present, the challenge for the Mathematics teachers who are teaching technical-vocational subjects is to make mathematical concepts applicable in practical terms such as how they are utilised in understanding the concepts in Technology and Livelihood Education (TLE). Practical terms employed in mathematical concepts is where the contextualisation took place. The challenge now for the Mathematics teachers is to apply the process of contextualising mathematics lessons and recognise which the learners functionally need skills Mathematics in Technology Livelihood Education/Technical-Vocational-Livelihood (TLE/TVL). Thus, Mathematics must be viewed as a tool that would fully capture not only its concepts but also its practical application for TLE/TVLE.

Therefore, the main objective of this study is to develop a model on the contextualisation of Mathematics for TLE/TVLE through the exploration of emerging mathematical contexts. Special mathematical skills that are practically necessary and suitable for working on the outputs of technical-vocational courses will be studied carefully. This contextualisation will be done to create more effective learning conditions. The connection of basic skills in education to applications and life goals is in line with the theory of constructivism, which prioritises students' interests and needs at the core of education.

This study will contribute to the development of a training package as a curriculum guide for the teachers involved in the contextualisation scheme. It will also guide the teachers on how they can effectively teach the learners with Mathematics in TLE/TVL. The development of this is very timely as Philippine education is in the transition to K-12 education. This is essential since TLE/TVLE subjects require skills enhancement in preparation for the world of work. The ASEAN qualification framework of the ASEAN 2015 was created and become mandated in the Commission on Higher Education (CHED) Memorandum Order No. 46, s. 2012 section 5. It pertains to the skills needed by the participating ASEAN region to participate in the national and international levels. The member nations agreed on the learners' qualifications for lifelong learning toward labour mobility in the Asia-Pacific region.

2. Conceptual Learning

Contextual strands were derived from the identified conceptual framework of the mandated K-12 curriculum guide crafted by the experts in mathematics curriculum development. These are experiential (Kolb, 1984), reflective thinking (Dewey, 1933), constructivism (Piaget, 2013; Bruner, 1966), cooperative learning (Tran, 2013), and inquiry-based learning (Vygotskii, 2012). Table 1 shows the Contextual Learning Matrix Form (CLMF) (De Lumen, 2008).

Table 1 - The Contextual Learning Matrix Form.

Learning Outcome	Assessment Criteria	Learning Content			Communications (English)
		Technology	Science	Mathematics	
LO1.					
LO2.					
LO3.					
LO4.					
LO5.					

2.1 Learning Outcomes

Learning outcomes identify what the learner will know and be able to do at the end of a lesson. In the Applied Academics for Excellence (APEX) classrooms, the contents are introduced using a variety of learning methodologies that enable learners to connect what they already know with what they are expected to learn. Project APEX (Applied Academics for Excellence) of DepEd has adopted a teaching process recommended by the Centre for Occupational Research and Development (CORD), which follows the constructivist viewpoint. It follows the constructivist method in teaching which includes the acronym REACT strategy which stands for Relating, Experiencing, Applying, Cooperating, and Transferring (Utami, 2016).

2.2 Relating

Learning, speaking of life experience situation, or relating, is a type of contextual learning which commonly happens to children. Difficulty in giving this significant setting for learning is expected as children grow older. If there is an attempt of the curriculum to situate learning in the setting of life experiences, the curriculum should demand the learners' attentiveness to daily highlights, actions, and situations. It should connect the said daily happenings to new information that will be assimilated or a difficulty to be resolved.

2.3 Applying

Implementing thoughts and information in a valuable context regularly projects the learner to an abstract future (a probable profession or occupation) or an unaware setting (an office or factory). In contextual learning courses, applications are regularly founded on work-related actions. This occurs mostly via text, video, labs, and activities. In most schools, these contextual learning experiences will be gone after with direct involvements like plant visits, mentoring activities, and internships.

2.4 Cooperating

Cooperating is learning speaking of distribution, answering, and cooperating with other learners in which it is a main instructional approach in contextual instruction. Its experience aids most learners in learning the content and is reliable

with the practical emphasis of contextual teaching. Employers believe that workers who can connect efficiently, give out information spontaneously, and exerts securely in a team situation are vastly appreciated in work. These, therefore, are enough reasons to encourage the learners to improve collaborative skills while they are still students.

The laboratory, as one of the key teaching approaches in contextual courses, is cooperative. Naturally, learners conduct lab activities with buddies or partners. They sometimes do it in groups with three or four members. Finishing the said activities needs assignment, observation, recommendation, and discussion. The data quality gathered by the group is based on the performance of every group member.

2.5 Transferring

Learning speaking of current knowledge, or transferring, utilises and constructs upon what the learners by now recognises. The said method is like relating, in which it calls upon the accustomed. Most conventionally educated high school learners seldom have the extra of evading new learning circumstances. They are challenged with them daily. They are helped by teachers to hold their dignity and improve self-assurance if they create an idea of constructing new learning involvements on what they by now recognise.

According to a survey of undergraduate students who use clickers in the classroom (Buil, Catalán, & Martínez, 2019) the students displayed that the equilibrium of skill and challenge have a constructive effect on their attention, sense of control and autotelic involvement. Both feedbacks given by the clickers and goal clarity had a constructive effect on awareness and sense of control but did not affect the autotelic involvement. Also, results corroborated the optimistic effect of attention and sense of control practised by them on perceived learning. Lastly, autotelic involvement projected both perceived learning and fulfilment.

2.6 Integrated Learning Activities

Integrative learning is a learning concept which defines a drive toward integrated instructions which help students build networks across curricula and educational systems by adopting new technologies and integrating Information and Communications Technology (ICT) in the teaching and learning procedure. Likewise, to make learners ready with the knowledge and skills they require in their subject content. Hence, the teaching profession is developing from teacher-centered to learner-centred learning atmospheres. ICT integration can be construed as the smooth practise of technology for educational progressions like managing curricular material and learner working on technology. It has developed as a vital instrument in improving the students' learning abilities and teachers who adopted it, giving significant learning involvements to the learner (Ghavifekr et al., 2014).

2.7 Expected Output in Integrated Lessons

Expected output refers to the deliverables by the teacher in the classroom (SEAMEO-INNOTECH, 2008). Figure 1 presents the sample contextualised three subject areas; namely, Mathematics, Science and Technical and Livelihood Education (TLE), which are selected in the APEX project for contextualisation. It indicates the academic and technical skills that the learner shall master which will equip him with the necessary skills for employability.

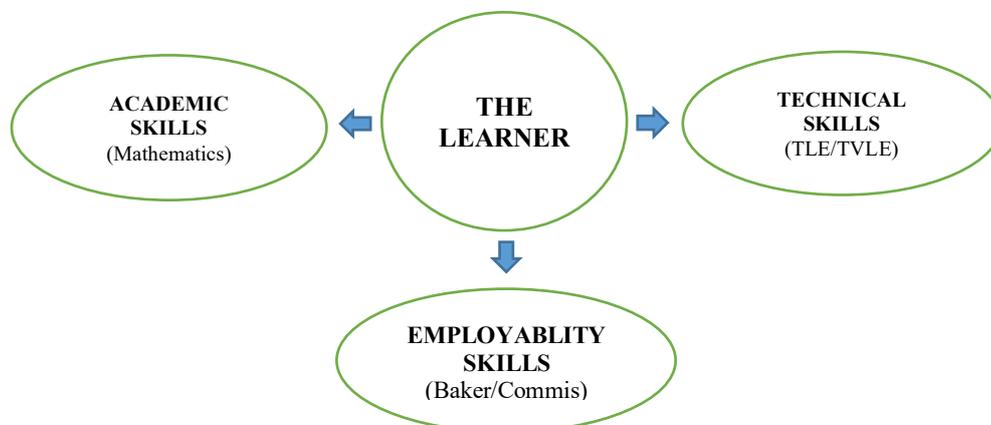


Fig. 1 - The Basic Workplace Model (Halbrooks, 2003).

2.8 Academic Skills in Mathematics

The skills in Mathematics that need to be mastered are the following: (1) Estimate the measures of quantities, especially length, weight/mass, volume, time, angle, temperature and rate; (2) convert measurement from one unit to another in both metric and English Systems; (3) solve cases and problems concerning measurements like perimeter, area, weight, time, speed, temperature, volume/capacity and utilities (meter reading); and (4) solve problems involving conversion of units of measurement.

2.9 Technical Skills in TLE/TVLE

These skills can be contextualised in TLE/TVL and it can be cut down across all strands further. For instance, Bread and Pastry Production in Grades 7 and 8 are exploratory while Lesson 2 in TLE is about Mensuration and Calculation which the learner must be able to perform. The learning outcomes include: LO1. Familiarise oneself with the table of weights and measures in baking; LO2. Apply basic mathematical operations in calculating weights and measures; and LO3. Measure dry and liquid ingredients accurately.

In the Home Economics subject of Grades 9 and 10, one of the specialisations is Bread and Pastry Production and Module 2 is about Preparing and Presenting Cakes which the learner must be able to perform. Lesson 1 learner must prepare and bake basic and specialised cakes. They will earn National Certificate 1 (NC1) in Food Trades when they finish this specialisation.

If a learner decides to continue Bread and Pastry in Senior High School, the Qualification Title is Bread and Pastry Production; Unit of Competency is Prepare and Produce Pastry Products; and Module Title is Preparing and Producing Pastry Products. The learning outcomes are: LO1. Prepare pastry products; LO2 Decorate and present pastry products; and LO3 Store pastry products. The learner will earn NC II after finishing this course.

2.10 Employability Skills

After earning NC1 and NC2 certificates, the learner is now ready for the world of work. If they want to earn money after senior high, they can now apply as a baker in a bakeshop. Armed with the knowledge and skills they have mastered from the contextualisation of Mathematics for TLE/TVL, they are now given the assurance that they will be able to pass the interview and trade test that will be conducted by future employers. In addition, the certificates awarded to learners in school is recognised by Technical Education Skills Development Authority (TESDA) which the learners can use in applying for jobs abroad where their acquired skills are in demand.

In order to prepare learners for higher-level skills development, the K-12 curriculum also included soft skills such as leadership skills, teamwork, communication and problem-solving skills, work ethics, adaptability, and interpersonal abilities. Soft skills in mathematics lessons in the lower grade levels include basic arithmetic, measurement, and figurative conceptualisation. The notion is in line with the spiral curriculum in Mathematics.

3. Method

This descriptive study adopted a qualitative method in collecting data by formal interviews to gain profound details, information and understanding of the trends in contextualising mathematics for TVL/TLE. This approach requires unforeseen findings without depending on numerical measurements and produces illustrative data from interviews and participant observation in describing specific occurrences (Cooper and Schindler, 2011). Thus, a thematic analysis of the data was employed.

3.1 Study Participants

Table 2 shows the twelve (12) expert-informants extending their professional qualification as to Mathematics Expert, Technical-Vocational and Livelihood Expert, Curriculum Developer and CTL Curriculum Developer. The table, likewise, shows at a glance the total expert-informants by position/designation as to the following: two (2) School Heads, four (4) Mathematics Head Teachers (CTL Curriculum Writer), three (3) TLE Head Teacher (CTL Curriculum Writer), one (1) DepEd Consultant in Technical-Vocational and Contextual Learning, one (1) Specialist on Educational Innovation (CTL Curriculum Developer) and one (1) Manager of the Learning Management Office (CTL Curriculum Developer). Experts were purposively selected from various regions representing the National Capital Region (NCR), Mindoro, Marinduque, Romblon, and Palawan (MIMAROPA), Bicol Region (Region 5), and Central Visayas (Region 7) recommended by the Department of Education (DepEd) Manila. They were the sources of all the information needed to develop the contextualised model in Mathematics for TLE/TVLE.

Table 2 - Summary information of study participants.

Area of Expertise	School Head	Head Teacher	DepEd Consultant for Tech-Voc. & Contextual Learning	Specialist on Educational Innovation	Manager of the Learning Management Office (LMO)	Total
Mathematics Expert	0	3	0	0	0	3
TLE/TVLE Expert	2	2	0	0	0	4
CTL Curriculum Writer/Developer	0	2	1	1	1	5
TOTAL	2	7	1	1	1	12

3.2 Data Source

The response, which resulted in the semi-structured interview with the informants who are experts in the field of mathematics, technical-vocational courses and CTL curriculum development will be the main data source for identifying the contextualisation Strategies and Indicators (S&Is). The outcomes of the survey became the basis for the output of the study that was the Contextualisation Model in Mathematics for the Technology and Livelihood Education (TLE) and Technical-Vocational and Livelihood (TVL).

3.3 Data Collection

The researcher conducted a face-to-face semi-structured interview for the expert-informants in mathematics, technical-vocational and curriculum experts in contextualisation through an open-ended question about the modelling contextualisation in Mathematics for TVL/TLE. "Based on your experiences and expertise, please list down the processes/steps on how Mathematics can be contextualised in Technical-Vocational and Livelihood Education (TVLE). Please provide a brief description of each process or step". The results of the interview were transcribed, organised and consolidated according to themes. The organised information became the basis for the semi-structured questionnaire that was given to the same expert-informants as part of validating the experts' consensus.

3.4 Data Treatment

Thematic analysis of the qualitative raw data gathered were conducted through the coding technique. The three stages of the coding process (Batdi & Elaldi, 2020) such as open coding (Gero & Abraham, 2016), selective coding (Scott, 2017; Singh & Sedory, 2012), and axial coding (de Avila Soares et al., 2015; Saldaña, 2016) were employed to filter the themes (S & I) as the components in the development of the proposed model.

The initial data were organised into themes which formed part of the validation of survey instrument fielded to the same participant for validation of the finally saturated themes. A Certain Level of Agreement (CLA) was utilised in order to describe the level of agreement among the participants. Putnam et al. (1995) stated that in order to obtain a Certain Level of Agreement (CLA), the rating scale must be divided into two categories such as Agree and Disagree as seen in Table 3.

Table 3 - Interpretation of the ranking of the themes.

Scale	Description	Categories
4	Strongly Agree	Agree
3	Agree	
2	Disagree	Disagree
1	Strongly Disagree	

The CLA cut off rate for each theme (S & I) in this study was 90% and above; hence, all themes (S & I) that obtained the rate were included in the components of the model. Below is the equation of the Certain Level of Agreement (CLA):

$$CLA = \frac{\text{Number of Participants Agreed}}{\text{Total Number of Participants}} \times 100\% \tag{1}$$

The CLA cut off rate was intentionally set to 90% and above to ensure that the themes (S & I) to be included in the final components of the model met the standard. After the CLA cut-off rate was identified, the responses were finally consolidated and served as the main components of the model in the Modelling Contextualisation in Mathematics for TLE/TVLE.

4. Discussion

The proposed model was conceptualised using S&Is to address issues and concerns about contextualisation and to fill in the gap between Mathematics skills and technical application of the particular skills in TLE/TVLE track and strands. Hence, the model will serve as a guide for teachers in developing, making use of or modifying a contextualised lesson or learning module based on the existing curriculum guide released by the Department of Education (DepEd) in accordance with the K-12 basic education curriculum.

Table 4 shows the proposed model for the Contextualisation of Mathematics for TLE/TVLE. The themes (S&I) were categorised into a stage serving as a modular curriculum guide.

Table 4 - Strategies and indicators of the proposed model of mathematics contextualisation.

Stage 1: Planning	
a.	Convening of the curriculum writers
b.	Identifying TLE/TVLE track and strands to be contextualised
c.	Job or work analysis
d.	Modification of the lesson
e.	Developing training design for teachers
Stage 2: Assessment of the Curriculum Guide and Resources	
a.	Mathematics and TLE/TVL Curriculum Guide
b.	Sustainability of resources in terms of:
	b.1 Facilities
	b.2 Budget
	b.3 Equipment
	b.4 Manpower
	b.5 Community partnership
c.	Community/Local settings
d.	Identifying Mathematics skills for specific track and strands
Stage 3: Collaboration and Consultative Meeting	
a.	Mathematics and TLE/TVL teachers
b.	Stakeholders
c.	Business and industry sector
d.	Partners in the community
e.	Private sector/individual
Stage 4: Crafting and Developing of the Contextualise Learning Modules/Lessons	
Stage 5: Implementation	
	Checking the effectiveness
Stage 6: Monitoring	
a.	Math and TLE teachers
b.	All stakeholders
Stage 7: Evaluation and Feedback	

4.1 Stage 1: Planning

One of the components of an effective curriculum development process is planning. Planning is the process of deciding in detail how to do something before one starts to do it (<http://www.collinsdictionary.com/>). In curriculum planning, educators define the target learning output, evaluations, content and requirements in teaching since these are necessary for student's success in the curriculum (OECD, 2009). The foremost objective of planning a program of instruction in a technology area is the preparation of individuals for employment and additional preparation for a career (Halbrooks, 2003). and many vocational teachers use Develop a Curriculum (DACUM) to help them establish a relevant and up-to-date curriculum for instructional programs (Norton, 1997). The planning stage consists of a) convening of the curriculum writers, b) identifying TVL track and strands to be contextualised, c) job or task analysis and d) developing an assessment tool for the learners.

4.1.1 Convening of the Curriculum Writers

As stated by Young, Malisius and Dueck (2016) "Curriculum developers are mandated with ensuring that program and course curriculums are of sufficient high academic integrity, are consistent with other academic institutions, are delivered in a manner consistent with program outcomes, and are aligned with the adopted Learning and Teaching Model (LTM)." In addition, they said that more communication between persons and areas associated with curriculum writing would guarantee higher fulfilment and success for every person associated with the curriculum development process.

Convening of a curriculum development committee composed of teachers, administrators, public members, and sometimes learners is the key factor in curriculum development and its implementation. Therefore, it is crucial that an effective, knowledgeable and respected chairperson leads. It should also include knowledgeable and committed members in the development phase of the process.

4.1.2 Identifying TLE/TVLE Track and Strands to be Contextualised

Contextualisation is a varied group of instructional approaches developed to more faultlessly connect the learning of basic skills and academic or occupational material by concentrating on instruction and on learning directly in the tangible applications of a detailed context (Mazzeo, Rab, and Alssid, 2003). From a cognitive viewpoint, contextualisation is promoting transmission of learning and the retaining of information (Boroch et al., 2007).

Stone et al. (2006) theorised that the formation of explicit links between situations is crucial if learners outside the classroom are to transmit their knowledge and skills (Stone III et al., 2006). If these basic skills and content area instructions could be brought closer together, it would perhaps result in increased proficiency of the learner in reading, writing, and mathematics skills in addition to the ability of the learners to implement the said skills in significant ways (Baker, Hope, and Karandjeff, 2009; Lee and Spratley, 2010).

In the Technical-Vocational and Livelihood Track, there are four strands to choose from: Agri-fishery, Home Economics, Industrial Arts and ICT. In each strand, there are certain modules where skills in Mathematics can be applied. De Lumen (2008) developed a Contextual Learning Matrix (CLM) as an analysis tool to help in identifying contents of Learning Outcomes (LO) in each module. The researcher, with permission from the author, adopted and modified the CLM for his own study.

4.1.3 Job/Task Analysis

Job analysis is the method of collecting, assessing, and taking down exact, impartial, and comprehensive job information. It recognises and defines what a worker does in regards with job descriptions or functions; how the work is being made; the methods or techniques associated, and the devices utilised. It is also concerned about the findings of the work; the products made, services given, and materials utilised. It likewise describes the workers' characteristics, skills, knowledge, abilities, and adaptabilities which are needed to achieve the tasks involved (ERIC, 1982). In the K-12 Curriculum, if a learner picks the TVL track as a specialty in senior high school (SHS), the learner will continue the TLE course being studied in 9th and 10th grades. This will allow the learner to earn NC II to be used as credentials in applying for a job after SHS graduation. Work analysis is necessary to know if an applicant is ready for the job (Dumduman, n.d.). Moreover, it is simply a part of a thorough job analysis process. However, it is a significant consideration in "on-the-job" training and orientation for a worker to do well in his or her job. A good task analysis not only defines basic job tasks but also separates the definite step-by-step processes need (Reinhart, 2017).

4.1.4 Developing Assessment Tools for the Learners

Curriculum development is viewed and considered as an assessment tool to assess or evaluate learner needs that will eventually lead to the upgrading of learner learning. Irrespective of the model that is observed, curriculum writers must collect information that includes the desired outcomes or expectations. Many assessment tools have been developed to measure learners' progress, like a grade-level criterion-referenced test, periodic test, performance-based test, and a final examination to measure learners' learning. These assessment tools do measure not only learners' progress but also the effectiveness of the goals and objectives of the curriculum in aiming for learner's needs (ERIC, 1982).

Effective assessment need not be too resource-intensive and that schools can progress towards a lower-cost assessment strategy without jeopardising quality (Nguyen and Ulbrich, 2013). However, the analysis revealed that no significant differences occurred with regards to learning outcomes between different assessment strategies. It appeared at first that it did not matter which strategy to apply. On the contrary, the analysis also showed that a computer-supported assessment strategy seemed to have advantages with regard to preparing learners for examination.

4.2 Stage 2: Assessment/Review of the Curriculum Guide and Resources

A curriculum guide is an organised document describing the philosophy, goals, objectives, learning experiences, instructional materials and assessment tools that make up an educational program. In addition, it embodies an articulation of what the learner should know and be able to do and it also helps teachers to enable them on how to achieve these goals.

According to Finch and Crunkilton (1999), "Technical curriculum will soon become outdated when steps are not taken to keep it from remaining static; hence, the vocational curriculum must be responsive to the constantly changing world of work." New advances in several fields must be fused into the curriculum. Graduates will be competing for jobs and when they will be able to accomplish their utmost potential. The curriculum must be "data-based, dynamic, explicit in its outcomes, fully articulated and future-oriented." Curriculum writers and teachers must regularly inspect the curriculum based on the performance and achievement of learner needs. Provisions must also be given for curricular revision to readdress, alter or remove an existing curriculum (DACUM Handbook).

Moreover, it helps in the planning and implementation of instructional programs. An effective curriculum guide is not simply a list of purposes and recognises instructional resources. It is also concerned about the available materials and how they will meet certain objectives. It is necessary that the curriculum guide link resources to curriculum objectives (Wentzell, 2006).

4.2.1 Mathematics and TLE/TVLE Curriculum Guides

Mathematics is that subject which is applied at any stage and situation. Hence, its worth thrives outside the classroom and learning institution. Mathematics, then, must be learned widely and deeply (Mathematics CG, k-12). The two aims of mathematics in the basic education levels, K-10, are critical thinking and problem-solving. Critical thinking is a process which involves conceptualisation, implementation, analysis, synthesis, and evaluation of information gathered from or produced through observation, experiences, reflection, and rational thinking that guide one's beliefs and actions (Azid et al., 2019; Rynes, Gerhart, & Parks, 2005; Zuckerman, 1966). The TLE curriculum guides in junior high school (JHS) observe the regulations of the TESDA. The TLE CG is for the Junior High School from Grades 7-10. Every TLE subject in Grades 7 and 8 is investigative. In Grade 9, the learner selects one course to concentrate on from amongst the courses. During this stage, a certificate of completion (COC) can be received by the learner. The TLE specialisation course the student selected in 9th grade will be followed by the student in Grade 10. With this, an NC Level I or II (NC I or II) may be achieved by the student based on the selected TLE course. If TVL track was selected by the learner as a specialisation in the senior high school (SHS), the TLE course he/she studied in Grades 9-10 will be continued. An NC II will be earned after graduation from SHS. This NC II certification can be used as a credential in job application if the learner would want to work immediately after SHS graduation.

4.2.1 Sustainability of Resources

Resources may refer to an organisation which serves a particular group of people and provide them the tools to improve the quality of their lives in the community. Hence, the sustainability of community funds can be sponsored by the government, business establishments, non-profit organisations, or even individuals to serve the community in different ways (Tse, Esposito, and Khaled, 2016). Teachers use a variety of supplementary materials, instructional modules for particular units, computer software besides the textbooks, thus, the curriculum guide suggest and link available resources to sustain the curriculum goals.

4.2.2 Facilities

This refers to equipment or services provided for a particular purpose. Educational facilities are the buildings, fixtures, and equipment for effective and efficient operation of the program of education, classrooms, libraries, rooms and space for physical education, toilets, laboratories, cafeteria, and building equipment (McGowen, 2007). The facility adequacy was slightly related to learner performance; however, attendance, behaviour, completion rate and teacher turnover rate had no significant relationship with the school facilities. There was a statistically significant relationship between building conditions and learner achievement (Al-Enezi, 2002).

4.2.3 Budget

Budgeting is a financial planning process which starts definite activities for the execution of plans, programs, and projects by identifying the stage of resources required to attain definite plan purposes. Ezeugbur (n.d.) and Akinsolu, (2008) describes school budgets as "plans outlined for financing the education/ school system for a given period aimed at translating objectives into reality." Hence, budgeting is a drawn-up administrative plan about the funds and resources to be utilised.

4.2.4 Equipment

It is a tangible property that is used in the operations of a business. An item can be classified as equipment if it is a machine, an instrument, or apparatus. There is a need to procure a state-of-the-art equipment like computers, software, video players, and other related technology-based devices which will be utilised in the preparation instructional materials (Landicho, Garcia, Ortiz, and Enojas, 2020).

4.2.5 Manpower

It is the total number of people who can work together to get something done (Farner and Rose, 1971). Department Order (D.O.) 19, s. 2016 issued by DepEd on 6th April, 2016, intends to deliver inclusive rules, standards, and measures which visibly describe the organisational backbone and recruitment patterns of diverse sorts of public senior high schools, in addition to making clear the duties and tasks of their teaching and non-teaching personnel. In addition, the organisational backbone, recruitment patterns, and measures set in the order will be utilised as a reference by the DepEd central and field units and also external partners to guarantee that the administration and supervision of public senior high schools are based on DepEd quality standards, and give rises to the improved transfer of basic education.

4.2.6 Community Partnership

Community partnership with schools balances and strengthens morals, principles and the learning prospects that schools can deliver for their learners. Teachers, school employees, parents, and other stakeholders who cooperates may contribute in the life of the learner (Bryan and Henry, 2012). In the Philippines, Domingo (2004) presented two points that relied profoundly on the contribution of the community and the private stakeholders: "text2teach" mobilised resources from the profit groups to offer schools with learning videos carried through satellite and mobile transmission modes. The purpose was to develop science teaching in Grades 5 and 6 (SEAMEO-INNOTECH, 2003).

4.2.7 Community/Local Settings

A community is a small or large social element composed of a cluster of individuals who have something in common like standards, religion, values, and identity. Communities usually are situated in a particular geographical area such as a province, town barangay, city or neighbourhood. Educators normally use the term community to denote the several persons, groups, business establishments, and organisations that show interest in the well-being and liveliness of a school and its community. A good example are the neighbourhoods and municipalities served by the school (Sanders, 2001).

4.2.8 Mathematics Skills for Specific Track and Strands.

The K to 10 Mathematics Curriculum offers a starting point for Mathematics during Grades 11 to 12. It delivers essential concepts and life skills needed by the students as they continue to the following phase in their life as students and as Filipino citizens (Finch & Crunkilton, 1999). The contents of Mathematics include "numbers and number sense, measurement, geometry, patterns and algebra, and statistics and probability. Numbers and number sense include concepts of numbers, properties, operations, estimation, and their applications. Measurement includes the use of numbers and measures to describe, understand, and compare mathematical and concrete objects. It focuses on attributes such as length, mass and weight, capacity, time, money, and temperature, as well as applications involving perimeter, area, surface area, volume, and angle measure. Geometry includes properties of two- and three-dimensional figures and their relationships, spatial visualisation, reasoning, and geometric modelling and proofs. Patterns and algebra study patterns, relationships, and changes among shapes and quantities. It includes the use of algebraic notations and symbols, equations, and most importantly, functions to represent and analyse relationships. The subject, statistics and probability, is all about developing skills in collecting and organising data using charts, tables, and graphs; understanding, analysing and interpreting data; dealing with uncertainty; and making predictions about outcomes" (Mamolo, 2019).

4.3 Stage 3: Collaboration and Consultative Meeting

Collaboration is an act of working together to produce something or get something done. It is also a process where two or more people or even organisations do something cooperatively to complete a task or attain a goal (Nutcache, 2015). The consultative meeting is a meeting with a professional or expert for purposes of gaining information. Consultation with experts promotes best practices on ways to enhance one's teaching effectiveness and improve learner learning across all types of courses and learners. Conducting a meeting with the experts will help teachers review their methods of teaching, collect and interpret learner feedback, and introduce them to new and exciting technology and pedagogy. The consultative meeting gives the opportunity to discuss teaching issues, solve teaching problems, or try new innovations in the classroom. Collaborative endeavours will help teachers identify their strengths and collect (Khotimah and Masduki, 2016).

4.3.1 Mathematics and TVLE Teachers

A math teacher motivates his learner as problem solvers and critical thinkers. In contrast, a TVL teacher (a career and technical education teacher) trains the learner the practical skill in the elementary, junior, or senior high schools. Refrigeration and air conditioning, auto repair, welding, agriculture, graphics and printing, cosmetology, business, food and nutrition, electrical, electronic, or computer technologies may compose the said TVL courses. The Math and TLE/TVLE teachers will have to collaborate and conduct a consultative meeting to discuss skills in Mathematics, which be contextualised for TLE/TVLE track and strand.

4.3.2 Stakeholders

These are the people who concern the welfare and progress of a school and its learner. Stakeholders include administrators, teachers, parents, community members, business leaders, and elected officials of the school community. This may also include industry partners, advocacy groups, committees, or other institutions who are could possibly contribute inputs to the TLE/TVLE curriculum development.

4.3.3 Business and Industry Sector

The business sector is a part of the domestic economy, not including the government's economic actions, private households, and non-profit organisations. While, the industry sector refers to the goods-producing segment of an economy. The industrial sector in the Philippines includes the economic sectors that create a finished, tangible product-production and construction. It involves converting raw materials into goods like manufactured steel that are made into cars or textiles are turned into clothing.

4.3.4 Private Sector/Individual

The private sector is a portion of the Philippines' economic system which is operated by individuals and companies instead of the government, while a private individual is someone who is not a public figure.

4.4 Stage 4: Crafting and Developing of the Contextualised Learning Modules/Lessons

Utech (2008) suggested that learning modules are systematic collections of course materials put together to become a learning module. It focuses on the significance of making learners realise what they are supposed to learn. In contextualising learning modules or lessons, teachers have to use authentic materials, introduce novel activities, inculcate the learner's interests, talk about relevant issues and know the needs of the learners.

Contextualisation helps learners develop their skills when teachers use authentic contexts where the learner must learn to use those skills in the real world. The aim of contextualisation is to generate situations for more well-organised learning, stated in developed skills, improved grades and rates of retaining in courses, and faster progress in more advanced course work (Dewey, 1933; Dowden, 2007). Contextualisation in a cognitive perspective is assumed to endorse transmission of learning and the retaining of information (Boroch et al., 2007).

Connecting basic skill training to reliable content area implementations that learners will come across in a specialisation course may raise the possibility of transferring the skills to a specific setting. Skills subjects like reading, writing and mathematics are taught distinctly from the skills to which they must be implemented (Perin, 2011).

Problems will arise if the learner is expected to apply newly learned skills in a very different setting. The most capable frequently do not eagerly transmit anew acquired skills to novel settings (Barnett and Ceci, 2002). In addition, learners may not be interested to acquire the skills taught because they do not distinguish them to be related to their individual learning goals (Cavasos Jr., Johnson, and Sparrow, 2010). Furthermore, academic skills' weaknesses may not be brought by the teacher whose aim is to teach the subject content, instead of the basic skills (Fisher and Ivey, 2005). Embedding educational instructions in disciplinary content could help because basic skill requirements vary significantly across disciplines (Goldman and Bisanz, 2002; Stahl and Shanahan, 2004). Following the PACC as the four (4) basic stages to be considered in developing the Model of Contextualisation of Mathematics for TLE/TVLE, it is imperative that the implementation, monitoring, and feedback evaluation should be embedded to complete the developmental process.

4.5 Proposed Model

Figure 2 shows the developed model. This model, called Planning, Assessment, Collaboration and Crafting (PACC), has (4) Stages and each stage has a corresponding Indicator as follows:

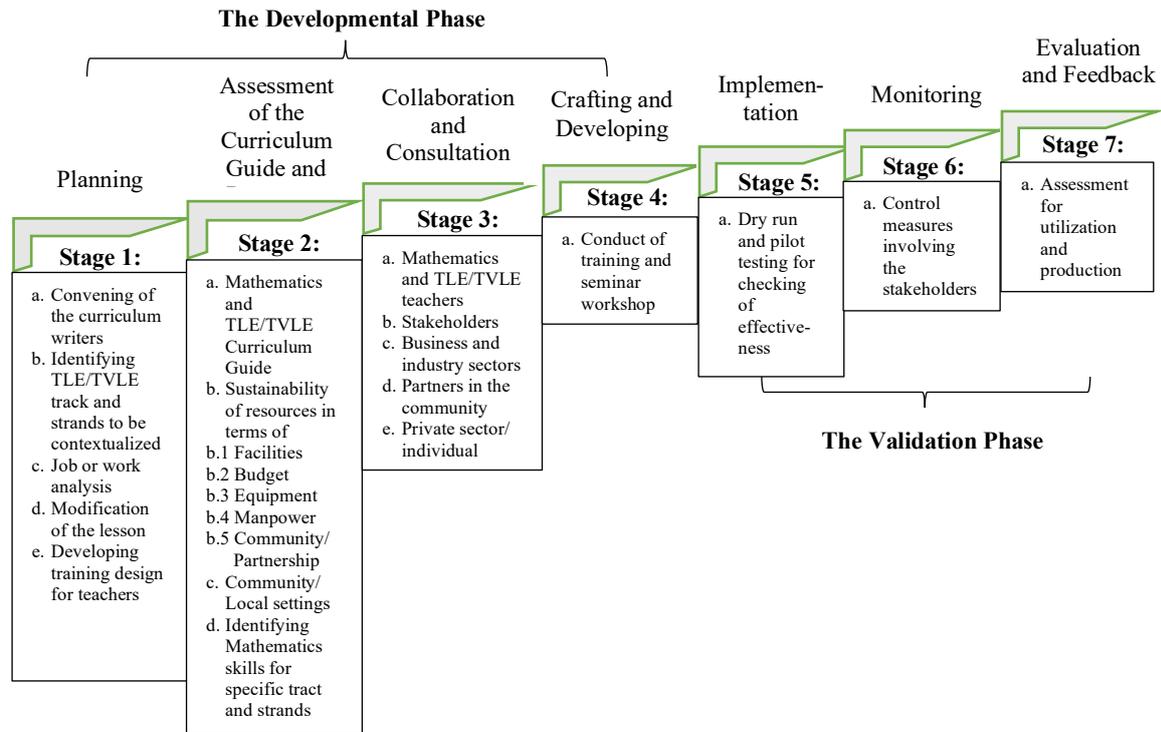


Fig. 2 - The PACC-developed model of contextualisation of mathematics for TLE/TVLE.

5. Conclusion

Guided by the aim of the study to explore the trends in Technical-Vocational Livelihood Education, the final output is shown in Figure 2. In this context, the researchers concluded that the emerging stages such as implementing, monitoring, evaluation, and feedback are embedded in the later stages of the curriculum development for purposes of creating a modular-type model for instructional and training guides. It is observed and analysed that the development of a Model of Contextualisation of Mathematics for TLE/TVLE shall pass through these stages to complete the validation process such as 1) Planning (Finch & Crunkilton, 1999), 2) Assessment of the curriculum guide and resources (Nguyen and Ulbrich, 2013; Finch and Crunkilton, 1999), 3) Collaboration and Consultative Meeting (Nutchache, 2015), 4) Crafting and Developing of the Contextualise Learning Modules/Lessons (Halbrooks, 2003; Finch & Crunkilton, 1999; Young, Malisius, and Dueck, n.d.), 5) Implementation (Finch and Crunkilton, 1999), 6) Monitoring (Rynes, Gerhart, & Parks, 2005), and 7) Evaluation and feedback (OECD, 2009; Rynes, Gerhart, & Parks, 2005; Landicho, Garcia, Ortiz, & Enojas, 2020).

Planning, Assessment, Collaboration, and Crafting of the working module (PACC) is the developmental phase. Implementation, monitoring, and the conduct of evaluation and feedback is the validation phase. As a module, the contextualised mathematics teaching can be utilised as a training guide for teachers in Technical-Vocational Livelihood Education strands of the K-12 curriculum. To acknowledge the varied learning needs of the students, teachers, and community, the curriculum should be readily adaptable for utilisation. Further assessment can be made to develop a holistic training guide framed within the context of the curriculum needs.

6. Recommendations

While the result of the study can be utilised by teachers as guide in developing their respective contextualised curriculum designs, this study hopes that curriculum writers will utilised the proposed model of contextualised mathematic teaching for TLE/TVL in curriculum preparations, assessment, validation, and modify the model according to the curriculum needs of their respective academic institutions. Further research may be conducted to validate the most appropriate modular approach in curriculum development.

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