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A Review of Instructional Models for Effective Teacher Education and Technology Integration

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Abstract

For effective production and delivery of instruction, patterns for the production of lesson content and media selection are areas of key concern. To this, models are needed to aid the selection and structuring of teaching strategies, methods, skills, and student activities for a particular instructional purpose. This study reviewed 15 instructional models which can aid teachers to effectively engage in this process. Findings from this study showed that similarities and differences exist between different models and as such two or more model can be combined to achieve and effective production and delivery of instruction.

Keywords: Instructional models; Teacher education; Technology integration.

1. Introduction

The need to improve learning experience between the teacher and the student vice versa has led to many views. This views over the years has been applied and confirmed to be theories and has been developed into models, known as Instructional models. Instructional models are ways in which instruction are presented and improved through making an analysis of learning needs and instructional material needs, for the efficient delivery of instruction and for creating better understthisyng between the teacher and the students. Due to continual evolving nature of theories and models around educational practices, a need for continuous professional review becomes necessary (Garba, 2018). Keeping up the pace can seem overwhelming, but knowing who and where to go to for the latest research-driven models is often a challenge. Thus, this is essential for pre-service teacher training programs. It facilitates the linking of theory or models with the actual practice, which empowers trainees to seek reasons for modifications in their practices and their beliefs (Brooke, 2012). This review will help teachers to evolve as they witness teaching philosophies bringing convenient learning outcomes. Additionally, any teacher professional development program should include addressing the models of technology integration (Garba, 2018). Identifying these models will help teachers and administrators assess utilization of technology. These models provide a systematic way of presenting a lesson both for online and traditional classrooms. This report is a summary of the 15 instructional models that can be used for preparing lessons.

2. Review of Instructional Models

2.1. Assure Model

The ASSURE model is a six-step instructional systems design model developed by Smaldino *et al.* (2008) which was intended to help teachers utilize technology and media in the regular classroom.

- A- ANALYZE LEARNERS: Who are your students? At this level, a trainer understands who his learners are, obtains certain information about them, for example, their prior knowledge, learning styles, and academic abilities and then consume this knowledge into lesson planned.
- S- STATE STANDARDS & OBJECTIVES: What are your objectives and lesson outcomes? Develop a syllabus to teach which will be used in your classroom alongside with specific objectives that will be the main focus of single lessons which will lead to a specific outcome.
- S- SELECT MEDIA AND MATERIALS: What methods are to be used in delivering this lesson? Before you choose the media and materials to help you deliver instruction, the intended instruction delivery method should first of all be chosen. For example, you might decide to use a collaborative or individualistic approach for the assessments. After which you can select the media or material that best back up or

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enhances the method of instruction you have chosen such as PowerPoint lesson presentations and can help the student best master the lesson.

U- UTILIZE MEDIA AND MATERIALS: How you get the selected media & material implement? In this step, the chosen media is been implemented but care should be taken by providing alternative lesson solution in case of technology failure. What do I require to transfer my PowerPoint slides? What if the USB drive didn't work?

R- REQUIRE LEARNER PARTICIPATION: What should you do to motivate learners' participation? Mediums that encourages learners' participation (Thinking, Solving, Creating, Developing, and Analyzing) such as assessments, classwork's etc. will aid feedback. To apply a teaching method beyond lecturing, it becomes a necessity to integrate technology into the lesson planned.

E - EVALUATE AND REVISE: How did the lesson meet its objectives? How effective were the material and media used help student participation? What more improvement can be made? Evaluations are done both on the instructors and the learner's part. Learners' may be given the opportunity to relate and apply the experiences they encountered during the lesson.

2.2. ABCD Format

ABCD model is a format used in writing objectives. In ABCD model lesson objectives much be; Visible and quantifiable, Clear, Results-focused, determined by quantitative and qualitative standards, Talk about successful learning in behavioural terms etc. Objective writing is an important subject to take into consideration because a clear objective will make it easier for the teacher to see and meet the goals of the instruction. Following the ABCD objective format makes lesson preparation an easy ride for success in achieving stipulated milestones. ABCD Objective format consists of four components:

A- Audience: These are the group of the focus of which the lesson is prepared for. To begin with, in objective preparation, the description of the intended learner or individuals is necessary. Who is the target of the outcome? Example: "The Lecturers attending this seminar…."

B- Behaviour: The description of the learner's ability should be determined and should be observable and measurable. What should the audience be able to know, do, or value?

Example: "… should be able to relate their classroom experiences…"

C- Condition: This refers to the situation the behaviour will take place. What equipment will be utilized? Example: …under a video constructed environment on Friday…

D- Degree: This provides the acceptable Standard of measurement or criteria for success. Example: … within 15mins.

2.3. Bloom's Taxonomy

Benjamin S. Bloom of the University of Chicago in 1956, with a group of educational psychologists, developed a classification of levels of intellectual behaviour, which is an important tool in learning. He classified learning into three overlapping domains which are: **Cognitive domain** which concerns the intellectual capability, for example, the ability to **know** and **think**, **Affective domain** which concerns the feelings for example **attitude,** and **Psychomotor domain** which concerns the manual and physical skills for example **skills or the ability to do**. He went further to define six levels within the cognitive domain which are knowledge, comprehension, application analysis, synthesis and evaluation.

In the 1990s, a former student of Bloom **Lorin Anderson** led a team for the revised taxonomy. This revision occurred in 3 broad categories which were terminology, structural and emphasis and this is what is known as the **Revised Blooms' Taxonomy** today. See below the two versions:
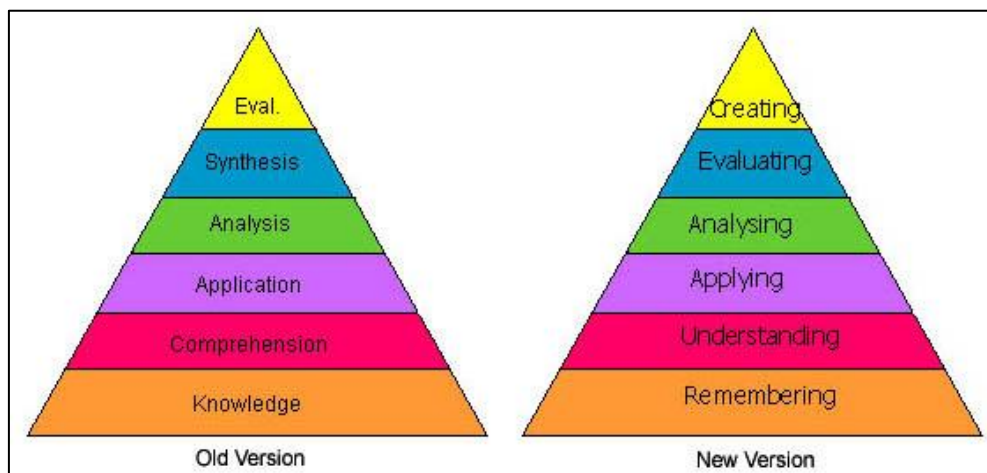

2.4. Ausubel's Assimilation Theory

Assimilation theory is also referred to as a theory of advance organizers (or subsumption theory). It was among the cognitivist learning theories established during the 1960s by an educational psychologist David Ausubel.

Ausubel explained that effective learning is a process whereby learners understand the construction of knowledge and can intentionally make new structures that will fit the already existing concepts in the brain. He distinguished 2 types of learning which include meaningful and rote learning. Meaningful learning is that which is well anchored and integrated into the cognitive structure. This learning helps the learner to relate new ideas with other existing concepts. Rote learning means knowledge that remains unconnected and unanchored to concepts which are already existing. It represents knowledge that remains unrelated and unanchored to existing concepts and is therefore easily forgotten.
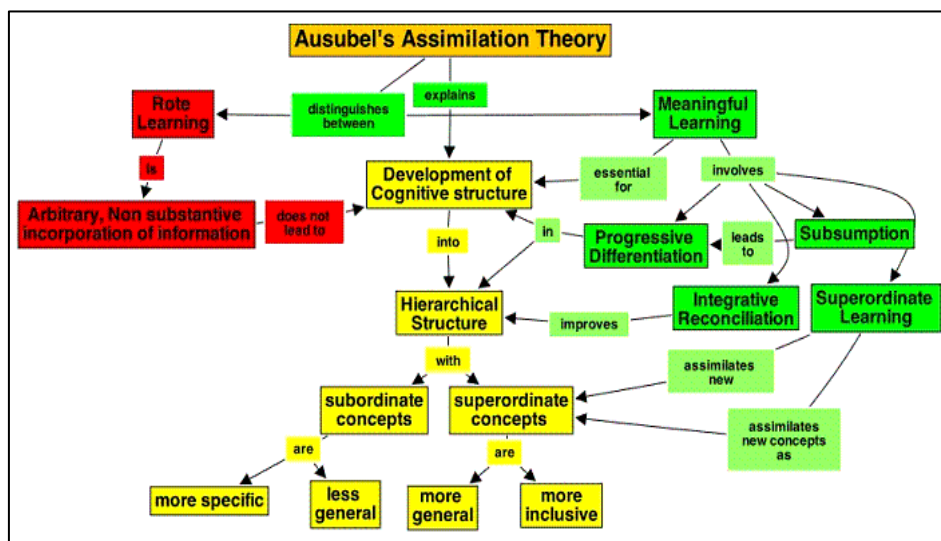
2.5. The Addie Model

Addie model is a five-phase standard process used by instructional designers and training developers for effective training and performance. It was initially developed by Florida State University. The 5 phases reprents a dynamic, flexible standard for building effective training and performance support tools.
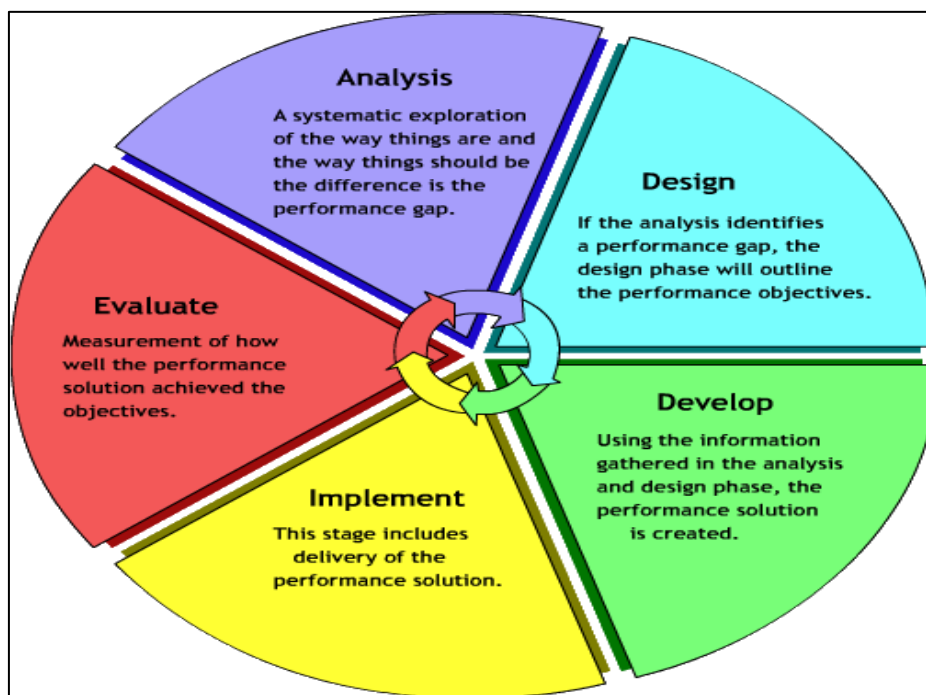
2.6. Dick and Carey's Model

Dick and Carey's model is a routine system including components – nine of which are basic steps inside an iterative cycle and one which is a culminating evaluation of the effectiveness of the instruction, designed in 1996.

  i.   Identify Instructional Goals: the purpose is to identify what the learners are expected to learning at the end of the lesson.
 ii.   Conduct Instructional Analysis: the purpose is to define a step-by-step of what will be done by the learners while performing the goal and also determine the skills acquired.
iii.   Identify Entry Behaviors and Learner Characteristics: the purpose is to identify the enabling skills the learners already have before the instruction.

iv. Write Performance Objectives: the purpose is to be able to interpret the needs and goals into achievable objectives. What the learners are able to do with the skills, the statements of the skills to be learned, the conditions, and the criteria

v. Develop Criterion-Referenced test items: the purpose is to create a criteria-referenced assessment that is dependent on the performance objectives.

vi. Develop Instructional Strategy: the purpose is to outline how instructional activities connects to the accomplishment of the objectives by developing strategies in pre-instructional activities.

vii. Develop and Select Instructional Materials: the purpose is to select printed or other instructional media which are meant to deliver the events and produce the lesson,

viii. Develop and Conduct Formative Evaluation: the purpose is to provide data for revision and improvement of instructional materials.

ix. Develop and Conduct Summative Evaluation: the purpose is to know the level of efficiency the system has and the first classroom iterations with the focus being on the outcome.

x. Revise Instruction: to use the data from the formative evaluation to examine the validity of the instructional analysis, student and context analysis, presentation objectives, evaluation instruments, instructional approaches, and instruction.

The model reflects an attempt to incorporate changes in the field, such as shifts toward constructivism and growth in computation.

2.7. Reigeluth's Elaboration Theory

The elaboration theory was formed in the late 1970s by Charles Reigeluth (Indiana University) and his colleagues. Elaboration theory proposes seven major strategy components:

- An elaborative sequence
- Learning prerequisite sequences
- Summary
- Synthesis
- Analogies
- Cognitive strategies
- Learner control.

The first component is the most critical as far as the elaboration theory is concerned. It is an instructional design theory that suggests that the content for the learner should be structured from simple to complex, as long as a meaningful context in which succeeding ideas can be incorporated is provided. It furthermore suggests that by having the complexity via increasing order, a room for prerequisite will be given which will make a learner to acquire particular knowledge or pass through a particular level of knowledge before going to the next level. This theory was further supported by three major approaches, they are

A. Conceptual Elaboration Sequence (to be used in situations where we have too many connected concepts for the student to learn),

B. Theoretical Elaboration Sequence (to be used in situations where we have too many connected principles for the student to learn)

C. Simplifying Conditions Sequence (to be used when a task of at least adequate complexity for the student to learn).

Reigeluth (1999) highlighted some values of elaboration theory such as; its values a sequence of instruction that is as complete as possible, to foster meaning-making and enthusiasm, gives opportunities during the learning process for learners to make many scopes and sequence decisions.Elaboration theory applies to the design of instruction for the cognitive domain.
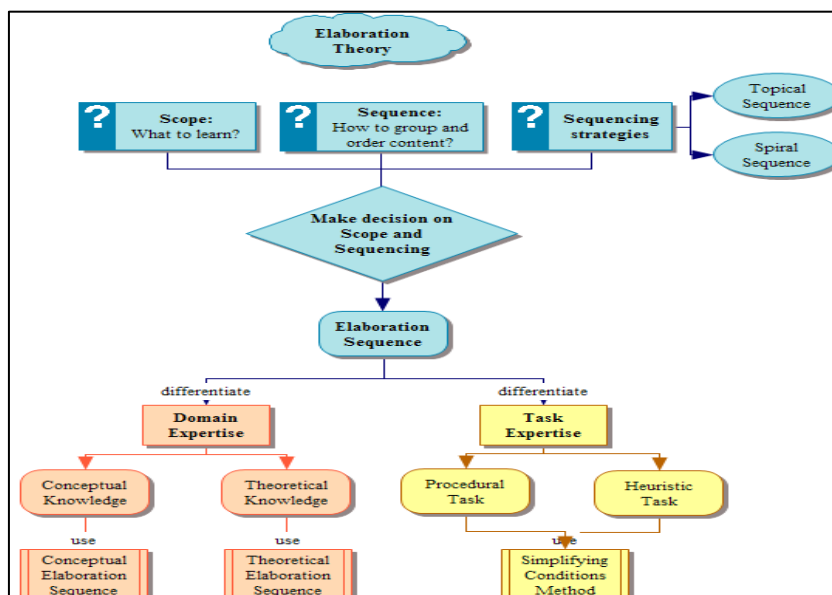
2.8. Hannafin and Peck Model

The Hannafin Peck is a three-phase process model designed in 1987. In the first phase, a needs evaluation is carried out, followed by the second – design phase. In the third phase, instruction is established and applied. The phases in this model involve a process of evaluation and revision.

Requirements analysis phase: during this phase, the Designer or developer has to make an assessment, particularly on the characteristics of the target group to ensure that the design process has guidance and direction that can be followed.

Design phase: Application design process begins with determining the objectives to be achieved by the user after using the application.

Development and implementation phases: The phase of development refers to the process of material production. In this phase, all the elements that were designed in the previous phase are translated into more practical either with the help of programming languages and authoring

Evaluation Phase: at this phase, the overall view of the shape, structure, teaching approaches, learning theories, media and technology types that will be involved is a matter to be investigated.
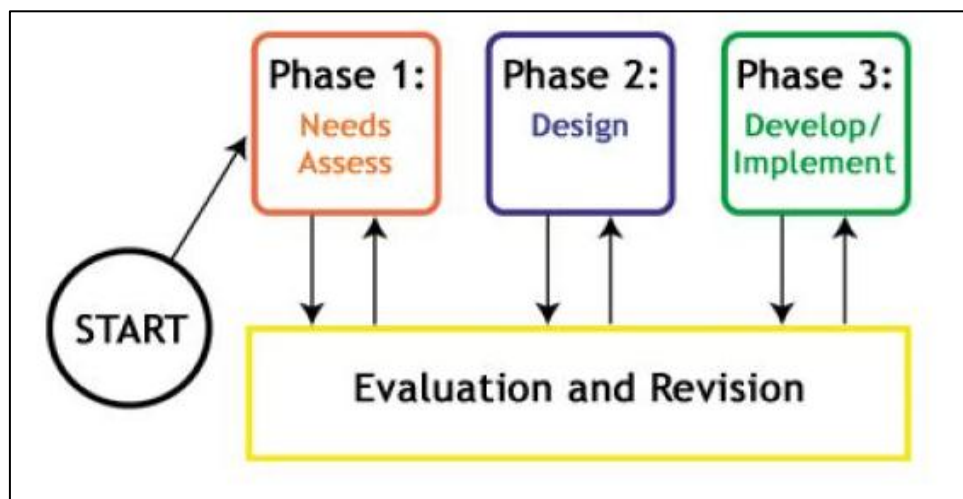
2.9. Knirk and Gustafson Model

The Knirk and Gustafon's design method and model was designed in 1986, with three stage process. They are problem determination, design and development. This is a prescriptive stage model for instructional designers.

The problem determination stage: includes identification of the problem, the definition of the pedagogical goals and identification of what the learners can do (knowledge, skills, learning styles, affect, etc.)

The design stage: includes developing objectives and specifying strategies.

The development stage: includes the development of materials, testing and revision.

In revision, materials that are used should be evaluated based on student behaviours, the criteria level, and aiming towards the instructional goals.

It is a simple design that can be used in both designing unit plans and single lesson plan but its evaluation and development do not occur until later process.
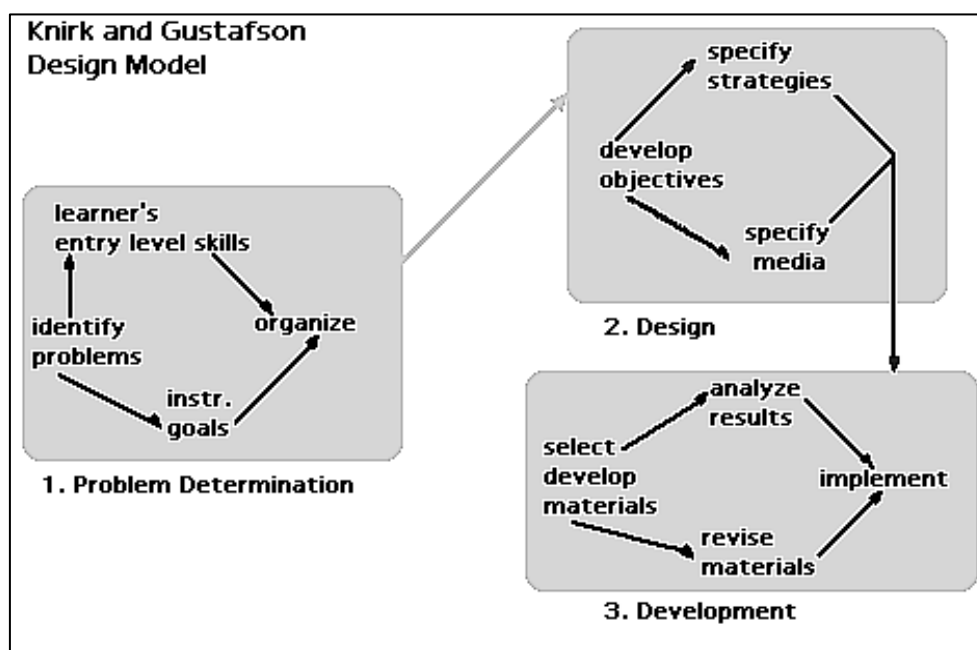
2.10. Tripp and Bichelmeyer

Rapid Prototyping is what is also know as Tripp and Bichelmeyer model. It was proposed by Tripp and Bichelmeyer (1990) as a viable system for instructional design and were also backed up with good theories and examples. Rapid prototyping contains rapid sequences of iterative test and revision cycles for each development stage which the output of one phase can be the input of another.

Rapid prototyping has sometimes been cited as a way to improve the generic ADDIE model. It involves:
- ✓ Simultaneous attention to the ADDIE phases
- ✓ Quickly creating a general sense of what the goal is with only limited design specifications
- ✓ Fast (and low cost) development of a prototype which has some of the operational features which are intended to be in the final product

It was initially used for software development so since it worked successfully with Software Development, they proposed it as an alternative to Instructional Design. See figure below:
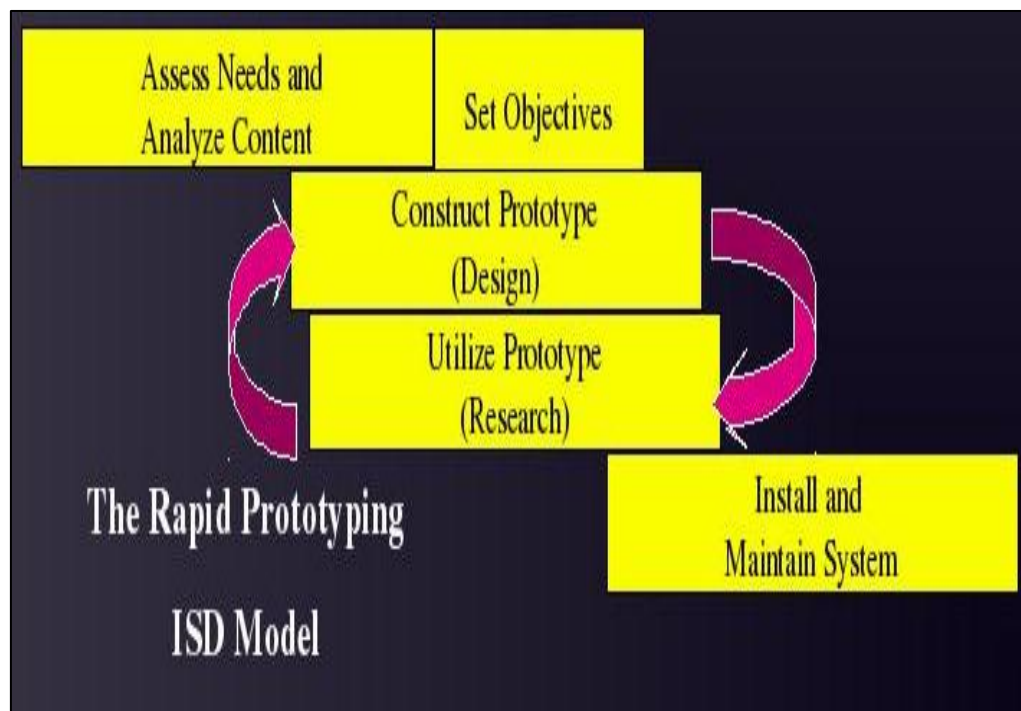
2.11. Icare Model

The ICARE model is an instructive framework for instructional design practice. This is done by implementing numerous steps of instructions which are particularly useful sections of an online course. Below are the basic components:
- ✓ Introduction: This phase consists of the introduction to the unit of instruction and includes context, Aims, Fundamentals, Obligatory study time, Equipment required, Essential reading materials.
- ✓ Connect: This phase familiarizes the students with necessary facts, theories, principles, and processes.
- ✓ Application: This phase provides tasks and practices that allow students to apply the knowledge gained previously from the Connect phase
- ✓ Reflect: This phase encourages learners to take some periods in order to reproduce what they've learned as they move from the Connect and Apply phase.
- ✓ Extend: The extend phase gives room for chances to individualize learning experiences

2.12. Jerrold Kemp Model

Kemp model is an instructional design model which defines nine different components which is used for designing effective instruction. It is useful for the development of large scale programs (higher education) and has a continuous cycle that requires constant planning, design, development and assessment to ensure effective instruction.

The nine components are:
- ✓ Determine instructional problems, and specify goals for designing an instructional program.
- ✓ Observe learner attributes that should receive attention during planning.
- ✓ Determine subject content, and analyze task components related to stated goals and purposes.
- ✓ State instructional objectives for the learner.
- ✓ Sequence content within each instructional unit for logical learning.
- ✓ Design instructional strategies so that each learner can master the objectives.
- ✓ Plan the instructional message and delivery.
- ✓ Develop evaluation instruments to assess objectives.
- ✓ Select resources to support instruction and learning activities.
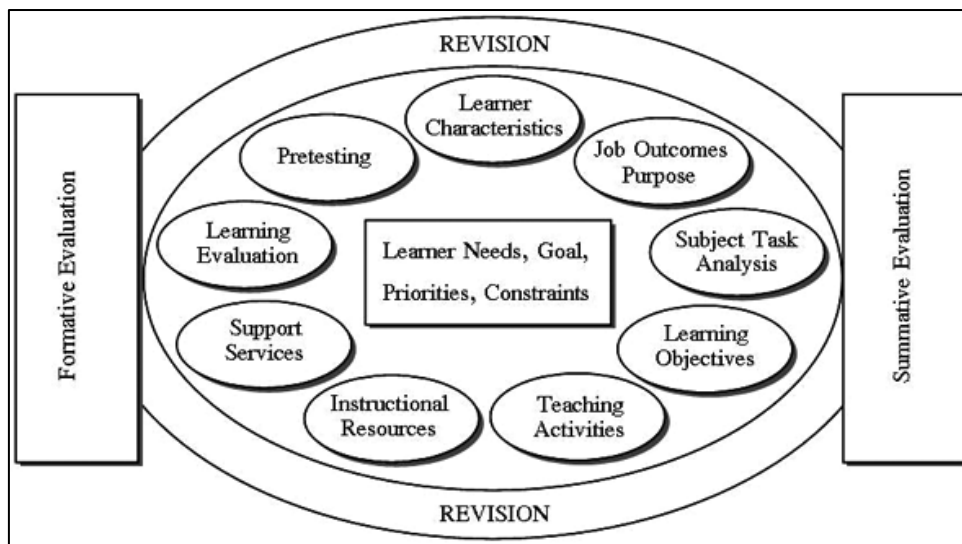
2.13. Gerlach-Ely Model

Gerlach and Ely model was designed as a perspective instructional model in 1971 by Vernom S. Gerlach and Donald P. Ely. This model supports the media-rich instruction model successfully and illustrates the fundamental principles of teaching and learning. It is suitable for K-12, as well as, higher education. The Gerlach & Ely model begins by non-asynchronously organizing the content and objectives. According to Jonassen and Grabowski (2012), the content is considered prior to the objectives, because in the classroom, content is typically prearranged, however, these steps can also be conducted concurrently. The Gerlach and Ely Model reflects a teacher orientation to the concept of instructional design. The model assumes the need for course content has already been established. Most teachers focus more on the content rather than goals and objectives. So the Gerlach and Ely model begin with content. Through the specification of the content (what are we going to teach), objectives are then written. Entry behaviours are then identified for the instruction. Because teachers have a great deal of experience in the development of instruction, they often do the next five steps simultaneously. Those steps and the design considerations for each of the steps are listed below.

i. Determine strategy: strategies range along a continuum from supplantive (behaviourist) to generative (constructivist)
ii. Organize groups: configurations can range from self-study to whole-class presentation based upon strategies, space, time, and resources.
iii. Allocate time: time itself is constant. However, decisions about time are based upon the number of strategies required for the lesson.
iv. Allocate space: space is sometimes no longer considered a constant with teachers being able to expand outside of the classroom for learning experiences (parks, playground, lunchroom, etc.)
v. Select resources: resources are dependent upon the location of the instruction, the availability of supplemental materials, and the adaptability of those materials.

The evaluation step of the Gerlach and Ely model is closely linked to the objectives. The evaluation directs the teacher's attention to measuring student achievement and attitude. The evaluation also includes feedback on how well the system is working. The feedback from the assessment is then used to modify the instruction to increase the effectiveness of the instruction.
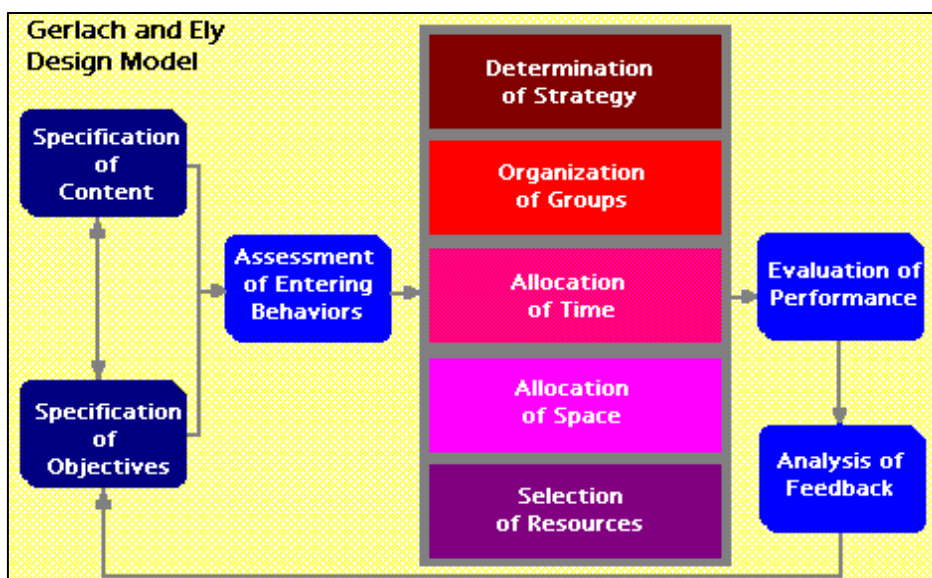
2.14. Smar Model

This is one of the popular models of technology integration. It was originally proposed by Peuntedura (2006). Its inherent assumption is that technology can fundamentally redefine the nature of the educational activity. The model proposed four possible levels of technology integration in the classroom, namely:

i.   Substitution
ii. Augmentation
iii. Modification
iv. Redefinition

According to Puentedura (2013) **Substitution** occurs when either the teacher or the student use technology to facilitate or access learning with no functional change. **Augmentation** extends teacher and student use of technology by offering a functional change afforded by technology selected. **Modification** involves the use of technology which allows for significant task redesign and **Redefinition** involves a situation where technology is used to allow for the creation of new tasks. The first two stages were described by educationists as the enhancement levels. Furthermore, the remaining two stages educationists' described as transformation levels where modification and redefining of learning activities is done through the use of technology (Phillips, 2015).
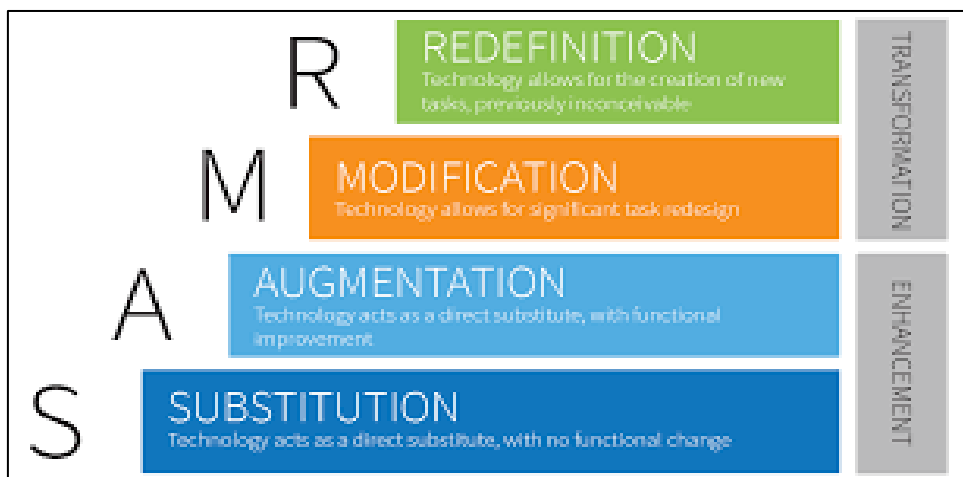
2.15. Tpack Model

TPACK which is known as Technological Pedagogical Content Knowledge is a framework developed to help describe the kind of knowledge that educators need in order to teach effectively while integrating technology. This conceptual model developed by Koehler and Mishra (2005) was based on Shulman's Pedagogigal Content Knowledge model. The framework contains seven constructs arising from the intersection of the three major knowledge dimensions namely; Technology Knowledge (T or TK), Pedagogical Knowledge (P or PK) and Content Knowledge (C or CK). See Figure below;
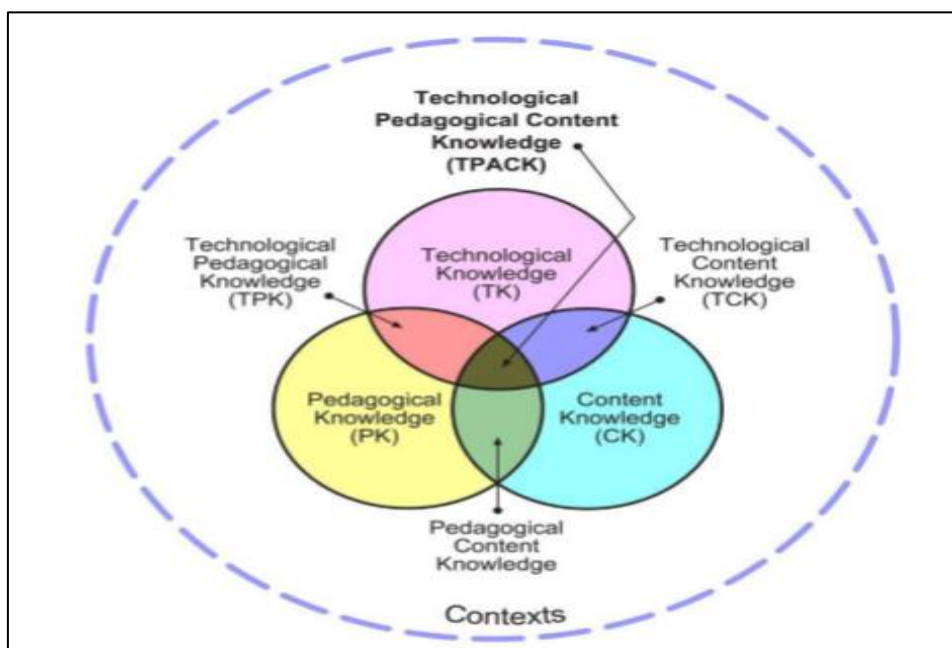
The major knowledge dimensions are represented with three overlapping distinct circles to form a Venn system, each circle representing the teachers' knowledge. At the connection of these components lies the understanding of teaching subject matter with appropriate pedagogical methods and technologies (Chukwuemeka & Iscioglu, 2016).

The intersection of the three major dimensions brought about formation of three more knowledge constructs namely, Technology Pedagogical Knowledge (TPK) which arises from the intersection between TK and PK, while Technological Content Knowledge (TCK) arises from the intersection of TK and CK and Pedagogical Content Knowledge (PCK) at the intersection of PK and CK. The interconnection of all the knowledge constructs reveals the last knowledge constructs called Technological Pedagogical Content Knowledge (TPACK). Thus, Mishra and Koehler (2008) definition of TPACK includes knowledge of how to make concepts understandable by using technology, knowledge of how to use technology with pedagogical knowledge in order to meet students' needs, knowledge of the difficulties in learning concepts and how to eliminate these difficulties by using technology, knowledge of students' epistemological beliefs and background knowledge and how to increase their epistemological beliefs level by using technology. Furthermore, Chukwuemeka et al. (2019) highlighted that TPACK framework can be useful for planning lesson contents, methods and approaches for tranfering content knowledge and respective technologies associated with content and pedagogy. It can also be used for assessment of pre-service teachers knowledge and appraisal of inservice teachers knowledge while serving as a professional development and technology integration framework for educational stakeholders such as the National Universities Commsion and other school administrators.

3. Similarities and Differences

According to the review, it was observed that all instructional models includes the analysis stage because the understanding and breakdown of the learners' needs are very important for the preparation of instruction and also the evaluation stage because instruction must actually be assessed in order to know the effectiveness and if the expected outcome was achieved.

Notwithstanding,

i. Bloom taxonomy has its concerns on learning behaviors and domains.
ii. ADDIE, ASSURE, ICARE, JERROLD KEMP and GERLACH-ELY are models of instructional design.
iii. ABCD presented a model for making lesson objective and can be used with any of these instructional models.
iv. Tripp and Bichelmeyer is a software development model but was adopted as a model for instructional design
v. SAMR and TPACK are models for technology integration.

4. Conclusion

This review of instructional models or frameworks is directed towards promoting effective teaching and learning activities in the classroom. There is no single model that is universally accepted as perfect fit for facilitating classroom instruction. In fact, there are many instructional models available for the teacher to adopt as guide to achieving the desired learning outcome. This review does not capture them all, but has examined fifteen (15) popular models of instructional design from a variety of sources. These models have peculiar similarities and differences which provides helpful understanding of the instructional system design and give educators perspective to design instructional patterns that will presumably make teaching and learning a successful endeavours. Instructional models can be used in both designing unit plans and single lesson plans, therefore teachers should be encouraged to adopt them. Constant usage of instructional models in the development of instruction will aid the teachers to master and update their knowledge of various concepts systematically. This approach will aid easy comprehension of the learner. However, the result of returning to previous stages and redoing steps according to the models that have revisions or repetitions could make the process more time-consuming on the teacher. Nevertheless, due to the varying level of quality of models, educators must be encouraged to be essentially careful in their selection of a particular model to follow when designing instructions.

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