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A REVIEW OF TECHNICAL-SCIENTIFIC AND NONTECHNICAL-SCIENTIFIC CURRICULUM MODELS: TYLER AND WALKER'S MODEL

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ABSTRACT

This review paper will caption an introduction, proactive definition ormeaning of curriculum development, ccurriculum development theories, critiques of Tyler and Walker's curriculum development theories, a comparison on these two models and contrast between these two curriculum development theories, as well as, a conclusion.

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INTRODUCTION

In the lay man's view, a review is judgement or discussion of the quality of something. Review also means to go over a subject again as part of study or to look at something another time. Review has many other senses as both a noun and a verb. A review is a critique of something: a look at something's good and bad points.This review paper on a technical-scientific and a nontechnical-scientific curriculum developmentmodel. The authors have given various definition of curriculum development theories, made clear, a comparison between the technical-scientific and nontechnical-scientific models. In developing a curriculum project, a guide, a framework, a structure, a model, a prototype, a specimen among others, is required in accordance of the content are to be developed. Due to the essence of curriculum development theories in developing curriculum project, different theories (or models) have been propounded.

Examples of curriculum development theories include:

- Ralph Tyler's model
- Hilda Taba's model
- Wheeler's circular model
- John Kerr's model
- Malcolm Skilbeck's model
- Adentwi's interactive model
- Decker Walker's model
- Denis Lawton's model
- Palma's model
- Nicholls & Nicholls' model
- Dick & Carey model
- Giles' model
- Brown's model
- Richard's model

The meaning or definition of Curriculum Development: The concept of curriculum development has been looked at from different perspectives depending on the orientation, philosophical and theoretical background of the individual. Ornstein and Hunkins (2009) consider curriculum development as a process of designing, implementing and evaluating curriculum.From the perspective of Beauchamp (1972, 1981) and Mahalwar (2020), and recently, Mobit et al. (2024), curriculum development is a procedural organization so that curriculum can be produced for implementation, appraisal and

modification.Pinar et al. (1995) view curriculum development as "a generic term which includes curriculum policy, school reform, curriculum planning, design and organization, curriculum implementation, curriculum technology, curriculum supervision, and curriculum evaluation".Richards (2001) considers curriculum development as "range of planning and implementation processes involved in developing or renewing a curriculum". Marsh and Wallis (1999) again indicated curriculum development is the process of selecting objectives, selecting learning experiences, organizing learning experiences, and evaluating them.

Curriculum Development Theories: Curriculum development theories are frameworks or models for developing curriculum.Several forms of frameworks or models have been classified for curriculum development. Models may exist as:

- Technical-Scientific Models and Nontechnical-Scientific Models (Ornstein & Hunkins, 2009).
- Product models and Process models.
- Behavioural/objective models and non-behavioural/non-objective models.

In each of these models, each could be seen as either, rational models, linear models, cyclical models, interactive or dynamic models.

Technical-Scientific Models: The technical-scientific models emphasize subject matter. It ooptimizes students' learning and to allow them to increase their output. They adopt logical sequence of delivering curriculum development (Bhuttah et al., 2019). Examples includes may include Ralph Tyler's model, Hilda Taba's model, Wheeler's model, etc. Technical-scientific model can be deductive or inductive.Examples of deductive include Tyler's model, and inductive include Taba's model. Curriculum development models could as well be seen as behavioural or objective models focus on educational aims and objectives as the basis of curriculum development (Avayiwoe, 2023). They believe that in curriculum development the intended learning outcome must be clearly stated in specific terms. They are largely influenced by the writings of behavioural psychologists such as Ivan Pavlov. They believe that real learning should be observable, measurable, and predictable.It is the oldest and most predominant approach to curriculum development. Behavioural or objective model can be rational/linear/cyclical model, interactive model, etc.Proponents of behavioural or objective models includes; Tyler's models, Taba's model, Wheeler's model, Kerr's model, etc. all these can also be called Product Models. Product models are behavioural/objective models in nature.It is more focused on the objectives when developing curriculum.It can be traced to curriculum theorists such as Tyler (1949).

Nontechnical-Scientific Models: Nontechnical-scientific models focus on the learners' need. They are described as subjective, personal, and aesthetic (Mobit et al., 2024; Ornstein & Hunkins, 2009). Subject-matter and society are considered as secondary focus. Nontechnical-scientific models could be seen as non-behavioural models. Non-behavioural models do not focus on educational aims and objectives as the basis of curriculum development.Hence, do not emphasize stating clearly the intended learning outcomes in curriculum development.Examples of proponents include Walker's model, Stenhouse's model. All these could also be referred to as Process Models.This curriculum development models emphasize on 'means' rather than 'ends'. Focuses on students and learner activities. That is, these proponents believe that learners should have part in deciding the nature of learning activities.

Approaches of curriculum development models: These two models, technical-scientific models and nontechnical-scientific models may be operating in the form of being rational, linear, cyclical, sequential, interactive.

Rational or Linear Models: Rational or linear models presents curriculum development in straightforward form or straight-line form, which begins with objective and ends with evaluation. According to Print (1987), they follow a sequential pattern. Proponents argue that stating objective first is crucial, because, other steps follow from the first, and determined by the first step (Brady, 1990; Zhang, 2023). Examples of rational/linear models are Hilda Tyler's model, and Ralph Taba's model.

Cyclical Models

- Cyclical models do not present curriculum development process in straightforward linear form.
- They believe that curriculum development process is a continuous activity, rather than being static process as advocated in the rational/linear models. Examples include; Wheeler's model, Nicholls & Nicholls' model, etc.

Interactive/Dynamic Models: Proponents of this models believe that curriculum development should follow non-sequential pattern. Also, they believe that curriculum development should reflect the practical reality of an educational environment.Examples of such models include; Walker's model, Skilbeck's model, Adentwi's model, Kerr's model, etc.

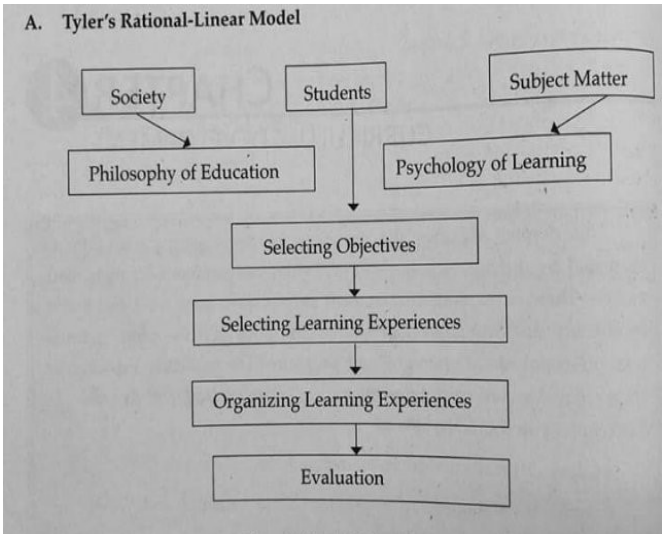
Tyler's Curriculum Development Theory/Model

- Tyler's model is technical/scientific, behavioural/objective model. It is linear in nature.
- In his book titled "*Basic Principles of Curriculum and Instruction*", Tyler explained "a rationale for viewing, analysing, and interpreting the curriculum and instructional programme for an educational institution" (Tyler, 1949).

Out of this, four (4) fundamental questions were raised:

i. What educational purposes should the school seek to attain?
ii. What educational experiences can be provided that are likely to attain these purposes?
iii. How can these educational experiences be effectively organized?
iv. How can we determine whether these purposes are being attained? (Tyler, 1949)

Out of this, he propounded his linear model



Selection of Objectives

Selection of objective is the first step of Tyler's model. Tyler believes that this stage is the "most critical criteria for guiding all the other activities of the curriculum-maker" (Tyler, 1949). He identified three (3) main sources of selecting objectives.

They are:

i. the learner

ii. contemporary life outside schooland
iii. subject matter specialists.

Tyler further indicated that, the selection of educational objectives from these three (3) sources should be screened and filtered using; educational and social Philosophy, and Psychology of learning.On the learner as a source of educational objective, Tyler suggested the need to "provide opportunities for students to enter actively into, and to deal wholeheartedly with, the things which interest him" (Tyler).He suggested examining the needs of the students as well as their interests. Also, he indicated that "education is an active process", and therefore must "involve the active effort of the learner himself".Tyler further recommended the use of teacher observations, student interviews, parent interviews, questionnaires, tests, and records as methods to investigate the learners' interest and needs.On contemporary life as a source of educational objective, Tyler indicated the need to focus on critical aspects of society that are relevant.Examples of contemporary life as suggested by Tyler includes; home and family life, occupation, social and civic life, personal and social life, etc.Again, he recommended that, educational objectives should consist of examining different social groups, communities, population changes, migration, natural resources, etc. when developing curriculum. Observations, questionnaires, interviews, public records, etc are means of investigating contemporary life (Tyler, 1949).On subject matter specialists as a source of objective, Tyler posited that subject specialists' knowledge is important in considering objectives, in two (2) ways; for determining "a broad function a particular subject can serve" and for determining "a particular contribution the subject can make which are not the primary function of the subject concerned" (Tyler).

Selection of Learning Experiences: According to Tyler (1949) learning experiences referred to "the interaction between the learner and the external conditions in the environment to which the learner can react". He noted that, it is possible for two students to be in the same class with different experiences.

Five (5) general principles of selecting learning experiences were identified by Tyler. These are;

- The learning experiences should give students opportunity to practice the kind of behaviour implied by the objectives.
- The learning experiences should give students satisfaction for carrying the kind of behaviour implied by the objective.
- The learning experiences should be within the range of students involved.
- Many possible learning experiences should be used to obtain the same educational objectives.
- The same learning experiences will usually bring about several outcomes.

Tyler went further to outline four (4) characteristics of learning experiences that are useful. These are;

i. The first characteristics is using learning experiences to develop skill in thinking (i.e., not just simple recall of information).
ii. The second is learning experiences that are helpful in acquiring information such as principles, laws, theories, experiments, supporting generalization, ideas, facts, terms.However, on this characteristics, Tyler (1949) cautioned that the information must be "viewed as functional", not as "an end in itself". Further indicated that "it is not desirable to set up learning experiences solely to memorize materials".
iii. The third is learning experiences that are helpful in developing social attitudes.According to Tyler, change in attitude comes as result of: either new insight and new knowledge about the situation or satisfaction or dissatisfaction one has obtained.
iv. The fourth is learning experiences that are helpful in developing interests.

Organization of Learning Experiences: According to Tyler (1949) for "educational experiences to produce a cumulative effect, they must be organized in such a way as to reinforce each other". And that effective organization of learning experiences influence the efficiency of instruction, and degree to which objectives are achieved. He noted two (2) broad organizational structures: vertical organization (within the same subject area), and horizontal organization (relating to other subject areas).Out of these, Tyler identified three (3) criteria for effective organization of learning experiences.These are; continuity, sequence and integration.Continuity is "the vertical repetition of major curriculum elements"(Tyler, 1949).That is, there must be recurring opportunities for a particular skill or concept to be practiced and developed.Sequence is building each successive experience on the preceding experience in a more broadly and deeply manner of the matter involved. Sequence emphasizes higher order learning not mere repetition. Integration is the horizontal relationships of the learning experiences. That is, relating learning experiences to other subject areas.Notwithstanding these criteria, Tyler (1949) further outlined some principles of organizing learning experiences. These includes;

i. Chronology
ii. Increasing breadth
iii. Increasing range of activities, etc

Evaluation: According to Tyler (1949), evaluation is the "process of finding out how far the learning experiences as they were developed and organized actually produced the desired results".It is through evaluation that programme's strengths and weakness can be identified. He noted that, it is important to appraise students before and after the learning experiences in order to measure the amount of change. He also noted the essence of measuring behavioural change during the learning experiences.Appropriate methods of evaluation such as tests, observations, interviews, questionnaires, samples of students' work, etc. were advocated by Tyler. He emphasized the need to check each evaluation instrument against the objectives. Tyler again indicated the essence of having reliable and valid evaluation instruments.The essence of piloting evaluation instrument to see whether it served as a convenient way of gathering evidence was noted by Tyler. Tyler (1949) argued that once evaluation results are obtained, the data need to be analysed in order to identify the strengths and weakness of the programme. Tyler (1949)concluded his curriculum development theory/model by indicating that "curriculum is continuous process and that materials and procedures are developed, they are tried out, their results appraised, their inadequacies identified, suggested improvements indicated, there is replanning, redevelopment, and then reappraisal".

Some advantages of Tyler's Curriculum DevelopmentTheory/Model

i. It provided the world with first complete and comprehensive view about how the school curriculum should be systematically planned and organized.
ii. It is the basic behavioural/objective model. Other models are attempting to improve upon it.
iii. Tyler's model has had much more influence on curriculum thinking than other models.
iv. It provides the basis for measuring the degree to which pre-defined objectives are achieved.
v. Tyler's model does not necessarily impose any particular philosophy of education on schools, making it possible to be used in all kinds of schools and cultures.
vi. Another advantage is that each step in Tyler's model is taken at a specific time. Thus, one step follows the other.

Some criticisms of Tyler's Curriculum Development Theory or Model: One major criticism of Tyler's work is that his curriculum development theory/model is considered as so simplistic and mechanistic. That is, the model is straight forward linear activity which begins with objective and ends with evaluation. Kliebard (1970) criticized Tyler's model for its traditional doctrine in the curriculum field.Also, Tyler's work has been criticized on the grounds that he used the term "objective" as if it is synonymous to

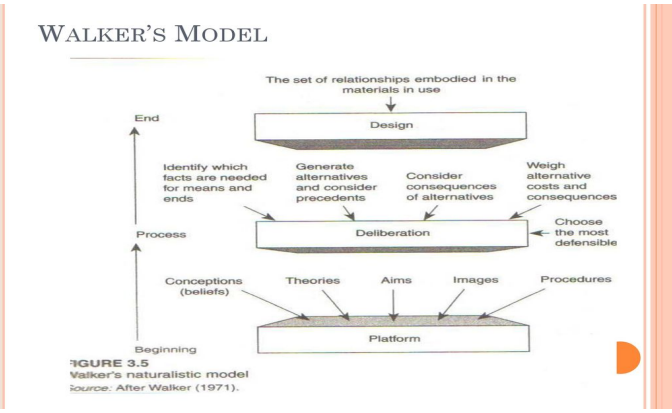
"content" (Kliebard, 1970). That is, he down-played the selection of subject matter or content.Tanner and Tanner (1980) were of the view that Tyler presented the three sources of objectives as separate entities without showing their interrelationship with each other. Again, Tyler has been criticized on the grounds that he did not indicate adequately the interrelatedness of the components of the curriculum process. Kliebard (1970) criticized Tyler's inclusion of "suggestions from subject matter specialists as a source of selecting curriculum objectives. That, suggestions from subject matter specialists are really not the source of objective.Kliebard (1970) again criticized Tyler on the grounds that, the inclusion of learners' needs as a source of objective for curriculum development was not a new idea. That, it has been a consistent element in literature since 1920s.Further, Kliebard (1970) indicated that Tyler's use of Philosophy as a screen for the sources of objective is a way to cover up the deficiencies the three sources created when formulating objective. Kliebard added that, "it is philosophy after all that is the source of Tyler's objectives and that the stipulated three sources are mere window dressings". Kliebard (1970) indicated that, Tyler's model should be viewed for what it is, but not the universal model of curriculum development. However, notwithstanding the criticisms from curriculum scholars such as Kliebard (1970), Tanner and Tanner (1980), Kerr (1968), etc., others have refuted such criticisms as unjustified treatment of Tyler (Hlebowitsh, 1992). For instance, Hlebowitsh (1992) pointed out that, Tyler warned repeatedly and cautioned readers from interpreting the *rationale* as a linear process.Again, Hlebowitsh (1992) refuted Kliebard's criticisms that the Philosophy is Tyler's source of objective, and the three sources were mere window dressing.By stressing that, Tyler repeatedly cautioned against using a single source for the formation of educational objectives, and emphasized the integration of all the three sources as well as the philosophical screens.

Walker's Curriculum Development Theory/Model-Naturalistic Model: Walker's naturalistic model is non-technical/scientific model, non-behavioural model.It is dynamic or interactive model. It is considered as a process model. It is descriptive in its approach unlike the Tyler's model which is prescriptive from its orientation. The model is naturalistic because, it describes how curriculum is actually developed rather than how it should be developed. That is, the model portrays how curriculum should be practically developed. The naturalistic model responds to practical problems of curriculum development. Proponent of this model believe that, curriculum development is not necessarily "to meet theoretical requirements, but rather as a response to practical problems (Hannay, 1989; Soltani, 2016).Walker's naturalistic model looks at how practically curriculum is developed.It examines how the process of curriculum planning is done rather than suggesting how it should be done. Walker (1971) is of the view that effective curriculum development is when individuals, experts and stakeholders participate in the curriculum process to reach consensus on the final product.

In the light of this, Walker (1971) identified three (3) phases (or stages) of his curriculum development model. These are;

- The platform phase/stage
- Deliberation phase/stage
- Design phase/stage

The Platform Phase/Stage: Building on the ideas of Schwab (1969), and Walker (1971) noted that whenever people come together to engage in curriculum development, they approach it with different beliefs and orientations. The platform stage constitutes the various conceptions, beliefs, theories, aims, ideologies, philosophies, orientations, etc. curriculum developers, experts, stakeholders, etc. bring to the discussion table as to how the curriculum should be developed.Walker suggested that, at this stage, theindividuals should be allowed to talk, discuss, and argue about their beliefs about what the curriculum should be. The platform stage is considered as a brainstorming stage, for generating as many ideas as possible without criticism (Van Damme et al., 2013). This stage is to ensure that adequate attention is given to all participants to air their opinions, beliefs, ideas, etc. on how the curriculum should be developed.The platform stage is for consensus building.Walker cautioned that, if this stage is not properly handled, it could delay the success of the curriculum development.



Deliberation Stage: Walker (1990), and Yang and Jeong (2022) consider deliberation as the process of rational argumentation in which possible actions are taken for developing and constructing curriculum. The deliberation stage is concerned with consensus, but the attention turns away from beliefs of individuals, into possible courses of action. It is the decision-making stage where the various alternative courses of actions are critically weighed. The deliberation stage is where time is largely spent on refining and elaborating on the ideas generated at the platform stage. It is where materials are shaped based on further deliberation of participants.

Walker (1971) specifies that, in the deliberation process, the following are done:

- Identifying relevant facts which are needed
- Generating alternative courses of action in the light of precedents
- Considering the consequences of all alternatives
- Weighing alternative costs and consequences
- Choosing the most defensible alternative

Roby (1985) argues that, during deliberation process, there should be self-criticism.That is, when deliberators take the time to perceive, criticize, and alter their own deeply felt preconceptions of the curriculum development. Roby (1985) further indicated that, deliberations should not be linear but rather 'spiral of meaning'. This is consistent with the suggestion of Schwab (1983) and Young-Tae (2008), that curriculum deliberation must take place in a back-and-forth manner. And that any attempt to make it "linear movement from ends to means is absurd".Through deliberation and reflection upon solutions, the curriculum is continually reformulated and reconstructed (Toh, 2021; Yang & Jeong, 2022).

The Design Phase: At the design stage, sufficient consensus has been achieved about beliefs, problematic circumstances, etc. without further considerations of alternatives. It is the actual phase of curriculum m design.Walker argues that, the design phase contains both implicit and explicit considerations. The design phase is the creation of the curriculum which include specific subjects, instructions, teaching materials or activities.

Some advantages of Walker's Model:It provides critical thinking, and hands on approach to curriculum development. It provides flexibility among curriculum planners to deliberate ideas, make changes, and improve curriculum development in schools. According to Print (1989), by avoiding the obsession of writing objectives, the curriculum developer becomes free to be more creative.Also, Brady (1990) and Tyler-Wood et al. (2000) maintains that, it allows the curriculum developer to change the order of planning.

Comparison Technical-Scientific and Nontechnical-Scientific models	
Technical-Scientific Models	Nontechnical-Scientific Models
• Curriculum as a plan or blueprint	• Questions assumptions of technical approach
• Product model (plans an intentions)	• Process model (activities and effects)
• Make assessment precise	• Complete freedom for students
• Planned by the teacher	• Problem-based centered
• Subject-centered design	• Student-centered design
• Usually, pre-ordained objectives	• Stresses on personal, subjective aesthetic nature of curriculum
• Tyler's Four basic principles, Backward design model (Wiggins & McTighe)	• Deliberative Model (reality exists in circles not linear) (Ornstein & Hunkins, 2004), post-positivism model
• Tyler, Taba,	• Walker

Some criticisms of Walker's Model: Brady (1990) criticized the model for lack of systematic way in terms of specifying objectives. Others have also criticized the model for downplaying objectives (Print, 1989).Deliberation can be chaotic, biased opinions, and side-lining other curriculum developers and specialists. Deliberations could be time consuming without achieving any concrete objective or direction for the curriculum development.Deliberations could be dominated by few individuals for their own interest.Again, others believe Walker studied large-scale curriculum project and propounded his model, therefore, translating his model to small-scale curriculum project could be problematic.Another criticism is that, others believe Walker's model does not provide sufficient guidelines after the curriculum is developed and implemented. Consensus is often hard to achieve when developing curriculum at district, regional or national level. Deliberations require intensive resources since different curriculum developers and specialists may be invited. It can result in producing curriculum that is not consistent and aligned internally.

Comparing and Contrasting Tyler's model and Walker's Model

Comparing: Both provide the basis for thinking about the curriculum development. Both models shape curriculum development.

Contrasting: Tyler's model is technical/scientific, behavioural/ objective model. That is, it focuses on objectives as the basis for curriculum development, whilst Walker's model is non-technical/scientific, non-behavioural/objective model. It does not focus primarily on objectives. Tyler's model is linear, whilst Walker's model is interactive. Tyler's model is prescriptive (Lee & Stinson, 2014). That is, it provides the theoretical framework for developing curriculum or what curriculum development should be, whilst Walker's model is descriptive. That is, it describes how curriculum is actually developed practically. Tyler's model provides means of evaluating curriculum after its development, whilst, Walker's model does not provide means of evaluation (Wraga, 2017). Tyler's model is rigid and does not allow for flexibility, whilst Walker's model is more flexible in making decision about the curriculum development.

CONCLUSION

Technical-scientific curriculum model is objective based whiles nontechnical-scientific curriculum model is standard based.

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Draft manuscript: Amidu, Kwakye, Agyemang, Aggrey, Susuoroka, Karim, Afful
Final revision: Kwakye, Amidu
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