A Comprehensive Review on Curriculum in Reference to Bachelor of Dental Surgery Kathmandu University

Rijal AH,[1] Rajbanshi R,[2] Humagain M[1]

[1]Department of Periodontology and Oral Implantology, Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu University Hospital, Dhulikhel, Kavre, Nepal.

[2]Department of STEAM Education, Kathmandu University School of Education, Hattian, Lalitpur, Nepal.

Corresponding Author

Arjun Hari Rijal

Department of Periodontology and Oral Implantology, Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu University Hospital, Dhulikhel, Kavre, Nepal.

E-mail: drarjunrijal@kusms.edu.np

Citation

Rijal AH, Rajbanshi R, Humagain M. A Comprehensive Review on Curriculum in Reference to Bachelor of Dental Surgery Kathmandu University. *Kathmandu Univ Med J*. 2024;88(4):478-85.

ABSTRACT

This review article provides a detailed analysis of educational curricula, focusing on their design, content, and teaching methods. It explores how a well-structured curriculum can support effective learning by balancing theoretical knowledge with practical skills. The article discusses key elements that make a curriculum successful, such as clear objectives, up-to-date content, and interactive teaching methods. It also identifies common gaps, like the need for regular updates and better alignment with current professional standards. By reviewing various curricula and comparing them to global best practices, the article suggests ways to enhance educational quality and ensure students are well-prepared for their careers.

KEY WORDS

Curriculum, Dental education, Effective learning

INTRODUCTION

The term 'curriculum' has been defined as "A programme of activities (by teachers and pupils) designed so that the pupils will attain certain educational and other schooling objectives".[1] Traditionally, curriculum is considered as the basis for the process of teaching and learning. Various factors may affect the effective implication of curriculum and these factors are interconnected. Schwab described these factors as teachers, learners, subject matter, context, and curriculum making.[2] According to him, failure to consider any one of them will result in incomplete curriculum. Curriculum is basically designed in three different manners: intended curriculum: a system-wide official curriculum, enacted curriculum: how teachers bring that content to life in their classroom and attained curriculum: the understanding students actually gain during a lesson.[3] Whenever there is development of new concept or new curriculum, it has to go through various process: initiation, implementation, continuation and outcome.[4]

Kathmandu University has designed a curriculum for Bachelor of Dental Surgery in 2011 to embrace modern educational scientific technology as applied to dental education, provides for acquisition of core knowledge. To focus on the need of the student-centered curriculum, the curriculum is patient-based and oriented towards to the community. A problem-based approach and integration of different subjects and specialties, to the possible extent, are encouraged and aims at providing the basic skills and understanding, required for general dental practice of standards that are expected, recognizing the achievement of appropriate standards of patient care based on needs of an individual and the community as a whole, appraisal for commitment for continuing education and preparing for higher training in a dental specialty.

This review articles tries to view the current curriculum of Bachelor of Dental Surgery of Kathmandu University in various dimensions.

DISCUSSION

Traditionally, curriculum is considered as the basis for the process of teaching and learning. Various factors may affect the effective implication of curriculum and these factors are interconnected.

1. Common places of curriculum

Swab described these factors as teachers, learners, subject matter, context, and curriculum making.[2] According to him, failure to consider any one of them will result in incomplete curriculum.

Teachers: Teachers are the central force of any curriculum without whom content cannot be delivered properly to the students. Hence, while making curriculum special emphasis is given to the teachers. A similar trend can be seen in the curriculum of Bachelor of Dental Surgery (BDS). Clinical and theory classes related to the human body are teacher dependent i.e. heavily dependent on the availability of the teacher. Selection of a teacher for this purpose depends on his/her background, teaching/learning experience, nature, etc. Overdependence on this commonplace will usually decrease the primary focus on the learners. However, till now teachers are considered as the primary point of the common places. In the present curriculum of the Bachelor of Dental Surgery, teachers are the primary driving force. Their experience, attitude, and nature of medical education are evaluated during their enrollment. Their expertise and experience usually useful for the proper update and the revision of the curriculum.

Learners: The primary goal of any curriculum is the delivery of the content for which both teachers and learners are essential. Background, interest, nature, qualification, and preference of the learners usually affect the delivery of the content to the learners. So, the teachers, learners, and content should be correlated with the context. Prerequisites for this course are basic knowledge of the science, first division marks, and completion of the entrance examination, which defines the learners in this course. After the completion of Bachelor of Dental surgery, the dental graduate should be able to: develop a holistic approach to the practice of modern dentistry, demonstrate understanding of contemporary knowledge and skills, possess qualities of a compassionate and socially accountable human being, provide education to people on oral health and health related matters, etc.

Context: Context is the setting in which content is delivered to the learners by the teachers. So, all these common places carry equal weightage while making new curricula.

Contents include various information and procedures regarding the human body, especially the oral cavity. Also, for this, special dental clinical setup is required.

2. Schubert's images of the curriculum

Schubert has described various images of the curriculum.[5]

Curriculum as a subject matter: In most of the education system, curriculum is reflected as a subject matter. Other associated factors like teacher's attitude/teaching style, teacher-student interaction, extracurricular activities, and learning from daily non-teaching activities are neglected in this type of image system. Our medical/dental curriculum is focused on the subject matter. Our study deals with the human body, normal physiology, and disease process. In my view, more emphasis on subject matter is deemed necessary to treat human diseases.

Curriculum as programme of planned activities

We usually provide all the information about subjects and activities to be completed within a definite period. Similarly, in the curriculum as a programme of planned activities, all the activities, subject matter, and planned activities are provided to the learners. Teachers usually prepare a planned activity (lesson plan) for a class and deliver the subject matter to students. This type of image mainly focuses on outcomes as end results rather than the overall development of the students. In our scenario, due to more focus on clinical activities, it's difficult to make a lesson plan/planned activity and follow in the classroom.

Curriculum as Intended learning outcomes

In the case of curriculum as intended learning outcomes, it mainly focuses on the end results that should be developed by the students. Students are aware of all the aspects of the intended outcome.

For example, in our scenario, the produced dental graduate must have following: clinical skills to diagnose and manage disease, desirable characteristics and attitudes ingrained in the profession, competency to determine and resolve health problems of the community, proficiency to function in diverse health care settings, interest in continuing dental education as a intended learning outcomes.

Curriculum as cultural reproduction: In every curriculum, we must include the subject matters that display the culture of the present society. The curriculum should be the image of the society. But, due to the nature of our curriculum (related to the medical/dental aspect of humans), there is a lack of incorporation of cultural aspects. Various traditional treatment aspects were not included in the present curriculum.

Curriculum as Experience: The curriculum should focus on the experience of the learners rather than their memory capacity. Curriculum as an experience mainly relies on the individual experience of the learners after the content is delivered. In our scenario, students should have memory-based knowledge of the subject matter so that, they can apply this type of knowledge while performing various clinical practical procedures. The main lacking point of our present curriculum is inability to incorporate students' experience as an important part of the curriculum.

Curriculum as Discrete tasks and Concepts: In case of curriculum as discrete tasks and concepts, it focuses on the skill-based knowledge. All the sets of training can be made to achieve certain types of skill-based goals. Our curriculum also focuses on skill-based outcomes with the help of theoretical and practical knowledge of the human biological system. With this, student can perform various clinical/nonclinical procedures to treat oral health-related diseases.

Curriculum as a Currere: Curriculum as a currere mainly relies on the individual experiences in the written form. The written document usually helps to enhance the skill and the process of learning. But, it is impractical to incorporate an individual's autobiography during the teaching/learning process.

Curriculum as a subject matter, discrete tasks and concepts, and intended learning outcomes mainly dominate the present curriculum of Bachelor of Dental Surgery. In my view, for a good curriculum, all the images of Schubert should be incorporated. Our current curriculum has certain positive as well as negative aspects. Due to the nature of the course, it should mainly focus on the subject matter and emphasize this image given by Schubert. Similarly, it should include discrete tasks and concepts, and intended learning outcomes as a main component in the curriculum. These are already included in the current one which is a positive aspect. But, due to the lack of other images in our current curriculum, I would like to include the curriculum as a programme of planned activities, cultural reproduction, social reconstruction, experience, and curerre.

For this preparation of the lesson plan, incorporation of the social values and knowledge of contemporary situations should be included in our present curriculum.

3. Various aspects of the curriculum

There are various aspects of the curriculum other than that of Schubert images. Theory and practice of curriculum can be viewed under the following: knowledge transmission, product, process, and praxis. These concepts of curriculum can be best explained based on the current curriculum of the Bachelor of Dental Surgery.

The main aim of any curriculum is to transmit knowledge to learners with the help of the teachers. For example, the current syllabus incorporates the basic, non-clinical, and clinical aspects of the human oral cavity which can be shared among the students with the help of teachers.

Secondly, the main outcome of the curriculum is to produce successful manpower who are creative and entrepreneur rather than skilled manpower which can be explained as a product. For example, the main product of our current curriculum is to produce skilled dental surgeons who can treat all kinds of oral-related diseases. Thirdly, process and praxis are the way of achieving the product of the curriculum. For example, skilled dental surgeons can be produced when students perform a series of pre-clinical, clinical laboratory works, and clinical practices in the patients. These can be considered as a process/praxis in the dental surgery.

4. Different models of curriculum

Curriculum development models serve as frameworks for creating educational programs and curricula that meet specific goals and needs. These models guide the systematic planning, implementation, and evaluation of curricula. Below are some prominent models of curriculum development:

Tyler's Model (1949)[6]

Ralph Tyler's model is one of the earliest and most influential models. It is often referred to as the "objectives model" because it emphasizes defining clear educational objectives. The model consists of four fundamental questions: What educational purposes should the school seek to attain? What educational experiences can be provided that are likely to attain these purposes? How can these educational experiences be effectively organized? How can we determine whether these purposes are being attained? Tyler's model is linear, focusing on the logical sequence of objectives, learning experiences, organization, and evaluation.

Taba's Model (1962)[7]

Hilda Taba's model builds on Tyler's work but is more detailed and teacher-centered. It advocates for grassroots involvement in curriculum development, with teachers playing a critical role. Taba proposed a seven-step process: diagnosing needs, formulating objectives, selecting content, organizing content, selecting learning experiences, organizing learning experiences, and evaluating. This model emphasizes the adaptability and continuous refinement of the curriculum based on feedback.

The Wheeler Model (1967)[8]

D.K. Wheeler's model is cyclic rather than linear, reflecting a more dynamic and flexible approach. It consists of five interrelated phases: aims, goals, and objectives; selection of learning experiences; selection of content; organization and integration of learning experiences and content; and evaluation. Wheeler's model highlights the ongoing nature of curriculum development and the need for constant assessment and adjustment.

Kerr's Model (1968)[9]

J.F. Kerr's model is another cyclical approach, emphasizing the interrelationship between objectives, knowledge, evaluation, and school learning experiences. Kerr argues that curriculum should be viewed as an interconnected process rather than a sequence of steps. This model promotes a holistic view, considering the educational environment and the dynamic interplay between different curriculum components.

The Backward Design Model (Wiggins and McTighe, 1998)[10]

Grant Wiggins and Jay McTighe introduced the backward design model, which starts with the end in mind. Educators first identify desired learning outcomes, then determine acceptable evidence of learning, and finally plan instructional activities. This model ensures that all curriculum components align with the desired goals, fostering a more coherent and targeted educational experience.

The Spiral Curriculum (Bruner, 1960)[11]

Jerome Bruner proposed the spiral curriculum, where learners revisit the same topics over time, each time at a deeper and more complex level. This model emphasizes building on prior knowledge and promoting a deeper understanding of key concepts through repeated exposure and incremental learning.

The Subject Centered Design (Ornstein & Hunkins, 2017)[12]

The subject-centered model of curriculum development focuses on the content and organization of subject matter. It is rooted in the tradition of academic disciplines, where the primary goal is the transmission of established knowledge and skills. In this model, the curriculum is organized around specific subjects such as mathematics, science, history, and language arts, with a structured sequence of topics to be covered within each subject. The emphasis is on mastery of content, and the teacher plays a central role in delivering information and guiding student learning. This approach ensures a comprehensive and systematic coverage of each discipline, preparing students with the foundational knowledge needed for advanced study and professional expertise.

The Learner Centered Design

The learner-centered model of curriculum development prioritizes the needs, interests, and experiences of students. It is designed to foster active and personalized learning, encouraging students to take responsibility for their own education. This model emphasizes the development of critical thinking, problem-solving, and collaborative skills, with a focus on real-world applications and student engagement. The curriculum is flexible and adaptable, often incorporating project-based learning, experiential activities, and interdisciplinary themes. Teachers act as facilitators and guides, creating a supportive learning environment that nurtures student curiosity and intrinsic motivation. This approach aims to produce lifelong learners who are capable of adapting to a rapidly changing world (Weimer, 2013).[13]

The Problem-Centered Design (Johnson and Johnson, 2002)[14]

This model focuses on real-world problems and challenges, encouraging students to engage in problem-solving and critical thinking. The curriculum is organized around key issues or problems, making learning more relevant and applied. This approach is particularly effective in promoting higher-order thinking skills and fostering a deeper connection between theoretical knowledge and practical application.

In summary, curriculum development models provide structured approaches to designing educational programs. Each model offers unique perspectives and methodologies, from Tyler's linear objectives model to the dynamic, cyclical approaches of Wheeler and Kerr, and the innovative backward design model by Wiggins and McTighe. Selecting an appropriate model depends on the specific educational context, goals, and needs, ensuring a comprehensive and effective curriculum development process.

5. Different steps of curriculum development

i. Needs Assessment

Understanding the needs of students and the community is fundamental to curriculum development.[15] Participants will learn methods for conducting effective needs assessments, including surveys, interviews, and focus groups.[16]

ii. Learning Objectives

Clear and measurable learning objectives guide curriculum design and assessment.[17] The workshop will explore Bloom's Taxonomy and other frameworks for writing effective learning objectives.[18]

iii. Content Selection and Organization

Selecting and organizing content that aligns with learning objectives is crucial.[6] Participants will discuss criteria for content selection and strategies for sequencing material to enhance learning.[11]

iv. Instructional Strategies

Effective instructional strategies engage students and facilitate learning.[19] The workshop will introduce various teaching methods, including active learning, problem-based learning, and collaborative learning.[20]

v. Assessment and Evaluation

Assessment methods should align with learning objectives and provide meaningful feedback.[21] Participants will explore formative and summative assessment techniques and the use of rubrics for consistent evaluation.[22]

vi. Curriculum Alignment

Ensuring alignment between learning objectives, instructional strategies, and assessments is essential for curriculum coherence.[23] The workshop will emphasize the importance of alignment and provide tools for achieving it.

5. Curriculum implementation

Whenever there is development of new concept or new curriculum, it has to go through various process: initiation, implementation, continuation and outcome.[24] The second

steps of curriculum development carried with two approach: programmed (fidelity) approach and adaptive evolutionary approach.[25]

Programmed (fidelity) approach

Programmed approach is appropriate if the amount of change intended is small or orchestrated in a gradual manner, if the curriculum may be specified according to tested and widely known teaching methods.

Features

• Predetermined programme, specific time

• Efficiency

• Standard

• For large group

Strengths

• It takes care to communicate its intentions and ways of implementation as clear as possible and, thus, its evaluation criteria are unambiguous

• Efficiency, clarity

Weaknesses

• Only suitable for such innovations which are actually programmable

• Needs and characteristics of persons and organizations in different regions may vary so much that some leeway is desirable

• Not flexible

• Teacher centered

Adaptive Evolutionary Approach:

Flexibility: This approach allows for adjustments and modifications to the curriculum based on feedback from teachers, students, and other stakeholders. It recognizes that a one-size-fits-all approach may not be effective in all contexts and that adaptations may be necessary to meet the needs of diverse learners.

Active Participation: Participants are encouraged to actively engage in the implementation process, providing opportunities for them to internalize the key aspects of the innovation. This active involvement can lead to a deeper understanding of the curriculum and a greater sense of ownership among stakeholders.

Continuous Learning: The adaptive-evolutionary approach views implementation as a learning process for all involved. It recognizes that complex changes may require ongoing relearning and adjustment, and it encourages a culture of continuous improvement and reflection.

Evaluation and Feedback: Regular evaluation and feedback mechanisms are essential components of the adaptive-evolutionary approach. By collecting data on the effectiveness of the curriculum and its impact on teaching and learning.

Situational Adaptation: This approach emphasizes the importance of adapting the curriculum to the specific characteristics and needs of the context in which it is being implemented. It recognizes that what works in one setting may not necessarily work in another and encourages a responsive and contextually sensitive approach to curriculum development.

Benefits

• Promotes innovation and creativity in teaching practices

• Enhances stakeholder engagement and buy-in

• Supports ongoing improvement and responsiveness to changing educational need

Though there are different approach for the curriculum implementation, we should use judiciously based on the need, quality and characteristics of the curriculum. In our current scenario, we are using programmed approach of curriculum implementation. Properly prepared curriculum is being used in students who meet basic requirements on a special classroom setup. One of the most important demerits of our curriculum is lack of continuous evaluation during the entire process of curriculum implementation.

Curriculum development by Kathmandu University with the help of all the stakeholders -implementation in different level (college level, class level) with the help of management, teachers, students -continuous curriculum revision workshop by subject committee experts -Improvements in the current status of the curriculum

Limiting and facilitating factors to apply current curriculum of Bachelor of Dental Surgery:

1. Characteristics of the curriculum

• There is perceived need of experienced dental surgeon in our rural as well as developed part of our country.

• The goal of the curriculum is very clear.

• Quality of the content is good

• Lack of advanced technique, material in the current curriculum

2. Local Characteristics

• Active support from the local community

• Community involvement of the content of the curriculum

3. Organizational

• Full of commitment/support from the university and dental college administration

• Availability of the resources

• Experienced teacher

• Positive attitude and vision of teacher

• Competencies and attitudes of the students is good

Minimization of the challenges in curriculum implementation

Curriculum design and development are critical steps in the adoption of new concepts. Similarly, curriculum implementation may present certain challenges. In the current context, the implementation of the Bachelor of Dental Surgery curriculum also faces various challenges. These challenges can be minimized through proper collaboration between curriculum developers, university administration, college management, teachers, and students.

There should be proper alignment among the curriculum developers and other stakeholders for the proper implementation. The new concepts/new idea developed by curriculum developer should understand by other stakeholders for proper implementation. Curriculum development committee can organize seminar, workshop for university administration, college managements and teachers. Curriculum implementation can be done in different level as follows:

1. In curriculum level

• Timely revision and update to incorporate the recent advances in dentistry

• Modification in the contextual goal

• Addition of contextual material in the curriculum

• Incorporation of simulation based or proper clinical based activities

2. Local characteristics

• Past experience of current curriculum will be sent to the managerial level

• Incorporation of community based clinical activities

• Obtaining of the proper support from the local community level

3. Organization

• Increase in the level of commitment from the university, college level

• Arrangements of proper resources

• Timely training of the faculties/staff

• Addition of competent and experienced teachers

• Entry criteria for students should be modified

4. Government and external agencies

• Support from the local as well as central government

6. Curriculum evaluation

Evaluation is a vital part of education. Schools and universities use it not only for quality assurance but for many other important reasons. Evaluation helps determine whether students are meeting their learning goals and whether teaching standards are being maintained. It also ensures that the curriculum evolves in the right direction.[26] In medical and dental education, the curriculum needs to continually adapt to meet the changing needs of students, institutions, and society. Different methods and guidelines have been proposed in the literature to evaluate these programs effectively. This ongoing assessment is essential to ensure that educational programs remain relevant and effective, preparing students for the demands of their future professions.[27]

Stufflebeam's CIPP model of program evaluation, developed in the late 1960s, has been widely used by many institutions to evaluate their curricula.[28] The reason for choosing this model in the present study is its straightforward approach, covering four key areas: Context, Input, Process, and Product. By using this comprehensive model, curriculum developers can improve existing programs and meet accountability standards, as it provides both formative (ongoing) and summative (final) evaluation. The CIPP model has been used to evaluate health profession programs in various parts of the world, demonstrating its effectiveness and adaptability.[29,30]

The CIPP (Context, Input, Process, Product) model is a comprehensive framework for evaluating educational programs. Here's an evaluation of the Bachelor of Dental Surgery (BDS) curriculum at Kathmandu University using the CIPP model. For evaluation the thorough study of the current curriculum was done and necessary information were collected.

Context: objectives, mission, goals

Input: resources, infrastructure, curriculum content

Process: teaching-learning process, co-curricular activities

Product: skills, values, attitudes, results

Findings

a. Context:

Goals: The BDS program aims to produce competent dental surgeons capable of meeting the oral health needs of the population.

Alignment with National Needs: The curriculum should align with Nepal's healthcare policies and address the prevalent oral health issues in the country.

Stakeholder Expectations: Students seek a curriculum that provides comprehensive clinical skills, while employers expect graduates to be proficient and ready for practice.

b. Input

Resources: The program has a qualified faculty, but continuous professional development is necessary to keep up with advancements in dentistry.

Facilities and Equipment: While the facilities are adequate, there is always room for upgrading to include the latest

dental technologies.

Curriculum Design: The curriculum is designed to cover essential theoretical knowledge and practical skills, but regular updates are needed to incorporate the latest research and technologies.

Admission Criteria: The selection process is rigorous, ensuring that only the most capable students are admitted.

c. Process

Teaching Methods: A combination of lectures, practical sessions, and clinical rotations is used. Innovative teaching methods, such as problem-based learning, could enhance student engagement and understanding.

Theoretical vs. Practical Learning: There is a good balance, but more opportunities for hands-on clinical practice could be beneficial.

Student Progress Evaluation: Regular assessments, including written exams, practical exams, and continuous assessments, help in monitoring student progress. Feedback mechanisms could be improved to provide more constructive guidance.

d. Product

Graduate Competencies: Graduates are generally competent, but continuous improvement in clinical skills is necessary.

Employment Rate: Most graduates find employment in dental practices or pursue further studies, indicating the program's effectiveness.

Perceptions: Both employers and graduates view the program positively but suggest improvements in clinical training and exposure to advanced dental procedures.

CONCLUSION

The curriculum for the BDS degree is to produce a well-rounded dental graduate who as a result of the four and a half years of undergraduate education programme in dental surgery will be competent to carry out preventive, promotive and curative functions expected of a dental surgeon. The accent of the curricular approach is community orientation, integrated teaching-learning and problem-based learning. The curriculum has been prepared after reviewing the various dental science curricula available in Nepal and India. Within the scope of this review the various characteristics of curriculum of Bachelor of Dental Surgery includes:

- Student centered (rather than teacher centered)
- Problem based (rather than subject based)
- Integrated (rather than discipline based)
- Community oriented (rather than hospital centered)
- Electives embodied (rather than standard program oriented)
- Systematic (rather than apprentice based)

Similarly, based on the findings of evaluation of the current curriculum following measures can be applied to enhance the quality of the undergraduate curriculum of Bachelor of Dental Surgery

Curriculum Updates: Regularly update the curriculum to include the latest advancements in dental science and technology.

Faculty Development: Invest in continuous professional development for faculty to ensure they are up-to-date with current best practices.

Clinical Exposure: Increase opportunities for hands-on clinical practice to enhance students' practical skills.

Innovative Teaching Methods: Incorporate more problem-based and student-centered learning approaches to improve engagement and understanding.

Feedback Mechanisms: Enhance feedback systems to provide students with more constructive and actionable insights on their performance.

By addressing these areas, the BDS program at Kathmandu University can further improve its effectiveness and better meet the needs of its students and the broader healthcare community.

REFERENCES

1. Grundy, S. Curriculum: Product or praxis? New York: Palmer Press. 1987.
2. Schwab J. Science, curriculum and liberal education: Selected essays. The University of Chicago Press; 1978.
3. Kurz A, Elliott SN, Wehby JH, Smithson JL. Alignment of the intended, planned, and enacted curriculum in general and special education and its relation to student achievement. *J Spec Educ*. 2010 Nov;44(3):131-45.
4. Fullan M. The new meaning of educational change. Teachers college press; 2015 Nov 30.
5. Schubert WH. Curriculum: Perspective, paradigm, and possibility. MacmillanPublishing Company. 1986.
6. Tyler RW. Basic principles of curriculum and instruction. The curriculum studies reader. 2009:69-77.
7. Taba H, Spalding WB. Curriculum development: Theory and practice. New York: Harcourt, Brace & World; 1962 Jan.
8. Wheeler, D. K. Curriculum Process. London: Hodder & Stoughton. 1967.
9. Kerr, J. F. Changing the Curriculum. London: University of London Press. 1968.
10. Wiggins, G., & McTighe, J. Understanding by Design. Alexandria, VA: Association for Supervision and Curriculum Development. 1998.
11. Bruner JS. The process of education. *The Physics Teacher.* 1965 Nov 1;3(8):369-70.

12. Ornstein AC, Hunkins FP. Curriculum: Foundations, principles, and issues. Pearson Higher Ed; 2017 Jan 16.
13. Weimer M. Learner-centered teaching: Five key changes to practice. John Wiley & Sons; 2013 Jan 28.
14. Johnson DW, Johnson RT. Meaningful assessment: A manageable and cooperative process. Pearson; 2002.
15. Posner GJ. Analyzing the curriculum. (No Title). 1992 Jan.
16. Wiggins G. Understanding by design. Association for Supervision and Curriculum Development. 2005.
17. Anderson LW, Krathwohl DR. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives: complete edition. Addison Wesley Longman, Inc.; 2001.
18. Bloom BS, Engelhart MD, Furst EJ, Hill WH, Krathwohl DR. Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain. New York: Longman; 1956.
19. Gagne RM, Wager WW, Golas KC, Keller JM, Russell JD. Principles of instructional design. 2005.
20. Prince M. Does active learning work? A review of the research. *J Eng Educ*. 2004 Jul;93(3):223-31.
21. Biggs J. Enhancing teaching through constructive alignment. *High Educ*. 1996 Oct;32(3):347-64.
22. Black P, Wiliam D. Assessment and classroom learning. Assessment in Education: principles, policy & practice. 1998 Mar 1;5(1):7-4.
23. Lattuca LR, Stark JS. Shaping the college curriculum: Academic plans in context. John Wiley & Sons; 2009 Aug 17.
24. Fullan M. The new meaning of educational change. Teachers college press; 2015 Nov 30.
25. Altrichter H. Curriculum implementation–limiting and facilitating factors. Making it relevant: Context based learning of science. 2005:35-62.
26. Morrison J. ABC of learning and teaching in medicine: Evaluation. *Brit Med J.* 2003 Feb 2;326(7385):385.
27. Fitzpatrick JL, Sanders JR, Worthen BR, Wingate LA. Program evaluation: Alternative approaches and practical guidelines. Boston: Pearson; 2012.
28. Stufflebeam DL. The CIPP model for evaluation. InEvaluation models: Viewpoints on educational and human services evaluation 2000 Dec (pp. 279-317). Dordrecht: Springer Netherlands.
29. Singh MD. Evaluation framework for nursing education programs: application of the CIPP model. *Int J Nurs Educ Scholarsh.* 2004 Jul 24;1(1).
30. Karier CJ, Hogan D. Schooling, education and the structure of social reality. John Dewey: Political theory and social practice. 1992;1(3):109.