DEVELOPMENT MODEL OF SCHOOL MATHEMATICS CURRICULUM IN TAIWAN

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Abstract

This paper attempts to analyze curriculum development in Taiwan based on the Taba curriculum development model. The 12-Year Basic Education Curriculum Guidelines were created in the spirit of holistic education, incorporating the ideas of taking charge, interacting with others, and looking out for the greater good in order to inspire students to become independent and motivated learners. The objectives of the Taiwan Curriculum are four: (1)inspire students to unleash their full potential, (2)teach and develop students' knowledge about life, (3)promote student career development, and (4)instill student citizenship. Taiwan divides its education stage into five learning stages. Mathematical materials in elementary school include numerical materials and their operations, algebra, geometry, measurement, statistics, and probability. Mathematical materials in junior high school include numerical materials and their operations, algebra, geometry, measurement, statistic, probability, and functions. Based on the core competencies, teaching goals, and student learning outcomes, the teacher chooses the best teaching model. They also use effective teaching techniques that have been tried and true in real-world settings and are in line with the traits of different domains, groups, programs, and subjects. Learning assessments should employ diagnostic tests, placement tests, or student transition tests depending on the needs of the student and take into account both formative and summative tests. If necessary, teachers build their own learning assessment tools.

Introduction

The nine-year mandatory education period was introduced in Taiwan in 1968. Previously Taiwan followed the National Curriculum of the People's Republic of China. There are some problems found in Taiwan in the development of the curriculum. Low birth rates, aging populations, diverse interactions between ethnic groups, the rapid development of the internet and information science, the emergence of new types of work, increased democratic participation, growing awareness of social justice, and academic pressure that students feel to continue their education are some of these. Individual education based on the concept of five ways of life is also provided. Education is put to a challenge by this. Taiwan contends that education needs to adapt to shifting societal demands, foreign trends, and changes brought on by globalization and internationalization. In article 11 of the Basic Education Act of 1999, Taiwan extended the number of years of its national basic education. The process of preparing changes to the curriculum from 9 years to 12 years of compulsory study was carried out gradually, and the plan was only fully implemented on August 1, 2014. Every country, including Taiwan, develops its curriculum to improve the educational quality of the country.

The curriculum is a set of plans that describe the set of courses, objectives, and contents, which must be taken by students as a guide in teaching activities to achieve a certain education[1]. Like Tyler, Taba argues that all curricula consist of certain elements [2]. The process of creating, executing, and assessing a curriculum that leads to a curriculum plan is known as curriculum development [3]. The construction of a Taba curriculum involves seven steps: needs analysis, goal formulation, material selection and organization, learning experience selection and organization (method development), and deciding what will be assessed and how [4]. This paper attempts to analyze the model of curriculum development in Taiwan based on the Taba development model.

Discussion

The first step in the development of the Taba curriculum is the diagnosing of needs. The 12-Year Basic Education Curriculum Guidelines were created in the spirit of holistic education, incorporating the ideas of taking charge, interacting with others, and looking out for the greater good in order to inspire students to become independent and motivated learners. The curriculum also calls for schools to actively support students in becoming motivated and enthusiastic learners by guiding them to improve their interpersonal skills with one another, with others, with society, and with nature. Schools should help students apply what they learn, discover the purpose of life, and cultivate the desire to contribute to the long-term sustainability of society, the environment, and culture, promoting mutual success and the general welfare.

The second step in the development of the Taba curriculum is the formulation of objectives. The objectives of the Taiwan Curriculum are four: (1) Inspire students to bring out their full potential,

(2) teach and develop students' knowledge about life, (3)promote student career development, and (4) instill student citizenship. The first objective is to reawaken students' passion for learning, foster their curiosity and capacity for exploration, as well as their capacity for judgment and action, and assist them in cultivating a willing and active attitude toward learning. Students may experience the joy of learning and elevate their value in this way. Students can also realize their potential, which will result in balanced and healthy growth. The second goal is to increase students' fundamental life knowledge so they can combine multiple approaches and utilize both their hands and their minds to solve issues. In addition to stressing interpersonal tolerance, collaboration, and social interaction, it is crucial to enhance students' communication abilities in order for them to communicate their viewpoints. This enables pupils to adapt to social situations, take the initiative to create, handle technology competently, and enjoy the beauty in everyday life. The third goal is to help students establish occupations based on their talents, make the most use of their talents, and uncover effective learning techniques. Furthermore, the goal is to increase students' ability and enthusiasm to engage in lifelong learning, motivate them to innovate and better themselves, and build essential skills in doing academic research or professional projects. Furthermore, the notion of decent work was established to help students build their bravery, knowledge, and capacity to tackle global career and collaboration issues, allowing them to adapt to societal change and global trends while also cultivating the courage to start new trends or fashion. The fourth goal is to improve students' democratic literacy, legal knowledge, human rights, morality and courage, social and tribal awareness, international understanding and national identity, and self-consciousness. Students can thus learn to value cultural and ethnic diversity, pursue social justice, internalize the concept of global citizens, respect nature, value life, develop a caring and active attitude toward resource conservation, strive for ecological sustainability and cultural development, and fight for the common good. According to Taiwan's education curriculum, the purpose of education is to improve students' thinking so that they have a balance between cognitive intelligence and mental health, to develop students' ability to communicate, and to improve students' life knowledge, such as how to interact, express opinions, use technology, and so on, to improve students' future career development, and to instill a sense of love for the country [5].

The third phase in the construction of the Taba curriculum is content selection. To achieve the principle and objectives of 12-Year Basic Education, fundamental competencies are employed as the foundation for curriculum creation to maintain continuity between educational stages, domain bridging, and topic integration. Core competencies are mostly used in the domains and general topics of elementary, junior, and senior high school. Core competencies are incorporated or implemented flexibly in vocational high schools, comprehensive high schools, and specialized high schools based on the professional qualities and clusters of such institutions. All of the information, talents, and attitudes that a person needs to equip his or herself in everyday life and tackle future problems are considered core competencies. Core competencies stress that learning should not be restricted to the information and skills provided in schools. Learning should instead take into account real-life events and promote holistic growth via action and self-improvement. In 12-Year Basic Education, the notion of core competencies stresses lifelong learning. These abilities are classified into three broad categories: spontaneity, communication and interaction, and social participation. Each dimension consists of three things. Spontaneity, in particular, necessitates physical and mental health and self-development, as well as logical thinking and problem solving, as well as planning, implementation, invention, and adaptability. Communication and interaction necessitate semiotics and expression, as well as information, technological, and media literacy, as well as creative appreciation and aesthetic literacy. Finally, moral practice and citizenship, interpersonal interactions and cooperation, and cultural and global awareness are required for social involvement. The component of spontaneity stresses that each individual is an independent actor and that the learner must decide the best way of learning, use systematic thinking to solve difficulties and be creative and proactive. To attain personal growth, students in a social setting must be able to control themselves and take appropriate measures to better their bodies and mind. The Communication and Interaction component stresses how students may engage effectively with others and their environment by utilizing a variety of physical and sociocultural skills. Artificial items (e.g., props, learning tools, stationery, toys, and vehicles), technology (e.g., supplementary technology), and information are examples, whereas sociocultural tools include language (e.g., spoken and sign language), textual characters, and mathematical symbols. Unlike passive media, these instruments work as active channels for interaction between humans and the environment. Another significant medium for communication is art. Citizens must be capable of functioning and enjoying beauty in their daily lives. The Social Participation factor underlines the need for pupils to learn to embrace variety in society in order to collaborate and communicate well with people from varied backgrounds. Each individual must improve his or her capacity to engage with others in a group context, therefore increasing the overall quality of life for all humans. As a result, social involvement comprises both social skills and citizen consciousness.

From these three dimensions, each dimension is described into three core competencies. Core competencies are used to categorize the characteristics of spontaneity. (1) physical and mental health; (2) logical thinking and problem-solving; and (3) planning, execution, creativity, and adaptability. The following key competencies explain the elements of communication and interaction: (1) semiotics and expression, (2) information and technology literacy and media literacy, and (3) appreciating, artistic, and aesthetic literacy. In the meanwhile, the characteristics of social involvement are classified as key competencies: (1)moral praxis and citizenship, (2) interpersonal connections and collaboration, and (3) global culture and comprehension.

The fourth step in the development of the Taba curriculum is the organization of contents. Taiwan divides the Education stage in Taiwan into five learning stages. The first learning stage is grades 1 and 2 of primary school, the second learning stage is grades 3 and 4 of primary school, the third learning stage is grades 5 and 6, and the fourth learning stage is graded 7, 8, 9 of first secondary school, and the fifth learning stage is graded 10, 11, 12 of upper secondary school. The first learning stage focuses on competencies connected to the building of healthy living habits and moral character, laying the groundwork for students' learning capacities. The focus of the second learning stage remains on fortifying students' talents, advancing fundamental knowledge and social abilities, developing compound intelligence, cultivating diverse interests, and assisting students in solving life issues via experience and practice. The third learning stage focuses on deepening student learning, encouraging self-exploration, increasing self-confidence, increasing the ability to distinguish right from wrong, developing the concept of society and national awareness, enhancing democratic values and legal awareness, and demonstrating a spirit of collaboration and teamwork. The emphasis of learning in the first secondary school, also known as the fourth learning stage, is a period of fast development in the student's body and mind, as well as an essential phase for the development of self-exploration and interpersonal interactions. Upper secondary school learning, also known as the fifth stage of learning, builds on the preceding nine years of primary education, with a focus on bridging multiple learning themes, physical and mental growth, career path decision, career preparation, and independence and autonomy.

Table 1. Distribution of mathematics materials in primary and junior high schools based on teaching materials being developed by the Taiwan Ministry of Education is available at https://priori.moe.gov.tw/index.php?mod=resource/index/content/material_path

Materials	The first stage of learning elementary school (1-2)	The second stage of learning elementary school (3-4)	The third level of learning elementary school (5-6)	The fourth stage of learning Junior high school (7-9)
Number of units and their operation	Recognition of numbers up to 1,000, application of coin conversion in 50 yuan, 100 yuan, 10 yuan, and 1 yuan in payment, sum and subtraction operations up to 2 digits, multiplication of numbers 2-9, unit place value dozens	Recognition of numbers up to 6 digits, sum and subtraction operations, multiplication operations up to 3 digits, comparison of fractions with the same denominator, sum and subtraction of fractions with the same denominator, sum and subtraction of decimal numbers with three numbers behind a comma	The number of factors and their multiples, prime numbers, Highest Common Factor (HCF), Lowest Common Multiple (LCM) arithmetic operations, summation and subtraction of simple fractional numbers and mixed fractions, division of fractional numbers, summation and	Sum operation, five integer subtraction, multiplication and division operation of two integers, absolute value, Highest Common Factor (HCF), Lowest Common Multiple (LCM), composite number, number of squares and square roots, factorization

			subtraction of decimal numbers to 4 numbers behind commas, rounding of decimal numbers to decimal multiplication	
Measurement	Measurements with non-standard units (time and Length) Measurements and count operations in default units (Length in cm and m), time, and month recognition in calendar	Calculation with units of time and its conversion, calculation with units of Length, units of weight of liquid objects, units of weight of solid objects, recognition and conversion of km, calculation and conversion with units of volume	Inner angle, area, and circumference, scale, calculating the area of a circle with the concept of scale, volume	
Geometry	Introduction of straight lines and curves, forms of two-dimensional figures, and three-dimensional figures. Angles, sides, and angular points of planes and build flat spaces, Length and area measurements	flat-build surroundings and loops Introduction to two-dimensional figures, knowing the relationship of angles, sides, and angular points.	Triangle, line symmetry, broad alignment, trapezoidal, triangle Build space: cube, sphere, cylinder, cone	Pythagorean theorem and distance between 2 points, angle, and symmetry, parallel and intersecting lines, calculation of Length and area of geometry, polygons, properties of triangles, constructive and precision of triangles, rectangles, circles, distance of points and circles, distance of two circles, volume and surface area of building space
Algebra	Ratios and their applications	The problem of multiplication of three numbers, the operation of calculating the mixture, the	Mixture count operation, Solving equations	Mathematical notation, one-variable linear equation, two-variable linear equation, 1-

		formula with symbol representation, understanding the calculation of the inverse between multiplication and division		variable inequality, polynomial equation, one-variable square equation, and the solution, three-variable linear equation.
Statistics and probabilities	Grouping of data in groups and creation of diagrams		Bar charts and line diagrams, Percentage	Ratio and proportion, Reach, probability, statistical diagram
Function				Functions and function graphics The quadratic function and its graph, the max and min values of the quadratic function

The division of mathematics material for primary and junior high schools can be seen in table 1. The material we mentioned above we compiled based on teaching materials that are being developed by the Ministry of Education of Taiwan. Because this is a development product, it means that the material in the teaching materials will continue to be improved over time. Taiwanese textbooks contain real-world problems in the lowest proportions, while American textbooks contain open problems in the highest proportions [6]. Finland, Singapore, and Taiwan explicitly set goals for teaching and presenting algebra in their primary school textbooks [7]. The Mathematics-Grounding Activity (MGA) module was developed as part of the JUST DO MATH initiative, which has been financed by the Taiwan Ministry of Education since 2014, in order to create meaningful math activities for students to enjoy studying and enhance their learning [8]. In summary, textbooks in Finland and Taiwan have a big impact on how well pupils learn mathematics. [9]. Overall, Taiwanese textbooks demand more concrete action, whereas German textbooks emphasize more abstract and mental procedures [10]. Under the direction of the Taiwanese ministry of education, mathematics became a subject that had to be covered in every class. There are four math classes per week, lasting 40 minutes for elementary school students and 45 minutes for junior high school students. There is a credit-based system in place while in high school. For each semester, there is one weekly teaching session available, lasting 50 minutes. Students receive one credit if they show up to all of the sessions during the semester or if they show up to sessions a total of 18 times. For Regular High School, mathematics is mandated by the ministry to be 16 semester credits. First year of study 8 credits. However, in the second year, mathematics is divided into two types of courses offered to students in the second academic year. Students must choose one of two classes according to their developmental needs. Mathematics courses in the second year are also worth 8 credits. For Vocational High School, the mathematics mandated by the ministry ranges from 4-8 credits. For comprehensive high school, the mathematics mandated by the ministry is 8 credits in the first year. For special high school, mathematics was also given 8 credits.

The selection of learning experiences is the fifth phase in the construction of the Taba curriculum. Teaching activities need to move away from traditional one-way teaching models, where the teacher is the only source of knowledge and the student is the passive receiver of knowledge, and instead incorporate other suitable teaching models and strategies based on core competencies, learning materials, student performance, and various student needs. The objective is to increase students' passion for learning, motivate them to collaborate with their classmates, and inspire them to become active learners. Before the start of the semester, instructors need to create their lesson plans, gather the necessary materials, and finish all pertinent chores. Teachers must consider the nature of the teaching materials, the teaching objectives, and the student's learning experiences and cultural backgrounds

when creating learning materials. They must also create materials that are appropriate for the student's needs and plan engaging flexible teaching activities. As a result, students are better able to comprehend the material and be able to apply it in real-life situations. Students are also given the opportunity to study, observe, investigate, question, reflect, discuss, and solve issues. With funding and support from the necessary competent authorities, instructors should experiment with performing novel teaching methods in accordance with their instructional activities.

The sixth step in the development of the Taba curriculum is the organization of learning experiences (development of teaching methods. Based on the core competencies, teaching goals, and student learning outcomes, the teacher chooses the best teaching model. They also use effective teaching techniques that have been tried and true in real-world settings and are in line with the traits of different domains, groups, programs, and subjects. When appropriate, teachers integrate resources and e-learning techniques to create engaging instructional activities that address the different aspects of the learning materials, such as facts, concepts, principles, skills, and attitudes. This language learning must be taught primarily in native languages and supplemented by bilingual education in order to encourage the acquisition of Native Languages and New Immigrant Native Languages. To establish a classroom setting, learning is done communicatively and interactively using the local tongue. Teachers are encouraged to use bilingual instruction in learning from various domains or during alternate learning periods and different activities, provided that the learning in other domains, clusters, programs, and subjects is predicated on the understanding and contextualization of the teaching materials. Students are also encouraged to speak other languages in their daily lives. Teachers should carefully classify students based on their distinctions, such as age, gender, level of learning, learning interest, talents, physical and mental traits, ethnic background, and socioeconomic background, in order to promote student growth based on talents and interests. Teachers must also use a variety of teaching strategies, supply learning resources, and use a variety of evaluation techniques to fulfill a variety of requirements. Teachers are urged to plan lessons that promote interaction between normal class students and kids in special education classrooms. The variety of the subject in homework should reflect the student's abilities, and there should be an acceptable amount of homework. It is important to make homework performance rubrics clear in order to boost students' enthusiasm for learning, stimulate their creativity, help them apply what they have learned, and give them a sense of accomplishment through feedback. To enhance student learning outcomes, teachers establish norms that promote learning, work to foster a pleasant learning environment and classroom culture, and boost teacher-student communication and cooperation. For students to get practical experience, act on ethical beliefs, reflect on their performance, and widen their perspectives, teachers design learning activities based on experiences like outdoor education, industrial practice, and service learning. Teachers must assist students in utilizing a variety of learning techniques in order to enhance their academic performance and foster their capacity for autonomous and lifelong learning. These include motivational strategies, general learning techniques, subject-, program-, domain-, cluster-, and cluster-specific learning techniques, thinking techniques, and metacognitive techniques. In Taiwan, it's crucial that math professors are of a high caliber. The findings revealed that eighth-graders learning success was positively impacted by the quality indicators of instructors in Oman and Taiwan [11].

The seventh step in the development of the Taba curriculum is the determination of what will be evaluated and how. The topic of education is the student. Therefore, rather than only focusing on passing the course, teachers should pay attention to students' learning outcomes and determine whether they have properly comprehended the subject material. To fulfill the diverse requirements of the students, learning assistance should be offered under the assessment findings using learning assessment tools to understand students' learning processes and outcomes. The applicable competent authority's supplementary requirements and learning evaluation standards are followed while conducting assessments of learning. Learning assessments should employ diagnostic tests, placement tests, or student transition tests depending on the needs of the student and take into account both formative and summative tests. If necessary, teachers build their own learning assessment tools. Students' physical and mental growth, individual and cultural diversity, the substance of basic competencies, and learning performance in specific areas like knowledge, skills, and compassion must all be taken into consideration while assessing content. Schools and instructors should properly modify their assessments to meet the unique requirements of kids with special needs. Written exams, in-person evaluations, and portfolio assessments are all acceptable kinds of learning assessments, provided they are focused on the subject and activity in issue; excessive reliance on written tests should be avoided. To better explain student learning outcomes to students and parents, assessment reports should include both quantitative data and qualitative explanations. The accomplishment of a student's learning objectives, learning power, engagement in extracurricular and curricular activities, motivation, and learning attitudes should all be included in qualitative descriptions. A substantial amount of evidence-based data must be used in learning assessment. The findings of assessments can be used as a guide by

educators to enhance curriculum, instructional strategies, and student learning outcomes. Based on the outcomes of their assessments, teachers alter their teaching strategies and resources and offer assistance to pupils. Teachers should modify their teaching strategies and provide remedial instruction for students who fall behind; for students who pick things up fast, instructional progress should be sped up, and learning resources should be supplemented and broadened. However, in mainland China and Taiwan, both students and their teachers corroborate the finding that comprehension exceeds performance expectations [12]. Teachers prioritize monitoring students' comprehension above giving several test practice options. However, students' support for performance standards that are greater than those of their professors may be a reflection of their desire for better academic success.

Conclusion

Looking at the curriculum development guidance document from the Taiwanese Ministry of Education, the government will prepare its younger generation to be able to live in various parts of the world later by placing Immigrant Language subjects. Taiwan divides the Education stage in Taiwan into five learning stages. For his mathematics, it became mandatory material that the Taiwanese ministry promised to the school. For the primary and junior high school levels, the same number of sessions for all schools. However, in high school, mathematics sessions differ depending on the type of school and the needs of students regarding the material. Based on core competencies, learning resources, student performance, and the various requirements of the students, Taiwan performs instructional activities that combine other suitable teaching models and tactics. When appropriate, teachers in Taiwan use e-learning resources and methodologies to create efficient instructional activities that address the multiple dimensions of learning materials, such as facts, concepts, principles, skills, and attitudes. Taiwan allows teachers to design their assessment tools if needed.

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