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Designing a consolidated curriculum model in sixth grade science education

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ABSTRACT

Background and Aim: Background and purpose: Education in elementary school is very sensitive. In this context, today, those involved in the educational system are trying to provide the desired form of education for learners through the curriculum in the form of a consolidated curriculum. Based on this, the main goal of the current research was to design an integrated curriculum model in sixth grade science education. **Methods:** The current research method was of a qualitative type in the qualitative content analysis method and of an inductive type. The participants included experts in educational sciences, curriculum planning and science education, (professors of Farhangian University, State University, Azadopiam Noor) and teachers, who were selected using non-random sampling method based on criteria and semi-structured interviews with 18 people. **Results:** The findings showed that 9 main categories based on Klein's curriculum elements (goals, content, teaching learning strategies, learning activities, place, time, tools, grouping of learners and evaluation of learning) and 151 subcategories were extracted and a suitable model was designed. Validation results based on the opinions of 13 experts according to CVI-CVR indicators showed that the designed model has the required validity. **Conclusion:** It can be concluded that the model identified in the current research can be implemented in the sixth-grade science course and it leads to the improvement of the quality of education.

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Introduction

In all educational systems around the world, empirical science education and learning hold a special position, and efforts are made to ensure that students, while familiarizing themselves with the principles and concepts of empirical sciences and acquiring necessary scientific literacy, gain the essential awareness to become ideal citizens (Aftabi, 2019). In this context, primary school science classes still employ traditional teaching approaches. Many teachers are unaware that students show little interest in lessons devoid of thinking. The most significant error is that teachers deliver lessons assuming students have no prior knowledge of the subject being taught (Toufaili & Mahmoud, 2020). In a teacher-centered classroom, students listen passively to the teacher's explanations of concepts without participating in learning. This approach is typical for students who passively receive information provided by the teacher in a classroom and consider it the ultimate truth. This happens because teachers are required to follow the curriculum set by the Ministry of Education. As a result, teaching in schools emphasizes teachers' mastery of content, without considering their awareness of students' prior knowledge or employing an appropriate and effective teaching method that allows students to form their understanding based on their previous knowledge (Emarati, 2021).

Traditional (subject-based) curriculum design comes with numerous flaws and problems. These include neglect of learners' personalities, needs, and interests, lack of alignment with their personal and social life realities, disconnection from today's societal issues, incongruence with the rapid advancement of knowledge, and the fragmentation of various parts of the curriculum (Moradpour, Naderi, Seif Naraghi, & Assareh, 2019). Therefore, focusing on science education in pre-primary and primary education, improving science teaching methods, using exploratory approaches, considering the teacher's role in science education, studying the challenges humanity faced in the last century, and reforming the curriculum to overcome these challenges are among the suggestions researchers have made for improving science education worldwide (Saadati, 2019).

Research indicates that Iran's education system has paid less attention to this aspect of primary education, despite its importance. Iran's education system has recently undergone significant changes in terms of structure, content, and implementation methods, one of which is curriculum integration (Ahmadi, 2021). It is evident that if the new empirical science content is taught using traditional methods and without modern teaching approaches appropriate to the curriculum content, the new objectives of the empirical sciences curriculum will not be achieved (Assareh & Imam Jome, 2015). Therefore, for better utilization of this subject, a growing number of studies suggest that integrated teaching strengthens learning (Reader-Bertrand, 2017).

Curriculum integration, due to its various advantages, can be used to realize the goals of the curriculum in primary science education for the greater benefit of students. Using integrated curricula allows teachers to blend academic subjects with everyday life issues, making the study of these subjects seem purposeful to students. They can apply what they learn in practical life, and this application of knowledge enables knowledge creation, making learning interesting and exciting for learners (Moradpour et al., 2018).

Regarding the current topic, studies have been conducted. Rostami (2021) found that integrating religious education curriculum with science lessons can be effective in learning various topics by linking impactful content. Kazemzadeh, Abbasi, Haji Hossein Nejad, Ahmadi, and Gholamali (2021) concluded that the empirical science curriculum pays the least attention to technological literacy and the most to basic competencies. The content of this curriculum needs more revision and attention in some subcategories, including critical thinking, entrepreneurship, the role of knowledge production, self-assessment and criticism, and logical thinking. Ahmadi (2021) found that an integrated curriculum in English language teaching cannot be used in the four main English language skills, namely reading, writing, speaking, and has meaningful results. Shafiei Sarvestani and Darabi Emarati (2021) found that a constructivist curriculum improves learners' performance in content, cognitive, and scientific research aspects. Mansa (2022) concluded that progressive teachers recognize the benefits of science education as a transformation and social action not only for their students but also for themselves as developers of multicultural science curricula.

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Regarding the importance of the present research, it should be said that the curriculum shapes the path to achieving the educational goals of any educational system. Therefore, attention to the integrated curriculum in science lessons can yield desirable results in achieving goals. Although studies have been conducted, there is still a research gap, especially in the primary education phase; hence, the main goal of the current research was to design a model of an integrated curriculum in teaching sixth-grade basic sciences.

Method

The present research is applied in nature and qualitative in approach. The themes were extracted through inductive qualitative content analysis from semi-structured interviews with experts, based on the nine elements of Klein. Participants included experts in educational sciences, curriculum planning, and experimental sciences. This group comprised curriculum professors from East Azerbaijan province in public universities like Payam Noor, Farhangian, non-governmental universities, and Islamic Azad University, as well as primary school science teachers and educational group leaders affiliated with the Ministry of Education and experts in sciences related to the Ministry of Sciences. For participant selection, a purposeful sampling method was employed. The sample size was determined by data saturation, meaning the selection continued until no new information was obtained. Entry criteria for the study included having a minimum educational qualification in one of the specialized fields of educational sciences (master's or PhD in Curriculum and Science Education), primary school teachers, science teachers (educational group leaders, etc.), affiliated with the Ministry of Education, and science specialists affiliated with the Ministry of Sciences.

Materials

1. Semi-structured interview: Semi-structured interviews were used as the research tool. In the first phase of the research, these interviews with experts were utilized to gather data and extract elements for an integrated science curriculum program. Interviews were conducted face-to-face after reaching an agreement and preparing with the experts. The knowledge and skill components required by primary school teachers for using integrated curriculum programs were extracted and collected as codes for each main category, based on Klein's nine elements, through semi-structured interviews with experts. For validity, the face validity method was used, and for reliability, the agreement coefficient between coders was employed, resulting in 89% from three interviews with repeated coding.

Implementation

Initially, interviews were conducted, and after reaching theoretical saturation, the data analysis in this research employed coding with an inductive approach to qualitative content analysis.

Results

Initially, some characteristics (educational field, degree, and service record) of the participants in the research were presented in Table 1.

Table 1. Subjects' characteristics

Work experience (Year)	Field of study	Education	**Number**
۱۵	Curriculum	Master's degree	۱
۱۴	Management	Master's degree	۲
۱۳	Curriculum	دکتری	۳
۱۰	Education management	PhD	۴
۲۲	Education management	Master's degree	۵
۲۹	Educational sciences	Master's degree	۶
۱۲	Curriculum	PhD	۷
۱۰	Education management	PhD	۸
۱۷	Philosophy	Master's degree	۹
۱۸	Curriculum	PhD	۱۰
۲۰	Education management	Master's degree	۱۱
۲۰	Educational sciences	PhD	۱۲
۲۱	Sociology	PhD	۱۳

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۱۱	Psychology	Master's degree	۱۴
۱۳	Curriculum	PhD	۱۵
۱۷	Psychology	PhD	۱۶
۲۰	Education management	PhD	۱۷
۲۹	Education management	PhD	۱۸

Based on the coding of interview texts and classification of findings in the form of an integrated curriculum model for sixth-grade basic science education in Table 1, the following is presented.

Table 2. Main themes and subthemes of integrated curriculum model

Main theme	Subtheme
Assessment	Employing various assessment methods
	Mastery of employing multiple feedback techniques
	Interest in assessment
	Innovation in student feedback
Grouping	Grouping based on student interests
	Grouping based on similar skills
	Grouping based on student interests
	Combination grouping
Location	Teaching in non-classroom spaces
	Teaching at home
	Teaching anywhere possible
Facilities	Utilizing all resources in learning
	Using environmental resources
Tools	Employing innovative methods
	Utilizing online education
	Combining all methods
	The nature of multi-method methods
Time	Teaching science at the right time
	Utilizing students' preferred and desirable time
	Utilizing suitable times with the learning environment
Learning activies and strategies	Setting goals in teaching
	Using learning in the environment
	Minimal and sustainable learning
	Consolidating learning
Content	Using textbook content
	Using relevant out-of-class content
Objectives	Describing educational goals
	Using goals
	Adjusting goals

Category of Objectives:

Some of the emphasized objectives of the participants in the research included fostering creativity, promoting critical thinking, focusing on the interests, needs, and abilities of learners, integrating culture and arts with sciences, paying attention to children-specific language and literature in integrating sciences, linking the curriculum with real-life issues, integrating scientific issues with sciences, living alongside natural phenomena, integrating topics in sciences and familiarizing with new sciences, understanding local and indigenous issues and features, and empowering learners in solving complex life problems. In citing interview texts with participants, direct quotes from some sentences are provided: Participant Code 13 stated: One of the important objectives of any

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lesson in school, especially sciences, is to pay attention to children-specific language and literature in integrating sciences. Participant Code 8 stated: In science lessons, one of the objectives can be to integrate scientific issues with sciences (understanding bacteria and viruses, understanding Earth from a physics perspective).

Category of Curriculum Content:

Content is a collection of concepts, facts, principles, experiences, skills, processes, and values related to a subject that is prepared to achieve educational objectives. In considering the content mentioned by the research participants, an appropriate integration of disciplines and different topics such as humans and the environment, religion, nature, etc., can be observed. Contents such as humans and nature, human life, appropriate integration with literature and writing, suitable for the age and needs of the age group, focused on current Earth problems, geology, astronomy, space, etc., are worthy manifestations in this area. Some of the content features emphasized by the participants in the research include nature, humans and the environment, up-to-dateness, focus on current Earth problems, sequence observance (from simple to complex, from past to present), attention to parallel topics, based on life experiences, appropriate integration with religion and ideology, appropriate integration with art, social attractiveness of content, suitable for the age and needs of the age group, attention to ecological features, and alignment with religious leaders' behavioral patterns. In citing interview texts with participants, direct quotes from some sentences are provided: Participant Code 1 stated: Science lessons can and should be coordinated and integrated with literature lessons, or the teacher in the writing class can ask students for topics aligned with science lessons. Participant Code 9 stated: It is important that lessons are arranged according to the climatic, local, social, and cultural features of different regions.

Teaching and Learning Strategies and Activities:

Strategies and activities for teaching and learning refer to the methods and activities that teachers and students use for teaching and learning. Learning activities are methods and approaches that students use during learning to achieve their intended goals. Participant Code 13 stated: Prior knowledge of the student is important, and whether they have previously studied it or not will affect their learning process. Participant Code 4 stated: It is important to consider whether the student, based on their physical, emotional, psychological growth indicators, has the ability to intellectually and physically work on which topics and which academic activities.

Facilities, Tools, and Educational Resources:

Educational aids refer to tools and facilities used in the teaching process to better convey lesson content and facilitate effective learning by both teachers and students. These tools move education away from pure lecturing and make learning easier and more achievable by engaging various senses. With recent advancements, teaching and learning without educational facilities, especially the internet and virtual networks, are no longer feasible. Participant Code 16 stated: Teaching science is not every teacher's job; the teacher must really know how to correctly use tools and facilities (such as laboratory equipment, etc.) to be able to teach the learner.

Category of Learner Grouping:

Some of the characteristics of learner grouping emphasized by the participants in the research include attention to the quality of group composition, focus on the subject of grouping, suitability of group size to members' abilities, appropriateness of group size to the subject, scientific group rotation, enhancement of social relations, balance in members' participation in the group, attention to intra and intergroup relations, etc. Participant Code 17 stated: Science is a subject that is more practical and should be taught more practically in combination with any subject and also practically retrieved... This is where group action becomes effective.

Category of Teaching and Learning Time:

Some of the time-related aspects of teaching emphasized by the participants in the research include timing the natural seasons with related topics during teaching, alignment of the time span with the living and educational places of students, appropriateness of time to the volume of presented lessons, proper allocation of time suitable for different conditions and situations, appropriateness of teaching time and specific subject topics, sequential timing with related subjects based on syllabus weighting, sequence

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in language and literature lessons, attention to ecological features, suitability for the first days of the week, attention to the start and end of the class, effective use of time in the teaching and learning process, learner's ability to understand a particular subject, the relationship between teaching and learning activities and academic progress, etc. Participant Code 2 stated: The scheduling and the number of lessons per week, the number of subjects, and the volume of content determine how much time should be given. Participant Code 10 stated: Sometimes we encounter topics that need more time to examine various aspects of the subject for better learning and familiarity of students, for example, teaching the subject, the process of paper production, which will be learned several times more effectively with a factory visit than usual.

Category of Teaching and Learning Space:

Some of the educational space features emphasized by the participants in the research include real and lively spaces, familiarity of teachers and learners with working in virtual spaces, having appropriate communication tools in the learning location and using them, the availability of internet infrastructure in the educational space, challenging spaces, suitable places for scientific experiments, ease of demonstrating phenomena or subjects in an appropriate location, ease of information retrieval according to the space structure, and ease of access to the learning location. Participant Code 10 stated: The teaching environment for empirical science subjects should foster creativity, in other words, stimulate creativity, like nature schools... and create unique and new questions in the minds of students. Participant Code 3 stated: The class should be equipped in such a way that subjects can be integrated, meaning the class and educational space should assist in integration... without any delays.

Category of Curriculum Evaluation:

The evaluation component plays a central and interactive role with other components and stages of curriculum planning. Some of the curriculum evaluation features emphasized by the participants in the research include content-based, objective-based, written evaluation, descriptive questions, projects, creativity evaluation, challenging evaluation, lesson-start evaluation, final exams, oral exams, observation, assessment of group work, etc. Participant Code 8 stated: In evaluating what is learned, it is better to be practical, for example, considering the content of science lessons which mainly revolve around nature, what practical lessons has the student learned?... and how can they use it?

Conclusion

The main goal of the present research was to design a model of an integrated curriculum in the teaching of sixth-grade basic sciences. The most important and key element and criterion of the curriculum are its objectives, and all activities and designs of the curriculum planning process are carried out in light of the objectives. Educational objectives, especially in empirical sciences, should be able to blend subject matters with everyday life issues in such a way that students do not perceive the study of subjects as futile and are able to apply what they learn in practical life. Moreover, the use and exploitation of integration make possible the creation of new knowledge and render learning interesting and exciting for learners. The results of the present research align with the findings of some studies such as Rostami (2021), Kazemzadeh et al. (2021), Ahmadi (2021), and Mansa (2022).

In explaining these findings, some objectives expressed by the participants in the research stand out, suggesting that an integrated curriculum in empirical sciences could be more effective if particular attention is given to them. Objectives such as familiarity with life skills, integration of the science curriculum with social issues (familiarity with professions...), understanding the role of nature, and acquaintance with the history and nature of science indicate that at the very least, an integrated empirical sciences curriculum should be able to educate individuals who are creative, exploratory, aware of current issues, God-conscious, nature conservators, and achieve broader goals.

An examination of the evolution of science objectives in our country's schools shows that although curricular planning has undergone changes, research indicates that these changes are insufficient, and there is a significant gap between objectives and programs and their implementation. On the other hand, the national curriculum of the country is based on a five-element model consisting of thought, faith, knowledge, action, and ethics, in four areas: relationship with oneself, relationship with God,

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relationship with people, and relationship with creation (National Curriculum Document, 2011). Some of the objectives confirmed in this research suggest that through an integrated curriculum, objectives such as environmental appreciation, empowering learners to solve complex life problems through complex and multi-dimensional issues (through experiments and thought stations), understanding the role of nature, enhancing religious insight (integrating the curriculum with belief issues, familiarity with Quranic verses relevant to the lesson), living alongside natural phenomena (living in hazardous areas, volcanic, earthquake-prone, etc.), and trusting nature can be achieved in line with the National Curriculum Document.

Looking at the content of the curriculum, it can be understood that today the most important educational mission in our country is to direct the activities of students, which is achievable through the content of textbooks. Since the Iranian education system is a centralized system based on subjects and curriculum, attention to the selection of curriculum content is of great importance.

In the field of curriculum content selection, care must be taken to ensure that the content is selected in a way that does not conflict with the spirit of creativity and critical thinking in students (Jahani et al., 2020). It should inspire a scientific spirit, research, and reflection in them and not only prevent them from becoming bored and tired but also create eagerness and excitement. This content should not arise from a bunch of memorized and repetitive materials that make the student a mere imitator. Overall, the content of the curriculum has a direct impact on the education of students (Rezazadeh Bahadoran & Eskandi, 2018).

This research, like all other studies, had certain limitations. In conducting this study, there was the potential for influence by factors and variables such as needs, attitudes, interests, personal characteristics, cultural, social, and political viewpoints, existing rules and regulations, and the prevailing culture in society, which were beyond the researcher's control and could have affected the interviews and statements of the interviewees. Based on the results, it is recommended that in relation to the objectives of the integrated curriculum of sixth-grade empirical sciences, attention to enhancing religious insight and God-consciousness alongside fostering creativity and critical thinking can be the key to sustainable development of the country through primary science education, and stakeholders of the curriculum should pay attention to this issue. In relation to the content of the integrated curriculum of sixth-grade empirical sciences, the use of an ecological approach and attention to the climatic features of different regions based on land use planning can help solve some of the problems of the science lesson. In relation to the content of the integrated curriculum of sixth-grade empirical sciences, aligning content with religion, ideology, and the religious values of society can facilitate the achievement of the objectives of this lesson.

Conflict of Interest

According to the authors, this article has no financial sponsor or conflict of interest.

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