journal of
Adolescent and Youth Psychological Studies
www.jayps.iranmehr.ac.ir

Spring and Summer 2022, Volume 3, Issue 1, 150-159

Quantum approach to the curriculum, another perspective on curriculum practice in the third millennium

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ARTICLE INFORMATION

Article type
Original research
Pages: 150-159

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Email: Kamyabi.mitra@gmail.com

Article history:
Received: 2022/07/02
Revised: 2022/08/24
Accepted: 2022/09/07
Published online: 2022/10/07

Keywords:
Curriculum, Quantum Physics, Complexity, Unconscious.

ABSTRACT

Background and aim: The beginning of the 21st century refers to an era that can be called the quantum era from the point of view of technology. Quantum theories have the ability to be useful in explaining complex human behaviors, including teaching and learning, and scientists use this theory in investigating phenomena such as mind, thinking, and subconscious mind. Quantum theory in Iran is especially important in the subject curriculum. It is unknown and it is necessary to explain the relevant concepts and with the help of its capabilities, the shortcomings of the existing curriculum will be resolved and lead to a conscious life in the third millennium. Therefore, with the aim of explaining the quantum concepts and determining the relevant components, this research has pursued this question: What components does the quantum curriculum include? **Method:** This research is qualitative in terms of fundamental purpose and data. For this purpose, conceptual structure evaluation and theoretical research were used. The statistical community of research in the qualitative part includes national and international documents and related researches and digital resources in the field of quantum physics and curriculum. **Results:** Application of this theory, transdisciplinary approach, contextual, collaborative and negotiation knowledge instead of hierarchical knowledge, readiness to face unexpected developments and situations, lifelong learning, lack of focus in curricula and dealing with all complex human dimensions and it presents his extensive interactions with the universe and the implementation of multicultural curricula. In order to succeed in the implementation of curricula, attention should be paid to the learner's environment and his mental and physical conditions and the injection of mental energy. In the evaluation of curricula, attention should be paid to the variety of tools and resources and it should be done qualitatively, continuously and in different situations. **Conclusion:** Quantum curriculum with a holistic view of right and left hemisphere interactive learning, by establishing a simple and dynamic model, returns the pleasure of teaching to professors and elevates students to the level of insatiable and knowledgeable learners.

How to Cite This Article:
Ebrahimi, A., Kamyabi, M., Zeinaddiny meymand, Z., & Manzari Tavakoli, H. (2022). Quantum approach to the curriculum, another perspective on curriculum practice in the third millennium. *jayps*, 3(1): 150-159

Introduction

The curriculum is a complex idea and theory that includes such diverse elements that a single definition cannot include its full meaning. Curriculum is the process of conceptualizing phenomena related to humans and the world in a balanced format to facilitate learning. With this definition, two dimensions can be considered for each curriculum: one dimension that introduces the general plan and insight. The second dimension, the provision of structure, means a coherent organization to convey different aspects of the experimental world to the learner. In fact, these two dimensions can be seen as the expression of Beauchamp's view regarding the curriculum domain, which includes curriculum design and curriculum engineering. The quantum learning model integrates life skills and learning, enabling learners to be effective throughout their lives. Quantum learning by using different senses, combining new learning with previous learning, paying attention to students' learning styles, dividing them into learning groups based on their favorite styles, and actively involving students during teaching and motivating them by giving appropriate feedback and encouragement in During and after teaching as one of the new methods of teaching in this century can meet the needs of new generation students. Although the quantum suffix is more of a metaphor, the philosophy of quantum teaching and learning is rooted in the philosophy of quantum physics (Dadgaran & Khalkhali, 2016).

The most fundamental paradigm that emerged in the last decades of the 20th century with the progress of science in various fields, especially mathematics, is the complexity paradigm (Ahanchian and Chabaki, 1392). Complexity theory is related to the third period of science. Newton's period, which is also called the philosophy of mechanical science, mostly has features such as rationalism (relying on reason, mind and memory), predictability (works are predetermined and have mechanical order (linear and sequential discipline), causality (every effect is caused by a specific cause), having pattern and controllabity (monitored), linear, objectivity and stability (unchangeable) (Golshani, 2006.(

In the 21st century, the interaction between different scientific disciplines has focused on redefining approaches and mental models. The main features of complexity theory derived from quantum physics are holism, the importance of the observer's view, mutual causality, subjective reality, uncertainty, self-regulation, multi-dimensionality, and non-linearity (Vella, 2002). The efforts of researchers have caused the theory of quantum physics to be used not only as a theory but as a way of thinking in other scientific fields. Quantum thinking as a new way of looking at the world is the result of years of effort by physicists and other scientists. Considering a universe composed of patterned and self-regulating energy, uncertainty, and interconnectedness are hallmarks of quantum thinking (Vella, 2002). On the other hand, the families of gifted students can play a significant role with their financial and spiritual support to recognize their child's talent and guide him (Okoye, 2013; Zlateva & Lavrentsova, 2015). Complexity is considered the essence of quantum physics. Complexity theorists have referred to the current curriculum with different titles such as traditional, prescriptive, modern, and above all, reductionist curriculum. According to them, the reductionist perspective prescribes a curriculum that cannot be modified based on the situation and context and denies the inevitable effects of the social environment along with its multiplicity of effects (Collins & Clarke, 2008).

According to Somara and Davis (2006), complexity theory in the form of pedagogy suggests a way between learner-centered and teacher-centered approaches that the teacher is neither a roleless observer nor an absolute controller (Collins & Clarke, 2008). Davis and Somara have proposed the idea of the teacher as an educational researcher from the perspective of complexity theory that teachers provide conditions for the interaction of ideas that are both related to specific topics and do not abandon

the responsibility of organizing behaviors (Fenwick, Edwards, & Sawchuk, 2011). By looking at the duality of the particle wave and the complexity of reality and the universe, and especially the complexity of man and his multiple dimensions, the need to change the attitude towards the separate approach to knowledge and to insist on branching and branching in the fields of knowledge to a transdisciplinary approach is felt. From the beginning of the development of new physics, this theory became popular that in order to understand a phenomenon, it is enough to break it down into its parts, and the whole reality does not exist beyond the parts. According to Pauli's principle of exclusion, which states that no two electrons in any atom can be the same in all respects, and in the combination of components, a new state is found that is related to the whole and cannot be delivered to the components (Samadi, 2001) and over time the former theory gave way to holism. Causality in the perspective of complexity, unlike mechanical causality, is a non-linear, recursive, interactive, and relational thing, and a kind of reverse causality is proposed in quantum principles (Prigogine, 1997). Therefore, grouping and participation of people of the same frequency in the group is very important in the curriculum and can cause individual and collective improvement. Also, placing a person with a wave state next to family, friends, and teachers who are similar in terms of motivation, morale, behavior, etc., causes positive reinforcement of the person. It is necessary to create situations with common characteristics of people in the curriculum so that this synergy leads to the promotion of individual people. Measurement of Bohr, Schrödinger, and Heisenberg's uncertainty, Bohr believes that the only way to obtain information from quantum systems is through measurement. Therefore, attributing properties to the quantum system of an isolated subject on which no measurements have been made is meaningless (Pashootanizadeh & Kokabi, 2014). Quantum theory says we cannot measure or observe something without disturbing it. For this reason, the necessity of the observer's role in understanding any phenomenon is clear, and its importance is so great that it has led some to believe that the only reality is the observer's thought (Ray, 1995). Therefore, it can be said that determining the position and impact of a particle is not possible even with the most accurate measuring tools, and calculations are always associated with probabilities and in an approximate manner. This uncertainty in measurement is one of the main features of quantum physics. Therefore, in the curricula, attention is paid to the fact that there is a possibility of different behavior in different situations. In the discussion of talent identification, in order to find out each talent in its respective field, it is necessary to prepare the special situation of that field, and in identifying the genius of the student, if the observed is not in the right conditions or does not show a suitable behavior with his talent, it is not possible to collect accurate information about the universal talent. As a result, it is possible that the subject may not show real behavior due to personal reasons (embarrassment, etc.). Considering the effects this theory has had in the humanities, educational sciences and the education system have not been spared from the effects of this developed theory and the use of theories and guidelines of this approach in this field is expanding day by day. The curriculum is one of the parts of educational sciences that is not affected by complexity theory. According to this theory, many thinkers have studied and researched the fields of curriculum (Doll, 2008; Osberg, 2008). The educational system and curricula based on complexity theory deal with the behavior of humans with the ability and characteristics of self-management, self-regulation, and self-organization. Humans who behave according to this theory can learn from the results of their behavior and use them to imagine and create new mental images to predict the results of actions and behavior that will occur in the future (Nadi & Kazemi, 2006). Based on these characteristics, people act on their own guidance and self-regulation. In fact, they adjust

the time and place, the speed, and all the educational facilities and tools in such a way that they use all of them to achieve the desired goal and their time and place. control (Ajam, Jafari, Mahran, & Ahanchian, 2013). In curriculum theories, the necessity of appreciating the complex dimensions of man and his interactions with the universe, the realization of transdisciplinary approaches, the selection of educational resources and materials related to local issues, the replacement of distributive, collaborative and negotiated knowledge instead of control and hierarchical knowledge, learning from the distance and preparation to face unexpected situations and sudden developments are felt more than ever. The idea of complexity challenges the view of Laplace and Newtonian modernism that the world is predictable, modeled, linear, causal and effectual and replaces them with non-linear and holistic events (Morrison, 2006).

The European Business Review report stated that the organizational leadership models should be revised and changed from the old Newtonian models to a new approach in the quantum era. The quantum age is the complex and chaotic world around us, within our organizations as well as our bodies and minds, and this quantum paradigm requires a new kind of leadership. The new model for quantum leadership is a plan for organizational leadership in a post-consolidation world based on more than 25 years of interdisciplinary research in the fields of behavioral science, neuroscience, computer science, economics, etc., and with new studies conducted during the 2020 pandemic. The importance of complexity theory in the world is so much that in UNESCO, a chair with the title of complexity has been considered (Montuori, 2008). In some countries, many conferences and associations have been formed to explain its foundations and solutions for education. However, unfortunately, in our country, this theory still needs to be discovered in most fields, especially in the field of education and curriculum. Only a few articles and treatises have examined it recently (Najarian, 2015).

Based on the works of Niels Bohr and Ludwig Wingenstein, Cantley (2017) suggests that a quantum theory model is more appropriate for measuring or evaluating cognitive abilities. Gornitz (2018) on quantum theory and the nature of consciousness suggests that our consciousness is a stream of meaningful quantum information is transmitted between the brain and photons, and knowledge is transmitted through consciousness; to explain quantum concepts and determine the relevant components, this research has pursued this question: What components does the quantum curriculum include?

Method

The current study used the qualitative method, conceptual structure evaluation, and theoretical research. The purpose of the research is to create and critique conceptual designs that make the fundamental nature and structure of the phenomena and processes of the program understandable in the curriculum. A complete set of basic concepts and identifying relationships between elements creates a conceptual schema through which one can think and discuss the curriculum. Also, this research helps reveal the fundamental nature of the curriculum, which is the most basic type of practical and interdisciplinary research in curriculum studies. This research in the field of the curriculum provides conceptual tools to understand and explain all types of practical research and routine curriculum activities. (Edmund Short, translated by Mehr Mohammadi, 2017). The statistical population of the research in the qualitative part includes national and international documents, related studies, and digital resources in the field of quantum physics and curriculum.

Results

According to the concepts and principles of quantum physics in the goals of the curriculum due to the wave nature of humans and the complexity and entanglement of this quantum being and reverse causality. The curriculum structure is not mechanical, staged, and

predetermined, and has a non-linear process and its future goals Goals are possibilities that should not be looked at to prepare for the future. Integrative contents, a transdisciplinary approach, adapting content to the situation to create new worlds, and interactive and network process-oriented programs are suggested. Quantum logic has a mental, physical intuitive approach and attempts to connect our classical world, a world in which objects have a certain identity, to the new quantum world, a world in which objects assume several meanings simultaneously (Salman, 2003). Quantum learning connects events to create meaningful information using the brain's neural networks (Zeybek, 2017). Based on the definition of the quantum learning model, this model can strengthen students' learning results, creativity, and memory. Creativity is the result of education that optimally uses the capacities of the right and left hemispheres of the brain (Sujatmika, Hasanah, & Hakim, 2018). DePorter believes music is essential to quantum learning because listening to music can help people work better and remember it more. Music encourages and empowers conscious and unconscious learning (Suryani, 2013).

Unlike machine design with a behavioral approach, quantum learning environments are based on living systems. It is the natural, dynamic and interconnected networks of relationships that are continuously learning and adapting, and evolving (Janzen, 2012). From the perspective of the principle of quantum entanglement that always changes everywhere and at any time, learning Offers a lifetime. Quantum thinking believes that the world is governed in contradictory and irrational ways. Paradoxical thinking requires the activation of the right hemisphere of the brain (Shelton, 2010), so curricula should emphasize increasing concentration and imagination. Also, because a person has a wave-like characteristic and his thoughts and behavior are accompanied by energy vibration, therefore, it is possible to use the injection of mental energies for his curriculum in various domains and spheres of the curriculum and by strengthening the unconscious of the person, lead him to inner awareness. He said that for this purpose, hidden curricula become especially important. Under these conditions, according to the butterfly effect, any change inside and outside will affect the universe. Positive changes will bring a world full of beauty, vitality, and peace with the help of a special quantum curriculum in the quantum being brought. Based on the theory of complexity, the curriculum must carry features of uncertainty, excitement, unexpectedness, and imbalance in order to provide the learner with the possibility of obtaining multiple perceptions. It causes deep, multifaceted learning and prepares people to live in an environment based on uncertainty (Morrison, 2008).

Therefore, in this thought, due to the great freedom and flexibility of planning and implementing the curriculum and the quality of the changes and the emerging world, evaluation should be done during the implementation of the process and based on the case, partial and local criteria. Complexity theory uses the ability of the organization itself, spontaneous adaptation, and the emergence of new and unpredictable behaviors to deal with continuous changes and developments in the curriculum according to its unique characteristics and solves the problems with complete uncertainty and stability in the curriculum elements. It examines from different angles. The edge of chaos, which considers the position between stability and chaos, can prevent the acceptance of pure stability or pure change in the curriculum in the conditions of change by planning the position of imbalance. The theory of complexity based on the uncertainty of knowledge, with the argument that reality is very complex and our tools and ability to know are limited, presents another aspect of a realistic view of human beings as the acceptance of the possibility of error, ambiguity, and contradiction in the process of human knowledge. Due to the acceptance of diversity, novelty, self-organization and non-linearity of learning,

complexity theory recommends educational technology based on network structure and non-attendance. Social media, web-based education, the internet, and satellite are among the new educational tools recommended based on accepting complexity and focusing on interaction. These tools are practical in realizing comprehensive, relational, and diverse learning and facilitating educational change. According to Klein's opinion, common curriculum models, focusing on some elements such as content and purpose, ignore the learner and his needs, or place a high value on the current interests of the learner and ignore the real issues of society and the problems he will face. They were. In the curriculum goals section, in the prescriptive and reductionist curriculum, the goals are definitively determined in order to control and predict things. At the same time, the curriculum structure as a complex system is not formed based on a predetermined internal plan and follows a non-linear process. Therefore, the ideal curriculum of complexity thinking does not exactly emphasize what is supposed to result from the learning processes. Any unexpected events in the meantime leave a tremendous impact. In the framework of the transdisciplinary approach, changes can be started from the elementary level and, with proper and gradual education, give appropriate answers to the child for how a biological being is simultaneously physical, chemical, physical, social, historical, and lives in a society with economic and cultural exchanges and, avoided cultivating one-dimensional minds (Mahmoudnia & et al., 2012).

In the perspective of complexity, the teacher is referred to as a facilitator of the learner in which learning becomes a collective journey of discovery rather than simply retrieving certain knowledge. The teacher's instructions have a butterfly effect to some extent and can greatly impact all the students and colleagues, and even this feature may happen to the students. The system interacts and any small change can cause significant changes. Determining specific learning time limits and curriculum and using the same content and curriculum for students of the same age reduces complexity and supports lifelong learning since equal learning change is continuous. Quantum mechanics can inform teaching methods, theories, and paradigms that, as a result, stimulate the quantum evolution of our society. For example, collaborative, experiential learning based on enthusiasm, imagination, curiosity and creativity of students, where teachers together with learners seek to discover knowledge and experiences, find meaning and purpose in awareness, see problems from multiple perspectives, and as a result, compassion, respect and peace are cultivated (Turner, 2020).

Conclusion

Considering that the education system is the most important system that tries to educate and train people to live better in society and bring them to a higher position, it is necessary to use its components to prepare a complex human being in a complex world. With the passage of time and the increase of knowledge and useful experiences in the field of curriculum design and production, the necessity of developing a strategic and comprehensive plan for the optimal organization of the curriculum is felt more than ever. Since we are in the period of quantum science, and this theory emphasizes change, transformation and adaptation, disorder at the same time as order, self-organization, uncertainty, unpredictability, hierarchical negation, observer's view and diversity. and the characteristics of positive feedback, adaptation and conformity, chaos, self-analysis, organizing communication, high sensitivity or butterfly effect positively affect curricula. Curriculum content is practically unrelated to the real learning issues they face in society, and graduates spend their most important learning years passively learning sciences that do not work for them in practice. The solution of the complexity theory to solve this problem is to contextualize knowledge and try to realize a transdisciplinary approach and integration that can be based on universal issues such as health, environment, natural resources,

peace, and social justice, the history of human life, his place in existence and so on. should be arranged and help from different scientific disciplines should be taken in each topic. Furthermore, The possibility of attractiveness in content and common sense, unity and understanding between learners will be provided. The current curriculum avoids facing changes and developments due to the fear of errors. However, the complex curriculum accepts the role of error and ambiguity in improving the learning process, considering the concept of uncertainty, and considers it necessary for creativity and innovation in learning. Also, this theory brings deep learning and stable and pleasant flexibility. Its prominent feature is the attention to the human being and his diverse dimensions. Concepts of quantum physics, transdisciplinary approach, contextual knowledge, replacement of distributed, collaborative and negotiated knowledge instead of hierarchical knowledge, preparation to face unexpected developments and situations, supporting lifelong learning by providing a problem-oriented, local curriculum, lack of focus in programs Curriculum and dealing with all the complex human aspects and his extensive interactions with the universe, as well as respecting different cultures and ethnicities, offers the implementation of curricula aimed at multicultural education. In the quantum approach, in the curriculum, the components related to the production of mental energy and its impact on learning, and as a result, individual awareness, unconsciousness, and pervasive emotions should be given a special place that has an impact on his learning. Also, learning is a multi-dimensional matter that every person can have his own unique style, and the same formula cannot be prescribed for everyone. To succeed in the implementation of curriculum, it is necessary to pay attention to the learner's environment and his mental and physical conditions and to inject mental energies. He paid attention to the priority of the hidden curriculum. Also, in the evaluation of curriculums, attention should be paid to the diversity of different tools and resources, and it should be done qualitatively, continuously, and in different situations, and the mental and physical conditions of the person should be taken into account so that accurate information can be collected. Quantum theories can be an effective guide to identifying individual talents in society.

Conflict of Interest

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

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