

ERD 2021**9th International Conference Education, Reflection, Development****A COMPARATIVE STUDY OF PRIMARY CURRICULUM OF
FINLAND, SINGAPORE, USA AND ROMANIA**

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Abstract

More than ever before, 2020, the year of the pandemic, led to a rapid and strong wave of digitalization of education and the work market. In a world of continuous change, a holistic and customized approach to learning becomes vital. The surrounding world cannot be perceived as bits and pieces. Therefore, all learning systems should switch from a monodisciplinary approach to an integrated one. The purpose of this research is to assess curriculums from economically developed countries such as the USA, Singapore, and Finland and conduct a comparative analysis of the integrated approach. Romania is one of the countries that hesitates to reshape the curriculum. The most significant steps toward an integrated approach were made in preschool and primary teaching after the implementation of new school curriculums in 2013. The new curriculums aim to ensure a cohesive knowledge process by breaking the boundaries between various study fields. At the international level, the situation is different. Developed countries target an integrated curriculum that focuses on exact sciences, engineering and technologies discovered by students through experiential learning. The US government was forced to rethink the educational system because of the low interest of students in exact sciences. On the other side of the globe, countries like Singapore and Finland implement a new curriculum focused on innovation and creativity, which allows students to develop the necessary skills for facing current world challenges.

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1. Introduction

Online teaching-learning developed after the Covid-19 pandemic has placed additional demands on both students and teachers, with technology playing an important role in student-teacher interaction. Today's learners need new sets of knowledge, skills, and capabilities to enable them to rapidly transfer knowledge across curricular areas for social and personal success.

Successful social inclusion, today and in the future, can no longer be achieved through monodisciplinary learning; an integrated approach is essential (Borzea, 2017). Interest in the integrated approach is not recent. Drake and Reid (2020) and Ma (2021) show that the concept of integrated curriculum started to be used after 1930. In 1935, the National Council of Teachers in England (NCTE) attempted to define degrees of curriculum integration. In their view the interrelation of subjects within themes can be superficial or stronger, going as far as fusion. In 1981, Humphreys considered that integrated study implied a correlation between knowledge from different curricular areas and the everyday problems faced by learners (Borzea, 2017). Referring to Humphreys' idea, Shoemaker (1991) defined integrated curriculum as "education organized so as to overcome disciplinary barriers, combining various aspects of the curriculum in meaningful associations, to focus in this way on broad areas of knowledge" (p. 5). This perspective allows for a holistic approach to teaching and learning and reflects the real world, characterized by the interaction of systems, processes, and phenomena (Shoemaker, 1991). In the process of instruction, knowledge integration is based on confronting students with problems collected from real life, leads to the acquisition of interdisciplinary concepts and skills, and involves, as a learning framework, project- and problem-based learning, inquiry learning, creative learning, problem solving, etc.

The curricular integration models developed by Fogarty and Pete (2009) are well known in the literature: (i) connected model: connecting ideas from different school subjects/disciplines; (ii) nested model: focusing on learning skills and organisational skills specific to each subject; (iii) sequenced model: the topics of one subject are sequenced so that they can be studied in connection with another subject; (iv) shared model: the contents of two different subjects, for example, contribute as partners, to develop, by overlapping, ideas and concepts; (v) webbed model: involves the selection of a theme whose contents are addressed in each of the disciplines studied, to develop ideas, themes and concepts specific to them; (vi) threaded model: involves the development of a "meta curriculum", with specific learning, social and thinking skills, the content providing the context for the acquisition or development of these skills; (vii) integrated model: the topic studied is developed by teams of teachers, who develop the defining concepts and ideas of the topic; (viii) immersed model: a student approaches the issue/topic studied and integrates it, according to their own ideas. Kysilka (1998, pp. 201-202) cites the work of Jacobs (1989) who identifies curriculum typologies defined by degrees/levels of integration: (i) separate disciplines addressed in parallel; (ii) multidisciplinary approach: the curriculum includes course units from different disciplines, these are addressed separately; (iii) interdisciplinary: the curriculum consists, of course, units that have been developed through the convergence/synthesis of knowledge from different disciplines. (iv) one-off/one-day integration: a theme/part of the theme is studied to meet the needs of the preschoolers at the time; (v) full integration: pupils decide what they study based on their interests, needs,

and experiences. Drake and Crawford Burns (2004) describe multidisciplinary, interdisciplinary, and transdisciplinary curriculum approaches. The multidisciplinary approach means that each subject is studied from the perspective of more than one discipline; the interdisciplinary approach means that the subject is studied with a view to developing interdisciplinary concepts and skills; the transdisciplinary approach places learning outside the disciplines by focusing on issues in the lives, needs, and interests of students.

Ciolan (2008) states that Romania is among the countries that hesitate to rigorously rethink the curriculum, preventing successful learning. The most serious steps in integrated teaching-learning have been taken in pre-school and primary education with the implementation of new curricula and the introduction of the preparatory class (Ciolan, 2008).

The replacement of general and reference objectives with general and specific competencies in the Romanian curriculum forces a rethinking of the design and delivery of teaching-learning activities. In an integrated approach, the teacher must think, over the course of a week, of broad, multi-, inter-and transdisciplinary activities, thus preparing the transition to the design of integrated activities. Although in primary education the curriculum connects some subjects, i.e. mathematics and environmental exploration, visual arts and practical skills, music and movement, their study is still predominantly monodisciplinary.

Internationally, developed countries are moving towards an integrated curriculum, with an emphasis on science, engineering, and technology, the latter being areas that have seen marked developments in recent years and with which pupils are familiarising themselves through life experience. Such education responds to the OECD expectation that schools should prepare pupils for jobs that do not yet exist, for the use of technologies that have not yet been created, and for solving problems that cannot yet be anticipated. Curiosity, motivation for learning, the practice of deep learning, metacognition and self-regulation, open-mindedness, and respect for oneself and others are traits that define the profile of the learner prepared for tomorrow's society OECD (2018, p. 2).

The present study is comparative in nature. Comparative studies of educational systems aim to identify similarities and differences between educational principles, rationales, and practices; moreover, they provide tools for their interpretation (Bray, 2007; Crossley, 2000; Kubow & Fossum, 2007; Lo, 2007; Lo, 2010). Their role is also to analyze educational experiences in several countries with the aim of changing perspectives on educational systems (Arnové, 2007; Kelly & Altbach, 1989; Lo, 2010; Noah & Eckstein, 1998).

2. Problem Statement

The perspective on curriculum integration is not uniform. It varies from teacher to teacher, from school to school, and from one education system to another (Wall & Leckye, 2017). Most often, teachers and schools integrate the curriculum based on different models of curriculum integration. The research question of the present study is: What are the characteristics of these models?

3. Research Questions

Given the broad typology of curriculum approach models and the fact that the most flexible model is the Drake and Crawford Burns (2004) model, the research questions are as follows:

Q1. Which curriculum approach model is used by the countries selected for curriculum analysis (Finland, Singapore, or the US) at the primary school level?

Q2. Are inter-and transdisciplinary competencies valued in the primary curriculum of the above-mentioned countries?

Q3. Which countries' curricula promote the STEM (Science, Engineering, Technology, and Mathematics) model?

4. Purpose of the Study

The purpose of this research is to analyze the curriculum in economically developed countries such as the United States, Singapore, and Finland to characterize the implemented curriculum model. For this purpose, an analysis of the available Web-based information sources was carried out.

5. Research Methods

To carry out this study, the curriculum documents of the four selected countries, available on the websites of specialized institutions (education ministries) and other studies in the field, were analyzed.

6. Findings

6.1. Results of Singapore, Finland, the US and Romania PISA tests

The results of the PISA tests provide us with relevant information about the educational system in different participating countries. Finland and the United States have participated in all PISA tests conducted so far, Singapore has participated only since 2009. Romania has not participated in the 2003 test (OECD, 2019).

The first PISA tests ranked Finland first. The Finnish education system is characterized by shorter school days, fewer standardized tests, and fewer homework. It has proven its effectiveness (Walker, 2017), with the Finnish education model being recognized worldwide. Finland has recorded the highest test averages since 2006, followed by a slight decline thereafter.

In 2018, Singapore had the best results on all PISA tests, after Beijing, Shanghai, Jiangsu and Zhejiang (B-S-J-Z-China) (OECD, 2019) (see Figure 1).

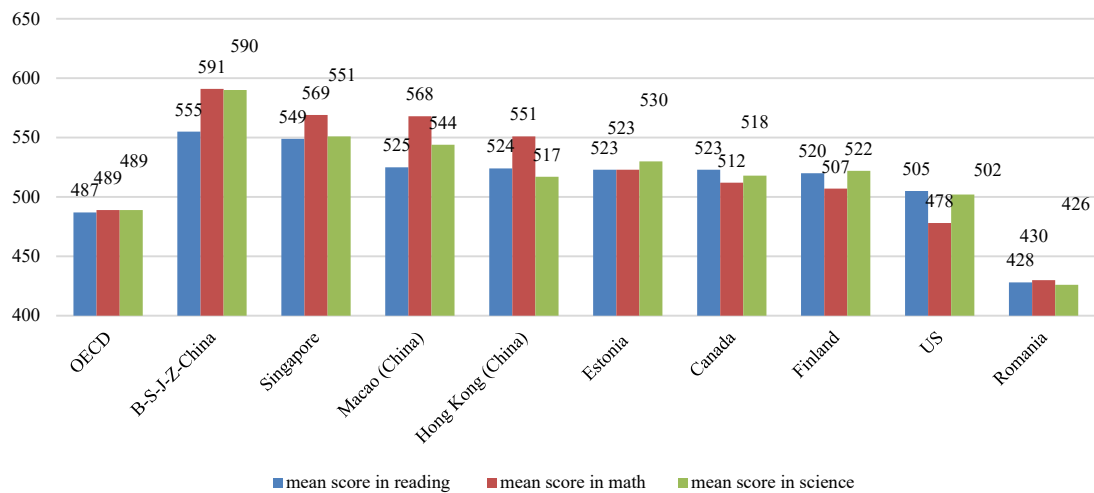


Figure 1. 2018 OECD average and mean score in reading, math and science of selected countries (OECD, 2019)

Singapore and Finland were of interest for the present research, given that they have performed well on international tests over the last 10 years, well above the OECD average. It should also be noted that Singapore is the only country with a strong emphasis on English language learning, which opens up new opportunities for students to develop interdisciplinary knowledge and skills. Finland's new curriculum reform promotes an integrative approach, proposing a learning model free from the pressures of national standardized tests in the early years of school.

The USA has achieved slightly lower averages on the PISA tests, with the average mathematics score over the last 10 years below the OECD average.

Romania has performed poorly on the tests in the average of the last 10 years, below the OECD average in all three domains (science, mathematics, and literacy). Romania's 2013 curriculum reform aims at integrated teaching and learning, which has been gradually implemented at the primary school level with the aim of improving academic results (OECD, 2019).

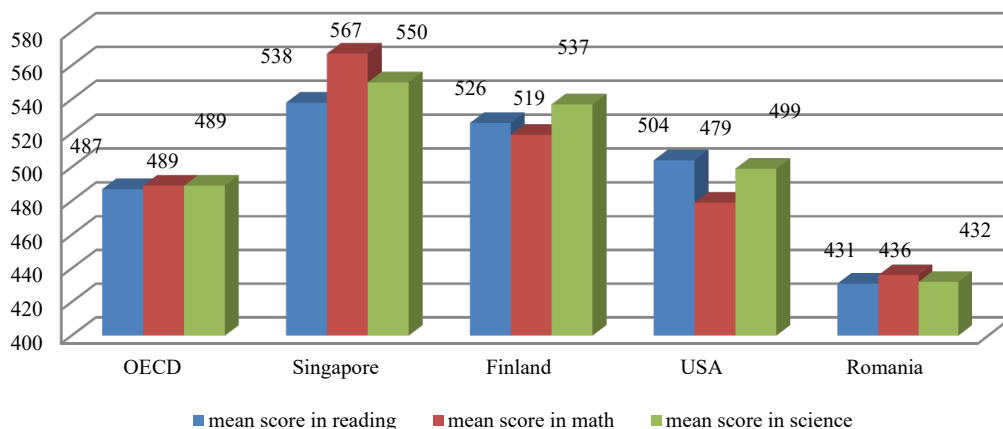


Figure 2. Arithmetic mean of the averages of the four countries over the last 10 years in reading, mathematics, and science

In Figure 2 we can see that Singapore has the best results compared to the other three countries, with the highest average in mathematics at 567. Finland ranks second with the highest average in science. The US averages over the last 10 years are roughly equal in reading and science, while in mathematics the average is below the OECD average.

In relation to these countries' PISA results, a brief analysis of their curriculum is necessary.

6.2. Curricular analyses

6.2.1. Finland

The McKinsey report (2017) praises the quality teachers and first-class instruction provided by the Finnish education system. In Finland, there is no distinction between primary and lower secondary education. Basic education starts at the age of seven and ends at the age of sixteen. In the first six grades, instruction is provided in most subjects by the same teacher and in the last three years by specialists in different subjects/fields (FNAE, 2017). Curriculum reform in Finland values student engagement, meaningfulness, the joy of learning, and teacher-student interaction. A specific aspect of Finnish education is student participation in planning their learning module.

The central objectives of the new curriculum in 2014 are to develop school culture and promote instruction through an integrative approach. Teachers work together to deliver learning modules that integrate skills and knowledge from different school subjects. The main changes in the new distribution of learning activities are that the number of arts and crafts, civics, and history lessons has increased considerably during core education. In Finland, there are no national tests during basic education (FNAE, 2017).

Also, the new curriculum comes with a new way of Phenomenon-based Learning (PhenoBL). Pupils aged 7 to 16 years must participate in at least one multidisciplinary PhenoBL module per year. Multidisciplinary learning modules cover periods when students work together to study a topic of common interest specific to their school age. At least one such learning module must be organized each school year. The theme of the modules is chosen locally (Kujala & Hakala, 2020).

This approach replaces the classic monodisciplinary routine that focuses on a single subject. Students studying according to this new approach explore phenomena that go beyond the subject boundaries (Varjo et al., 2019). The approach represents a transition to a new cross-curricular way of thinking about the organization of teaching and learning in schools.

Summarizing, the new Finnish curriculum reform (FNAE, 2017) also proposes a hybrid approach at the small school level. In it, Finnish pupils acquire competencies in individual areas of knowledge and transversal competencies. Multiliteracy, ICT skills, and entrepreneurial skills are essential for 21st century education. The last competency refers to the participation of young learners in the realization of a sustainable future in order to form responsible behavior toward the environment. The Finnish curriculum aims to develop a set of democratic knowledge and values. The development of thinking and learning to learn skills, cultural competence, and respect for the fundamental rights of human society are the most important transversal skills/competencies targeted by the new curriculum. Self-care and well-being at school by achieving a balance between learning and recreation is also a priority.

6.2.2. Singapore

The Singapore curriculum is forward-looking and innovative, focusing on information technology, creative-critical thinking, and problem-solving skills. 32% of the curriculum time is devoted to English language learning, 26% to mother tongue, 20% to mathematics, and the rest to other subjects. This type of curriculum places Singapore at the top of quality education systems (Ministry of Education [MOE], 2014). Singapore is also ranked 1st in terms of its ability to meet the needs of a competitive economy (McKinsey Report, 2017).

Singapore's Ministry of Education continuously oversees the development of the national curriculum keeping pace with the demands of digitization. To this end, it has developed a national online platform - Student Learning Space (SLS) which provides equal access to quality educational resources aligned with 21st-century skills. The platform also provides support to teachers in developing educational resources that meet the learning needs of young learners. For example, teachers have access to tools that help make pupils' thinking processes visible. Also, through this platform, teachers in Singapore can collaborate to implement and adapt new pedagogies (Lo, 2010; MOE, 2014).

Singapore's curriculum is aimed at a range of cross-curricular skills designed to innovate the education system. The focus is particularly on the development of character and self-management skills, social skills, and cooperative skills in relation to others. Numeracy and especially multiliteracy are skills needed by students in the early years of schooling, in the view of the Singapore Ministry of Education. Communication and information skills, together with the development of critical thinking skills, creativity, and the ability to make effective use of the knowledge acquired by pupils complete the list of transversal skills specified by specialists in education.

MOE (2021) introduces integrated learning as a principle, along with five other principles that guide the educational process: Holistic development and learning, Active learning, Supporting learning, Learning through interactions, Learning through play. The rationale for this integrated learning is that children learn by confronting facts of life and integrating knowledge that they are not even aware belongs to different fields/disciplines.

At the primary level, students go through a six-year course designed to give them a good foundation. Pupils study science only from the third grade onwards, but take courses in social studies, moral and civic education, music, arts and crafts, health education, and physical education. At the end of Primary 6, pupils take the Primary School Leaving Examination (PSLE), which assesses their skills and competencies to enable them to move on to a secondary school course that will suit their pace, abilities, and learning inclinations. In Singapore, the usual learning method used is a three-step learning model, which introduces them steadily and progressively to the study of concepts. A learning approach follows three stages: concrete representation, visual representation, and abstract representation of knowledge. Learners are taught not only to know how to carry out an approach but also why that approach works the way it does (Lo, 2010; MOE, 2014).

An analysis of Singapore's curriculum shows the predominance of a monodisciplinary approach, but also the openness to interdisciplinarity. The Singapore primary school curriculum focuses on subject-based learning (English, mother tongues, mathematics, science, art, music, and social studies) with the greatest emphasis on English, foreign languages, and mathematics. In Singapore, the holistic approach to

learning plays a key role from kindergarten onwards. At the end of primary school, Singaporeans can distinguish between right and wrong, have learned to share and put others first, can build friendships with others, have a great curiosity about things, can think and express themselves, take pride in their work, have cultivated healthy habits and love their country (Yew-Jin, 2019).

6.2.3. United States of America

American education is centered on the following slogan – No Child Left Behind (NCLB) and focuses on reading and math, with other areas of instruction receiving less attention.

The Learning Standards guide states and school districts on the goals that students must meet to reach Adequate Yearly Progress (AYP). The curriculum differs from state to state. School districts also select curriculum guides and textbooks that reflect the state's learning standards. Many teachers in the US use innovative strategies such as discovery learning, experimentation, and other methods designed to develop critical thinking (Hasni & Potvin, 2015; Lamberg & Trzynadlowski, 2015). In recent years, there has been growing interest in the integrated approach in the US as well. This type of approach aims to develop interdisciplinary skills needed in the fast-paced century, among which we can list the development of critical thinking, teamwork, and communication skills. Another new practice in American education is multi-age programs in which children from different grades share the classroom and teachers.

As for primary education, at the age of 5-6, the American child leaves kindergarten and will study in primary school until the age of 10-12. In the USA the cross-curricular competencies/skills specific to the primary curriculum are different by state. The curriculum for primary grades includes reading, writing, listening, speaking, literature, drama, social studies, mathematics, science, health, physical education, music, and visual arts. There is an active interest in developing language and mathematical skills (US Department of Education, 2021).

6.2.4. Romania

The last educational reform in primary education in Romania occurred in 2013, when the school curricula underwent considerable changes. The integrated approach has become particularly important. As a result, at the primary level, the new curricula in the first three years of study aimed to take an interdisciplinary approach to the study subjects. Mathematics is studied in direct correlation with the natural sciences, and the lessons themselves aim to approach a subject from several perspectives. For example, in a Romanian language communication lesson, in addition to objectives aimed at developing communication skills in Romanian, objectives specific to mathematics, science, art, music, or even physical education are proposed.

In Romania, the typical age of a pupil enrolled in primary education is 6. The first three years of study aim at forming the fundamental skills of literacy and mathematics, and the last two years aim at forming the basic skills needed for further studies. Science is studied from the fourth year of study, and in the last year of study, students learn the basics of history and geography. Throughout the 5 years of study, Romanian students attend classes in English, arts, moral and civic education, and music. In the 2nd and 4th grades, students are subject to national tests (Cucos, 2014).

The Romanian curricular approach at the primary school level is predominantly integrated, especially in the first three years of study. In the last two years of study and at the secondary and high school level, there is a shift to a monodisciplinary approach.

Cross-curricular or key competencies are a relatively new concept in Romania, the National Education Law (LEN) 1/2011 stipulating in the curriculum section the eight key competence areas that determine the training profile of the Romanian student: communication competencies in Romanian and mother tongue, communication competencies in foreign languages, basic competences in mathematics, science and technology, digital competences, social and civic competences, entrepreneurial competences, cultural awareness and expression competences, the competence of learning to learn (Ministry of Education, 2021).

6.3. The national curriculum of selected countries and STEM education

The promotion of integrated STEM/STEAM/STREAM approaches in education is based on the consideration that the world cannot be discovered and understood by students only through the perspective of a single subject or disciplinary approach. Most problems encountered in life require interdisciplinary knowledge and very often knowledge from STEM/STEAM fields. In order to highlight the need and importance of this knowledge, teachers need to propose to students to solve problems with their life experience as a source (Barnutiu & Ciascai, 2020).

Finland is concerned with STEM education. This is seen as an instructional standard for education. STEM is included in all curriculum areas/fields as a problem solving approach (Su et al., 2017). In Singapore, there is a diversity of STEM programs offered by stakeholders and agencies, under the coordination of MOE (Tang, 2019). STEM Inc, established in 2014, advises and provides schools with packages of materials to implement STEM programs. In recent years, there has been growing interest in the US in the integrated STEM approach. The concern for STEM instruction is driven by declining PISA test scores, students' disinterest in studying technical subjects and in science and engineering careers, and the need for specialists (Fayer et al., 2017), all of which have prompted the Obama administration to implement the integrated STEM approach in the school curriculum. In general, schools that implement an integrated curriculum are few due to the lack of teacher training in STEM fields and the organizational challenges that the integrated STEM approach entails.

The same trends are also observed in the other countries whose curricula were analysed. In Romania, there are only occasional concerns in the STEM field, e.g., training courses for teachers and summer courses for students.

7. Conclusion

Curricula in Finland, Singapore, the USA, and Romania favour monodisciplinary education but also aim at developing interdisciplinary skills required by the demands of today's society. The trend towards an integrated approach is gaining increasing interest in the curriculum policy of the four countries mentioned above. However, the integrated approach to teaching is difficult to put into practice on an ongoing basis due to the lack of teacher training in this area.

The Romanian curriculum provides an integrated approach to study subjects, especially in the first three years of primary school, with a change to a single subject agreement in secondary school in the last two years. Since 2014, the Finnish curriculum has promoted instruction through an integrative approach, but the curricular approach is predominantly a monodisciplinary one. Similarly, the Singapore and American curricula are based on a monodisciplinary approach.

A closer look at the transversal competencies or skills mentioned in the curriculum documents of the four countries shows that they cannot be formed in a subject-centered education system. It is necessary to move from monodisciplinary to interdisciplinarity, and especially to transdisciplinarity.

The concerns of Finnish and Singapore education are noteworthy. The Finnish curriculum places great emphasis on the formation of transdisciplinary competencies of well-being and sustainable development, while in Singapore it considers the formation of the child's character to be extremely important. The primary school curriculum in all four countries emphasizes the formation of transferable skills, including learning-to-learn, cooperation and interrelation skills (group work), and communication skills.

STEM education helps students to understand the interdependence between STEM knowledge and real-life issues. Interest in the integrated STEM approach (science, technology, engineering, mathematics) is systematically promoted in all the countries whose curricula were analyzed, except Romania where there is no curriculum policy in this respect, but there are specific concerns.

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