PRACTICING SOCIAL-EMOTIONAL AND COGNITIVE TEACHING STRATEGIES AND STEAM ACTIVITIES IN EARLY CHILDHOOD EDUCATION

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Abstract

STEAM education is recognized as an efficient practice of holistic education, which is already relevant at the stage of early childhood education. STEAM research focuses on the search for models of interdisciplinary integration and the justification of innovative educational approaches. The aim of this paper is to reveal the relationship between practicing social-emotional and cognitive teaching strategies and STEAM activities in early childhood education. The conducted quantitative study reveals that the population of early childhood teachers is heterogeneous in terms of practicing teaching strategies and STEAM activities. Early childhood teachers, who use social-emotional and cognitive teaching strategies with equal frequency, also often use integrated STEAM activities in young children education. Other teachers prioritise social-emotional teaching strategies and pay less attention to cognitive teaching strategies, although the latter have a slightly stronger link to the development of STEAM practices. Teachers who are less likely to use cognitive strategies to teach young children tend to use STEAM activities less frequently.

Keywords: *Early childhood, STEAM, social-emotional teaching strategies, cognitive strategies.*

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1. Introduction

STEAM (Science, Technology, Engineering, Arts, Maths) is defined as an integrated approach to education in these fields, as a model of inquiry-based, creative, interdisciplinary education, and as education based on solving real-life problems (English, 2016; Yata et al., 2020). STEAM education in many countries is related to the pursuit of technological breakthroughs, which need to stimulate learners' interest in science, mathematics, technology and engineering (DeJarnette, 2018). Research is actively carried out to find the best model for the integration of STEAM education domains, and the following models are distinguished: a model for exploring phenomena (water, energy, etc.) from a cross-disciplinary perspective (Aydin, 2020), engineering or technology education as a cross-disciplinary integrative field, and others (English, 2016; Bati et al., 2018; Yata et al., 2020; Aydin, 2020; Kastriti et al., 2022).

STEAM activities in early childhood education take the form of playful, spontaneous, and teacher-initiated interest in the world around children, exploring natural objects and phenomena (water, wind, diversity of life, the Earth, etc.) by asking questions, observing, experimenting, and drawing conclusions (science education); exploring the purpose, function, and operation of tools, instruments, technological processes, and mechanisms (measuring instruments, digital microscopes, pulleys, wheels, etc.), creating models, and testing them (technology education); designing, building, constructing different structures (houses, bridges, roads, robots, etc.), exploring the properties of materials (bricks, Lego, robotics kits, natural materials), and understanding the phenomena of stability, balance, etc. (engineering); activities involving calculation, measurement (maths), design (arts). (Campbell et al., 2018; Aldemir & Kermani, 2016; Ata Aktürk et al., 2017; Knaus & Roberts, 2017).

A wide range of research studies reveal how methods applied by teachers support and extend children's interest in STEAM activities and promote the development of their knowledge and skills. The emphasis is placed on methods that promote cognitive processes: raising hypotheses, observing, clarifying, questioning, exploring, experimenting, modelling, designing and redesigning, predicting, and developing higher order thinking skills of children (Yata et al., 2020; Aydin, 2020). According to Kastriti et al. (2022), these are scientific tools that should be used in a creative way. This is what children learn when the arts are integrated into the concept of STEM.

In their systematic review of research on teaching methods in STEAM education, Kastriti et al. (2022) highlight the most effective approaches to STEAM education - Project Method, Problem-Based

Learning, Inquiry-Based Learning, and Discovery Method. These approaches are also more associated with cognitive teaching strategies, although there is also an emphasis on the social aspect, promoting children's motivation and cooperation. Social-emotional approaches to teaching are less often emphasised in STEAM education. However, in early childhood education, the social-emotional dimension is relevant to the whole educational process, including STEAM education (Laureta, 2018).

In the present study, we analyse the social-emotional teaching strategies used by early childhood teachers in STEAM education, which include the Pedagogy of Listening to the Child, the Personalised Dialogue-Based Educational Interaction with the Child, Emotionally Engaged Learning, and Self-Regulated Learning. Attention was also allocated to cognitive teaching strategies, which include Experiential Development of Higher Order Thinking Skills (discriminate, compare, group, model, predict, reason), Promoting Deep Learning, and Reflective Learning. Attempts were made to reveal how social-emotional and cognitive teaching strategies practiced by early childhood teachers relate to the practice of STEAM activities. Recognising that the teacher population will not be homogeneous, we have analysed the grouping of teachers according to the characteristics of these practices.

2. Objectives

The objectives of the research were: a) to reveal the clusters of teachers according to social-emotional and cognitive teaching strategies and STEAM activities they practise in early childhood education; b) to establish the relationship between the frequency of using social-emotional and cognitive teaching strategies and the frequency of practising STEAM activities.

3. Methods

The research instrument. A quantitative research approach (Cohen, Manion, & Morrison, 2018) and survey design (Creswell, 2014) were used to conduct the study. The self-reported online questionnaire was designed following a theoretical construct. The questionnaire consists of seven subscales (46 items): two subscales focus on application of social-emotional and cognitive teaching strategies for organizing STEAM activities; five subscales are designed to reveal the integral practices used by educators in science, technology, engineering, art and mathematics education. The teachers rated each statement on a Likert scale from 1 to 5, with 1 being not applicable in their practice, 2 being rarely applicable, 3 being moderately frequently applicable, 4 being frequently applicable and 5 being very frequently applicable. It was recommended that the participants use "rarely" if they employ the relevant strategies or STEAM activities in their practice with children once a month or less; "moderately frequently" should be marked if they use them several times a month, "frequently" - if they apply strategies or STEAM activities once or twice a week, and "very frequently" should be chosen if the teachers apply them daily. The internal consistency of the questionnaire statements is high as the Cronbach Alpha equals 0.952. The internal consistency of the separate parts of the questionnaire is greater than 0.8.

Sample. The research participants included early childhood teachers working with 3- to 6-year-old children. The teachers were sampled using the random probability sample strategy. Raosoft software suggested that the minimum sample size needed in this study is 982, with a 3% margin of error and a confidence level of 95%. The internet questionnaire was filled in by 1231 teachers (2.65% margin of error, 97% confidence level).

Methods of data analysis. Statistical data processing methods were applied for the analysis of quantitative research results. The obtained research data were processed using IBM SPSS Statistics 23.0 and MS Excel programs adapted for Windows. Methods of descriptive statistics were applied. The normality of the variables was checked with skewness (<-1 or >1) and kurtosis (<-1 or >1) of the distribution. The analysis of the research data indicated that all variables were normally distributed (see Table 1). Cluster analysis and the K-Means method were used to group teachers into groups according to social-emotional and cognitive teaching strategies they apply and the STEAM activities they practice. Pearson correlation was used to identify correlations between the teachers' application of different teaching strategies and the practice of STEAM activities.

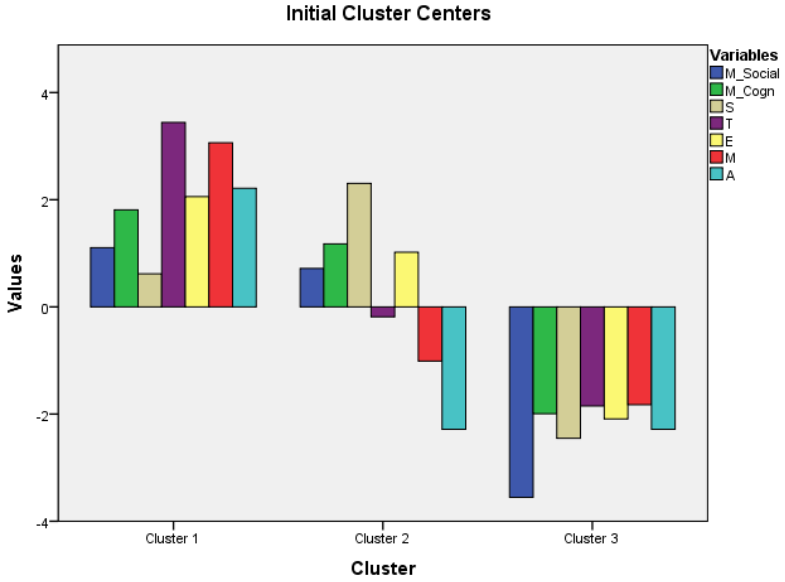
Procedure and ethics. All teachers participated in the questionnaire survey on a voluntary basis. The questionnaire was anonymous and full confidentiality was ensured.

4. Research results

In the present study, our aim was to reveal whether early childhood teachers are a homogeneous group in terms of which teaching strategies, social-emotional and/or cognitive they use more often to organise STEAM activities, as well as in terms of the frequency with which they implement integrated

STEAM activities (science, technology, engineering, art, maths). To achieve this, the cluster analysis of the data was carried out, the results of which are shown in Figure 1. The abbreviations used in this figure are as follows: M_Social - social-emotional teaching strategies; M_Cogn - cognitive teaching strategies; S - Science; T - Technology; E - Engineering; M - Maths; A - Arts. The data show that three clusters of early childhood teachers clearly stand out in terms of the teaching strategies used and the frequency with which they practise STEAM activities. Cluster 1 includes 27.86 % of early childhood teachers, Cluster 2 encompasses 46.95 % of teachers, and 25.18 % of the participants are assigned to Cluster 3.

Figure 1. Teacher clusters according to the frequency of practicing social-emotional and cognitive teaching strategies and STEAM activities (standardised values).



In addition, we analysed how often early childhood teachers from different clusters use social-emotional and cognitive teaching strategies and how often they practise STEAM activities. The mean scores for the different teaching strategies and STEAM activities practised in the education of the children in their group are shown in Table 1.

Table 1. Mean scores of frequencies of applying different teaching strategies and practicing STEAM activities.

Cluster	Social-emotional teaching strategies Mean	Cognitive teaching strategies Mean	Science Mean	Technology Mean	Engineering Mean	Arts Mean	Math Mean
1	4.66	4.13	3.78	3.12	4.05	3.98	3.36
2	4.20	3.13	2.97	2.27	2.97	3.03	2.39
3	3.13	1.95	2.23	1.71	2.00	2.03	1.76

The data show that Cluster 1 includes early childhood teachers who frequently and very frequently use both social-emotional and cognitive teaching strategies when implementing STEAM activities in early childhood education. The average score for the use of teaching strategies is between 4 (used frequently) and 5 (used very frequently). These educators practise social-emotional teaching methods such as listening to children, dialogue-based interaction with children, developing emotionally engaged learning, promoting emotional self-regulation, etc. They also use cognitive teaching methods: they practise child-friendly experiential techniques that encourage the development of higher-order thinking skills of young children (discriminate, compare, group, model, predict, reflect, argue), and they use techniques that stimulate children's deep learning, reflecting on their own cognitive experiences and others. Teachers assigned to Cluster 1 practise STEAM activities with early age children moderately frequently and frequently. The average score for practicing STEAM activities is between 3 (used moderately frequently) and 4 (used frequently).

Cluster 2 includes early childhood teachers who use social-emotional teaching strategies frequently and very frequently (mean score - 4.2), but only moderately frequently apply cognitive teaching strategies (mean score - 3.13). These teachers favour social-emotional teaching methods as they develop

personalised educational interactions with children, and their emotional response to children's interest is sensitive and frequent. They pay much less attention to cognitive methods. This is probably the reason why teachers in Cluster 2 practise science, engineering and art activities with early age children moderately often (mean scores - 2.97 and 3.03), and technological and mathematical activities rarely (mean scores - only 2.27 and 2.39).

Early childhood teachers in Cluster 3 also prioritise social-emotional teaching strategies but use them less frequently in STEAM activities than teachers assigned to Cluster 2, that is, only moderately often (mean score - 3.13). However, these teachers rarely use cognitive strategies to teach pre-school children. This clearly has an impact on the practice of STEAM activities in early childhood education, as these teachers rarely offer STEAM activities to children in their groups.

It can be assumed that the frequent and very frequent application of both teaching strategies (social-emotional and cognitive) is related to the frequent and very frequent practice of STEAM activities. In addition, teachers who are less likely to use cognitive teaching strategies are also more unlikely to practice STEAM activities.

To test this hypothesis, we found correlations between the social-emotional and cognitive teaching strategies used by early childhood teachers and the frequency of practicing STEAM activities. Pearson correlation was applied considering the normal distribution of the test data. The classical Pearson correlation coefficient was used: a coefficient value of up to 0.2 indicates a very weak correlation, 0.20 to 0.39 shows a weak correlation, 0.40 to 0.69 refers to a moderate correlation, 0.70 to 0.89 indicates a strong correlation, 0.90 to 0.99 demonstrates a very strong correlation, and when the coefficient value is 1, the relationship is linear.

Table 2. Correlation between practicing of social-emotional and cognitive teaching strategies and STEAM activities (Pearson correlation coefficient values and p-values).

Teaching strategies	Science	Technology	Engineering	Arts	Maths
Social-emotional teaching strategies	0.458	0.407	0.517	0.447	0.586
	p<0.0001	p<0.0001	p<0.0001	p<0.0001	p<0.0001
Cognitive teaching strategies	0.552	0.510	0.583	0.554	0.659
	p<0.0001	p<0.0001	p<0.0001	p<0.0001	p<0.0001

The data show that the relationship between the frequency of practicing social-emotional and cognitive teaching strategies and STEAM activities is moderate with all estimates of Pearson correlation coefficient ranging between 0.407 and 0.659, and the relationship is statistically significant ($p<0.0001$). Pearson correlation revealed a slightly stronger correlation between the frequency of using cognitive education methods and practicing STEAM activities (0.510-0.659, $p<0.0001$) than between the frequency of using emotional-social education methods and practicing STEAM activities (0.407-0.517, $p<0.0001$).

5. Discussion and conclusions

Our study highlights a number of important aspects. Although most researchers (Yata et al., 2020; Aydin, 2020; Kastriti et al., 2022) point to the relevance of cognitive learning approaches in STEAM education, the results of our study show that it is not only cognitive, but also social-emotional teaching strategies that are relevant in the educational process. Our study reveals that teachers who are most likely to develop integrated STEAM activities in early childhood education are equally likely to use both cognitive and social-emotional teaching strategies. Teachers use listening pedagogy particularly frequently as hearing children's voices allows them to support the development of STEAM activities that are relevant to children and promote their motivation. To achieve dialogue-based interactions, teachers use collaborative participation and joint thinking methods, working together with the children, participating in STEAM activities they initiate or propose. Teachers use provocations, contexts that promote emotional engagement and timely responses to the child's emotional experience.

Some researchers justify the prioritisation of “soft skills” in early childhood education (Laureta, 2018). Our study reveals that about two-thirds of early childhood teachers also prioritise social-emotional teaching strategies for teaching children and less frequently use cognitive strategies. Such teachers employ STEAM activities less frequently. Possible assumptions of this fact are revealed by research carried out by other authors, which shows that early childhood teachers lack not so much motivation, but rather subject-specific STEAM knowledge, understanding of technological and engineering processes, and familiarity with methods that stimulate children's technological, engineering, and mathematical thinking (Bers et al., 2013; John et al., 2018; Yata et al., 2020). This fosters a fear of using practices based on exploration, modelling, designing, and testing to promote the development of children's higher order thinking skills and deep learning.

Our study reveals a statistically significant relationship between the frequency of social-emotional and cognitive teaching strategies and the frequency of practicing STEAM activities, although the relationship between the frequency of cognitive teaching strategies and the development of STEAM practices is slightly stronger. This is in line with the rationale for the effectiveness of cognitive approaches to STEAM education presented in Kastriti et al. (2022). The mastery and increased practice of cognitive teaching strategies could lead to the development of STEAM activities in early childhood education.

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