The Effect of Layered Curriculum on Academic Achievement: A Meta-Analysis Study

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ABSTRACT
The layered curriculum maintains its importance in education as it helps students gradually develop their cognitive levels, supports their academic success, and offers a structured learning process tailored to individual learning needs. This programme contributes to the development of skills such as taking personal responsibility, critical thinking, advanced problem-solving, and achieving academic success, thereby increasing its effectiveness in education over time. This study aims to analyse the results of experimental studies examining the impact of the layered curriculum on academic success through meta-analysis and to identify the effects of moderator variables, including publication type, institution, experimental process durations, and sample size. A total of 41 effect sizes derived from 13 theses meeting the inclusion criteria were included in the meta-analysis. The findings of the study indicate that the layered curriculum has a positive and moderate effect (g=0.80) on academic success. No significant differences were observed in the moderator variables related to publication type, institution, and experimental process durations; however, a significant difference was found regarding sample size. Based on the data obtained from the study, it is predicted that the effective implementation of the layered curriculum will enhance academic success.
Keywords: Academic achievement, Layered curriculum, Meta-analysis, Tiered instruction.

INTRODUCTION
In the Information Age, societies are faced with the need to raise individuals who can adapt to rapidly changing technology and information flow. In this context, education systems are also in an effort to transform into a structure suitable for these needs. It is observed that traditional methods applied in education are inadequate especially in skills such as issue resolution, analytical reasoning and independent learning. The deficiencies of traditional methods in achieving the goal of raising individuals who can access information quickly, analyse and apply it are becoming more and more evident. The inability of our education system to respond to the demands of this modern age at the desired level increases the need for more effective and efficient teaching approaches. At this point, the layered curriculum stands out as one of the approaches that attract attention in order to meet modern educational needs. Unlike traditional teaching approaches, the layered curriculum ensures that learning is handled as a structured process that is suitable for the individual development of the student. In addition to students' academic achievement, the development of advanced cognitive abilities including critical analysis and issue resolution has become one of the most important goals of education programmes today. In this context, the role of the programme in question is becoming increasingly important regarding not only enhance students' academic success, but also providing them with skills such as analytical thinking and developing a solution-oriented approach. This situation demonstrates why more innovative and student-oriented approaches are necessary for the education system to adapt to the Information Age and increase student achievement.

Over the past few years, demand has escalated for student-centred approaches in which students are placed at the centre of the learning procedure. In this context, important efforts are being made to expand our understanding and practice of student-centred approaches within the field of education (Seiler, 2024). The layered curriculum, which is one of the student-centred approaches, is a structuring method that supports the development of high-level thinking skills and taking individual responsibility by taking into account the differences of individuals regarding learning processes. This programme is inspired by Bloom's taxonomy of cognitive domain objectives. Step C of this curriculum, which is divided into three different levels as C, B and A, represents the basic level of the programme. This stage focuses on the learning objectives associated with the "knowledge" and "comprehension" levels in Bloom's Taxonomy and aims to ensure that students understand basic concepts and acquire knowledge. Here, students attain basic information and meanings about the course. Step B corresponds to the "application" level. It focuses on the organisation and application of the knowledge learnt at stage C. This stage

provides students with the opportunity to practice their problem solving skills. Stage A corresponds to Bloom's "analysis, synthesis and evaluation" stages. It covers enhanced-level cognitive abilities such as critical thinking and developing original ideas. The layered curriculum is a learning-teaching approach that combines learning outcomes, activities and evaluation studies structured according to the steps specified in the areas where it is applied (Gürbüztürk, 2023; Orakcı, 2020).

The layered curriculum proposed by Nunley enables students to learn in their preferred learning styles and at their own pace by organising learning processes according to their individual differences (Nunley, 1998). This programme has initiated as a consequence of the curricula developed in many countries in compliance with the constructivist approach. This programme developed in the USA bears the traces of the constructivist approach and is accepted as a teaching approach that can be applied in the classroom environment. In this curriculum, the student is at the centre and the process is carried out on the basis of activity. In this programme, which is under the responsibility of the student, the individual structures his/her own learning process. Cascade teaching is considered as an effective approach that increases student participation in the learning process with the different levels of teaching strategies it offers. Students are encouraged to actively participate in the learning process via this strategy by taking into account their individual learning needs (Yılmaz, 2022). In addition, the programme aims to determine at which stage students are in the learning process and to establish general objectives that will enable students to acquire to the maximum degree according to their learning capacities, interests and needs. It is envisaged that these objectives will be diversified and organised in a gradual structure by supporting them with activities within the framework of specific learning units. The programme is structured in three stages, consisting of levels A, B and C, and encourages student participation and involvement in creative activities. This pyramid is presented schematically in Figure 1 (Demirel, 2020).

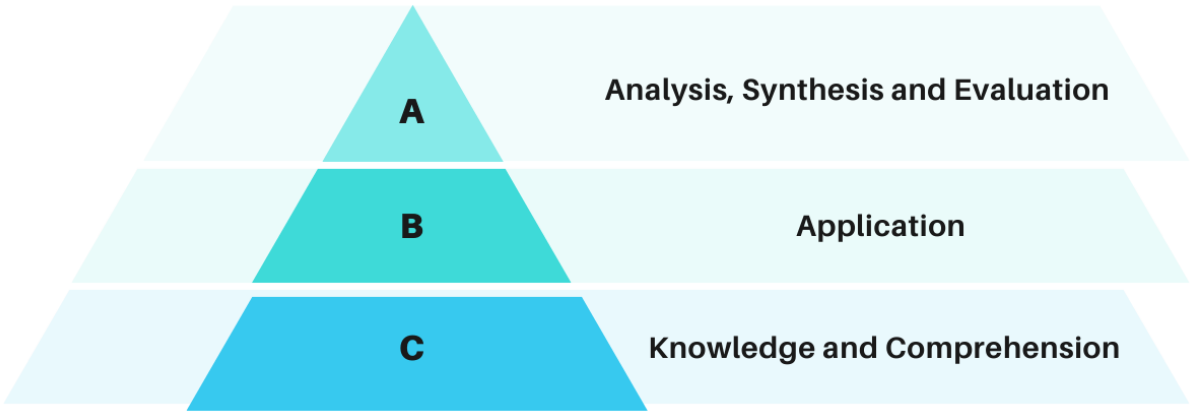

Figure 1. Levels of The Layered Curriculum

The reflections of progressive teaching on education aim to enable students to acquire and comprehend new knowledge, as well as to use this knowledge in problem solving, to analyse and thus to generate new knowledge. In this programme, it is essential that the learning environment is adapted to the unique structure of each individual. Education ought to be modelled by considering the cognitive and affective readiness levels of the individual, so that the most appropriate learning experience should be offered to the student. Since each student is different, a single teaching method or technique may not be sufficient. Therefore, learning environments should be diversified and versatile. The teacher, on the other hand, should assume a role that directs and guides the student to discovery rather than being the transmitter of knowledge. Thus, the necessary steps will be taken to make learning a more interactive and student-controlled process (Akpınar, 2014; Sönmez, 2020).

The layered curriculum is an effective educational model that customises and diversifies students' learning processes by taking into account their individual differences. One of the important arguments of this approach is that it aims to provide a learning environment adapted to the cognitive and affective readiness levels of each student. Thus, it supports each individual to learn in the most efficient way. The programme in question, which increases students' participation and encourages high-level cognitive skills such as creative thinking and problem solving, brings the guidance role of the teacher to the forefront and transforms the teaching process into an interactive and student-centred format. On the other hand, it enables students to set goals according to their different learning needs and to carry out their learning processes in a more personalised way through its three-stage structuring. As a result, it can be said that the stepped curriculum helps students to learn more deeply, increase their active participation and take responsibility for learning.

Glass (1976) defines meta-analysis as comprehensive statistical analyses carried out to bring together the findings from many individual studies. This approach aims to provide broader and more meaningful data by integrating the results of existing studies. Meta-analyses are methods and techniques used to statistically combine the results of previously conducted independent studies. When there are a lot of research addressing a particular research problem, studies testing the same hypothesis are expected to yield similar findings. Such studies are considered important in terms of making a valid generalisation. Meta-analysis can be considered as an analytical technique that summarises the findings of various studies as well as delivering the tendency to reach similar results through the effect size unit. Therefore, it stands out as an effective tool for both summarising the results and creating a solid basis for new research (Assen, et al., 2023; Bakioğlu & Özcan, 2022; Bayraktar, 2021). Meta-analysis is a method that brings together the possible findings of one or more independent studies within the framework of a subject and statistically analyses these findings. The fact that the results of different independent studies differ greatly makes it necessary to interpret these information sets in line with certain criteria and to need reliable unifying studies that will shed light on new research. Today, it is known that the number of scientific studies has significantly increased. Meta-analysis studies not only determine the general trends of research in the existing literature, but also open new horizons for future research and serve as a guide in the relevant field (Akgöz et al., 2004; Field & Gillett, 2010; Özkaya, 2021).

The number and variety of researches in educational sciences have been increasing rapidly in recent years. This increase leads to a gradual growth in the volume of information obtained. Therefore, it is necessary to interpret this knowledge with a holistic approach. It is important to know in which direction the accumulation of studies affects people and how the existing knowledge serves our position. Therefore, instead of the results obtained from individual studies, it will be more effective to present researches with common themes by combining them with effective methods. As a matter of fact, it is difficult to evaluate the findings obtained through comprehensive studies separately in a limited time. Therefore, the problem of which method to combine the studies becomes an important issue. In this case, meta-analysis can be used as an effective tool to obtain more comprehensive and meaningful results by integrating the available information (Bakioğlu & Göktaş, 2018). Meta-analysis can provide guidance for future studies by identifying gaps in the existing literature. It is skilful in revealing missing or insufficiently examined topics and can provide researchers with an important orientation in which areas they should conduct new studies. In this respect, meta-analysis can contribute to scientific progress not only by systematically compiling existing information but also by identifying inconsistencies and theoretical gaps in the field.

The changes and developments in the recent past have increased the interest in student-centred approaches in the field of education and these approaches have significantly transformed the dynamics of the educational process. Student-centred education, as the name suggests, draws attention as an approach that encourages students to actively participate in learning processes and focuses on individual needs and interests. In this framework, the layered curriculum stands out as an important programme among student-centred methods. When the literature (Aydoğuş, 2009; Başbay, 2006; Bayer, 2022; Biçer, 2011; Doğmaz, 2016; Durusoy, 2012; Genç-Tosun, 2016; Gün, 2012; Kahraman, 2020; Karagül, 2017; Koç, 2013; Öner, 2012; Özdemir, 2019; Üzüm, 2017; Yıldırım, 2016; Yıldız, 2018; Yılmaz, 2019; Zeybek, 2016) is examined, there are many studies investigating the influence of both the layered curriculum and the layered curriculum on academic achievement. On the other hand, although there are meta-analysis studies on student-centred studies (Kurnaz & Korkutan, 2023) in the literature, it is also observed that meta-analysis studies involving the layered curriculum are included in student-centred studies (Yağan, 2022). In the study carried out by Bademci et al. (2023), studies on the layered curriculum were examined by meta-synthesis method. In his study, Caughie (2016) focused on how the layered curriculum shapes students' effective participation and performance in lessons. It is predicted that This research will add to the body of knowledge on examining the effect of the layered curriculum on academic achievement directly by meta-analysis method. In this context, it is aimed to evaluate the effect of the programme on academic achievement in a broad framework and to obtain reliable results. The research aims to reveal the benefits of the programme if it is adopted as an effective application among student-centred approaches. In this axis, the effect of the programme on academic achievement was tested by calculating the effect sizes gathered from the studies dealing with the layered curriculum. The main purpose of the study is to analyse the quasi-experimental studies examining the effects of layered curriculum on academic achievement through meta-analysis and to determine the role of certain study characteristics on this effect. In this framework, Answers to the following queries were requested in line with the sub-objectives of the study.

1. What is the effect of the layered curriculum on academic achievement?
2. Does the effect of the layered curriculum on academic achievement differ in terms of the publication type of the studies?
3. Does the effect of the layered curriculum on academic achievement differ according to the institutes where the studies were conducted?

4. Does the effect of the layered curriculum on academic achievement differ according to the experimental process duration of the studies?
5. Does the effect of layered curriculum on academic achievement differ according to the sample sizes of the studies?

METHOD

Research Model

The research was conducted by using meta-analysis technique in order to examine the effects of layered curriculum on academic achievement. Meta-analysis is a statistical method used for synthesising and interpreting by combining the results of different studies and making a general evaluation in terms of effect size (Card, 2012). Dinçer (2022) defines meta-analysis as a type of analysis performed to draw a general conclusion by combining the data obtained from various studies.

Data Collection

In order to determine the effects of layered curriculum on academic achievement, postgraduate theses in Türkiye were examined. In this context, the National Thesis Centre database of the Council of Higher Education was searched using the keywords "layered curriculum" and "academic achievement". As a result of the search, 840 theses were listed and the authorised full texts of 837 of them were accessed. As a result of additional searches with binary combinations, 18 thesis studies were reached. In line with descriptive statistics and screening strategies, 15 studies were identified, and finally 13 theses that met the inclusion criteria were gathered in the research process. A total of 41 effect sizes obtained from these theses were determined. In the 13 theses included in the research, there were a total of 801 subjects participating in experimental applications. The flow diagram of the research process is presented in Figure 2 in line with the model proposed by Moher et al. (2009).

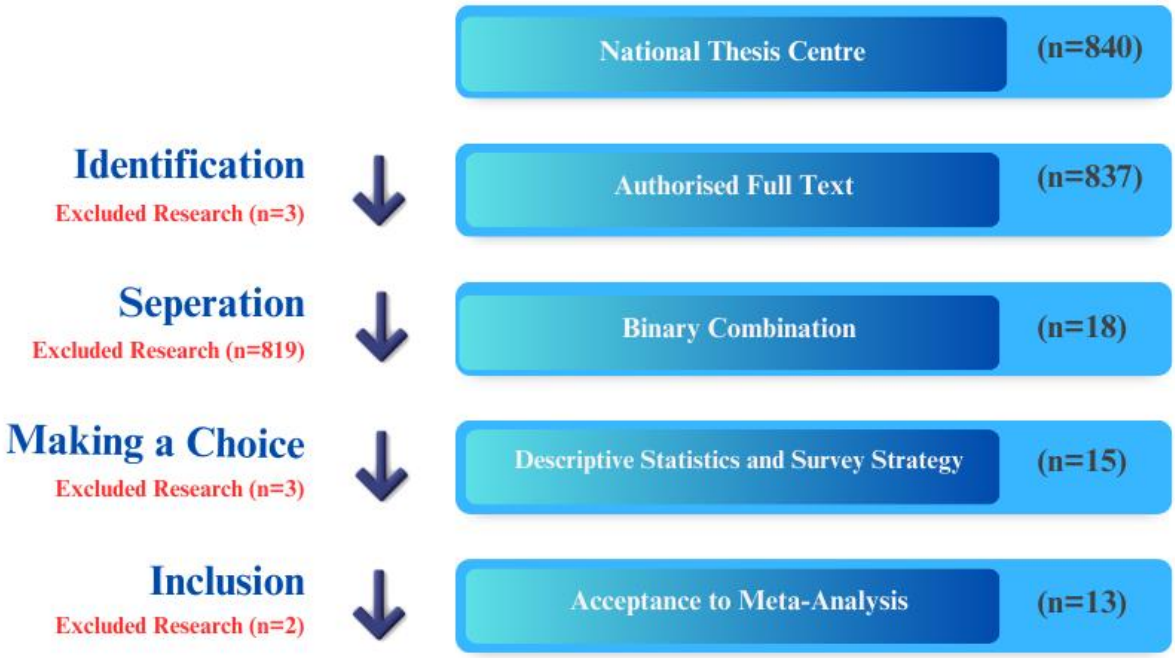

Figure 2. Flow Diagram

Inclusion Criteria

In this meta-analysis study, which was carried out to examine the effect of the layered curriculum on academic achievement, the inclusion criteria were determined as follows:

- The study is one of the postgraduate theses at the Council of Higher Education's National Thesis Center,
- Access to studies in full text,
- The fact that the analysed studies have a quasi-experimental design,
- Availability of statistical data such as arithmetic mean, standard deviation and sample size to enable calculation of effect size,
- The research must be written in Turkish or English and suitable for digital scanning.

Operating Characteristics

There are four study characteristics in the meta-analysis study titled The effect of layered curriculum on academic achievement. These consist of publication type, institute, experimental procedure duration and sample size.

Coding of Data

Within the framework of the research, the descriptive data in the quasi-experimental studies were carefully analysed and coded by the researchers. This process was carried out in line with a systematic plan. The data were meticulously processed on the coding form created using Microsoft Excel. Thus, a standardisation was achieved in the analysis of the data and an error-free data entry process was aimed.

Validity and Reliability of Coding

Within the scope of the research, validity and reliability were increased by applying expert opinion. Necessary arrangements were made in the light of the feedback received from the experts and the study characteristics were shaped in the light of this feedback. The theses included in the study were reviewed by the researchers at certain time intervals to check the accuracy and consistency of the data. During the data analysis process, the reliability of the research was measured by taking into account the reliability calculation proposed by Miles and Huberman (1994) [Reliability = (Agreement / (Agreement + Disagreement)) x 100]. Inter-coder reliability agreement was determined as 96%. This rate was determined that the level of reliability between the coders was within the acceptable axis according to the criteria put forward by Neuendorf (2002). This high reliability rate reinforced the consistency and reliability of the data coding process and strengthened the validity of the research results.

Analysing the Data

Comprehensive Meta Analysis 3 demo version statistical software was used to calculate the effect size of the studies. Hedge's g coefficient was used in the calculation of effect sizes, taking into account the sample sizes included in the study (Şen, 2019). In the analysis process, the significance level was determined as 95%. For the evaluation of the effect size, the classification proposed by Cohen et al. (2021) was taken as basis. According to this classification, effect sizes between 0 and 0.20 are considered as weak effect, values between 0.21 and 0.50 as small effect, values between 0.51 and 1.00 as moderate effect, and values above 1.00 as strong effect.

FINDINGS

In this segment, the results derived from 13 thesis research gathered in the meta-analysis and the frequency and percentage distributions of the study characteristics representing the moderator variables in the research are presented. The publication years, sample sizes and percentages of the studies are presented in Table 1.

Table 1. Publication Years, Sample Sizes and Percentages of The Studies

No	Studies	Year	Year (%)	Sample	Sample (%)
1	Aydoğuş	2009	7.69	118	14.72
2	Biçer	2011	7.69	53	6.61
3	Durusoy	2012	23.08	44	5.49
4	Gün	2012		71	8.85
5	Öner	2012		67	8.36
6	Zeybek	2016	15.38	24	2.99
7	Yıldırım	2016		107	13.34
8	Karagül	2017	7.69	44	5.49
9	Yıldız	2018	7.69	69	8.61
10	Yılmaz	2019	15.38	47	5.86
11	Özdemir	2019		69	8.61
12	Kahraman	2020	7.69	37	4.62
13	Bayer	2022	7.69	51	6.36
	Total	**13**	**100**	**801**	**100**

As can be seen in Table 1, a total of 13 thesis studies were included in the scope of meta-analysis to examine the effect of layered curriculum on academic achievement. Considering the change in the studies within the scope of the research over the years, it is seen that the most studies were carried out in 2012 (n:3, 23.08%), while the least studies were administered in 2009 (n:1, 7.69%), 2011 (n:1, 7.69%), 2017 (n:1, 7.69%), 2018 (n:1, 7.69%), 2020 (n:1, 7.69%) and 2022 (n:1, 7.69%). It is noteworthy that the interest in the layered curriculum increased with three studies conducted in 2012. On the other hand, the studies in 2016 (n:2, 15.38%) and 2019 (n:2, 15.38%) reflect that the education intensified in this period and important analyses were made on teaching methods. In terms of sample sizes, the largest sample was found in the study conducted by Aydoğuş (2009) in 2009 (n:118, 14.72%)

and the smallest sample was found in the study conducted by Zeybek (2016) in 2016 (n:24, 2.99%). The fact that the sample sizes of the studies vary reveals that the studies were carried out on groups of different sizes. The total sample size included in the studies consists of 801 subjects. This shows that the influence of the layered curriculum on academic achievement was examined comprehensively with a large sample size. The frequencies and percentages of the publication types of the studies are given in Table 2.

Table 2. Frequency and Percentage Values for Types of Publication

Type	**f**	**%**
Master's Degree	7	53.85
PhD	6	46.15
Total	**13**	**100**

When the data in Table 2 are examined, it is observed that although master's theses (n:7, 53.85%) and doctoral theses (n:6, 46.15%) are close to each other among the studies included in the research, master's theses are slightly more. Therefore, it shows that the research covers the academic literature in both master's and doctoral studies and both levels are represented in a balanced manner. The frequency and percentage distributions of the universities where the studies were conducted are presented in Table 3.

Table 3. Frequency and Percentage Values of Universities

University	**f**	**%**
Adnan Menderes	1	7.69
Afyon Kocatepe	1	7.69
Ankara	1	7.69
Atatürk	3	23.08
Bartın	1	7.69
Fırat	1	7.69
Hacettepe	2	15.38
İnönü	1	7.69
Necmettin Erbakan	2	15.38
Total	**13**	**100**

As seen in Table 3, most of the studies in the research were conducted at Atatürk University (n:3, 23.08%). Atatürk University is followed by Hacettepe (n:2, 15.38%) and Necmettin Erbakan Universities (n:2, 15.38%). Adnan Menderes, Afyon Kocatepe, Ankara, Bartın, Fırat and İnönü Universities were represented with equal values (n:1, 7.69%). This distribution shows that the research includes studies carried out in different universities and that Atatürk University stands out in the studies in this field. Frequency and percentage values related to the institutes where the studies were conducted are shown in Table 4.

Table 4. Frequency and Percentage Values for Institutes

Institute	**f**	**%**
Education Sciences	9	69.23
Social Sciences	4	30.77
Total	**13**	**100**

As seen in Table 4, the studies in the study were distributed between educational sciences and social sciences institutes. While the institute of educational sciences is more represented with 9 studies (n:9, 69.23%) in total, the institute of social sciences is ranked lower with 4 studies (n:4, 30.77%). This shows that the number of studies conducted in the field of education is significantly higher than in the field of social sciences. The frequency and percentage values related to the duration of the experimental process in which the studies were conducted are shown in Table 5.

Table 5. Frequency and Percentage Values Related to Experimental Procedure Periods

Experimental Procedure Periods	**f**	**%**
4 Weeks and Below	5	38.46
5-9 Weeks	4	30.77
10 Weeks and Over	4	30.77
Total	**13**	**100**

As seen in Table 5, the studies within the scope of the research exhibit a relatively balanced distribution in terms of the duration of the experimental process. The highest number of studies were conducted in periods of 4 weeks

or less (n:5, 38.46%), while studies conducted in periods of 5-9 weeks and 10 weeks or more (n:4, 30.77%) were at lower rates. This shows that different experimental durations were used in the research process. This distribution of experimental periods offers diversity in the research field to understand the effects of different time periods.

Publication Bias

The funnel plot prepared to evaluate the publication bias in the meta-analysis study is presented in Figure 3.

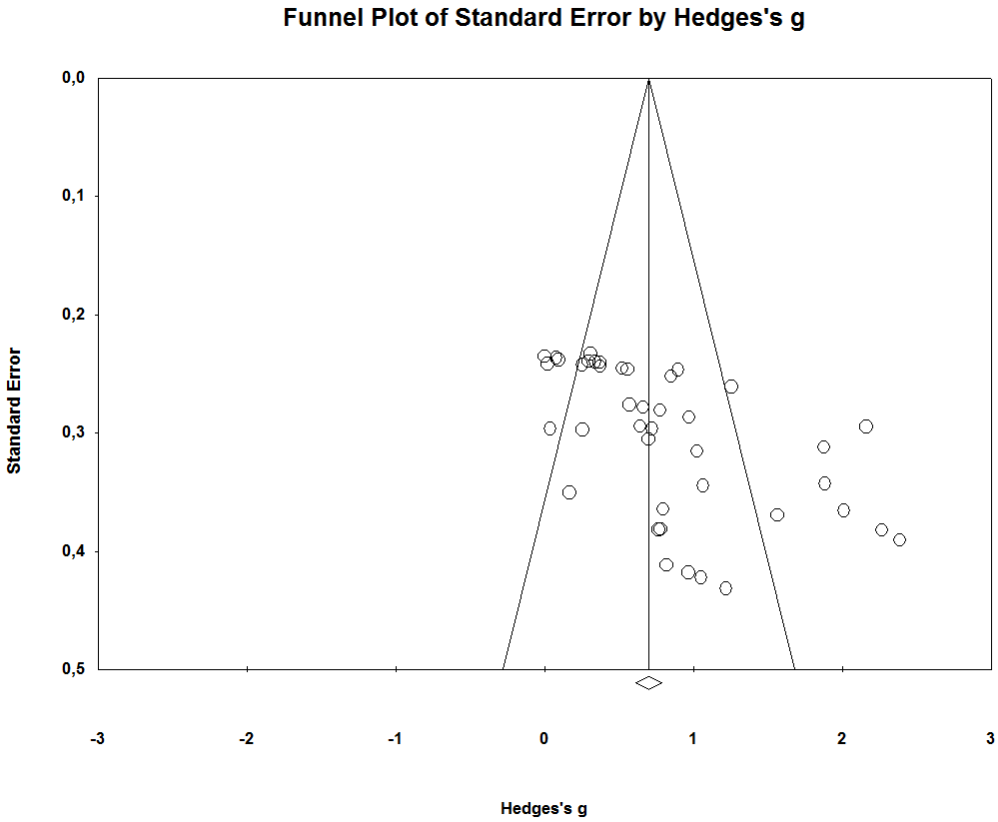

Figure 3. Funnel Plot

When the funnel plot in Figure 3 is analysed, it is observed that the effect sizes do not exhibit an asymmetric distribution. This is considered as an important indicator for the reliability of the research results. Classic fail-safe N and Orwin's fail-safe N statistics were also utilised to determine whether there is a publication bias. In this context, calculations made with the Classic fail-safe N statistic showed that 2928 additional studies were required for the effect size to reach a value above 120 (5k+10). This situation reveals that a large number of additional studies are required to invalidate the findings of the study. On the other hand, when Orwin's fail-safe N statistic was used, it was determined that 28609 missing studies were required to reduce Hedge's g value to a non-significant level (0.001). These findings reveal that the meta-analysis study does not contain publication bias (Dinçer, 2022; Rosenthal, 1979; Şen & Yıldırım, 2020).

Findings Related to the First Sub-Aim

In the first sub-objective of the research, the answer to the question "What is the effect of the layered curriculum on academic achievement?" was sought. In order to answer this question, the homogeneity of the studies was evaluated by using the fixed effects model to calculate the effect size. Based on the fixed effects model, the results obtained for the overall effect size and homogeneity of the studies are presented in Table 6.

Table 6. Findings on Overall Effect Size and Homogeneity of Studies

Programme Type							95% Confidence Interval	
	Es	Df	Q	X^2	p	I^2	Alt	Top
Fixed Effects Model	0.699	40	171.849	55.759	0.00	76.724	0.610	0.787

The homogeneity value of the studies included in the meta-analysis, as determined by the fixed effects model, was determined to be Q=171,849 based on the data in Table 6. Examining the X^2 table reveals that the comparable value, at the 95% confidence range for 40 degrees of freedom, is 55.759. It is found that the I^2 value is 77% and the Q value is more than the critical value in the X^2 distribution. According to Higgins et al. (2003), a substantial degree of heterogeneity is present when the I^2 value is more than 75%. However, because the findings of the heterogeneity test were significant (p=0.00; p<0.01), the random effects model was used for effect size estimates rather than the fixed effects model (Dinçer, 2022). Table 7 displays the general effect size results derived from the random effects model.

Table 7. Findings on the Overall Effect Size of the Studies

Programme Type	N	Z	p	SE	ES	95% Confidence Interval	
						Alt	Top
Random Effects Programme	41	8.446	0.00	0.08	0.80	0.616	0.988

The random effects model yielded an effect size value of 0.80 with a standard error of 0.08 based on the data in Table 7. The effect size had a lower limit of 0.616 and an upper limit of 0.988, as indicated by the 95% CI in Table 7. These results (p=0.00 and p<0.01) are statistically significant. The experimental group benefits from the therapy, as evidenced by the positive value of the average effect size (+0.80). According to Cohen et al. (2021), this data indicates that the layered curriculum has a moderately beneficial impact on academic attainment. Figure 4 displays the impact size values determined using the random effects software alone, without the forest plot.

Model	Study name	Statistics for each study							Hedges's g and 95% CI
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-1,00 -0,50 0,00 0,50 1,00
	Aydoğuş, 2009a	0,764	0,382	0,146	0,016	1,513	2,002	0,045	
	Aydoğuş, 2009b	0,780	0,381	0,146	0,032	1,528	2,045	0,041	
	Aydoğuş, 2009c	0,796	0,364	0,133	0,082	1,510	2,184	0,029	
	Aydoğuş, 2009d	0,167	0,351	0,123	-0,520	0,854	0,476	0,634	
	Biçer, 2011a	0,968	0,287	0,082	0,406	1,530	3,378	0,001	
	Biçer, 2011b	0,571	0,276	0,076	0,029	1,112	2,065	0,039	
	Biçer, 2011c	0,660	0,278	0,077	0,115	1,206	2,374	0,018	
	Biçer, 2011d	0,776	0,281	0,079	0,225	1,327	2,761	0,006	
	Durusoy, 2012a	1,022	0,316	0,100	0,404	1,641	3,240	0,001	
	Durusoy, 2012b	0,256	0,297	0,088	-0,327	0,839	0,861	0,389	
	Gün, 2012a	0,898	0,247	0,061	0,415	1,382	3,640	0,000	
	Gün, 2012b	0,000	0,235	0,055	-0,461	0,461	0,000	1,000	
	Öner, 2012a	0,021	0,242	0,058	-0,452	0,494	0,087	0,931	
	Öner, 2012b	0,254	0,243	0,059	-0,222	0,729	1,046	0,295	
	Öner, 2012c	0,848	0,252	0,064	0,353	1,343	3,360	0,001	
	Öner, 2012d	0,371	0,244	0,059	-0,106	0,849	1,524	0,128	
	Öner, 2012e	0,558	0,246	0,061	0,075	1,041	2,265	0,024	
	Öner, 2012f	0,518	0,246	0,060	0,037	1,000	2,110	0,035	
	Zeybek, 2016a	1,049	0,422	0,178	0,221	1,876	2,484	0,013	
	Zeybek, 2016b	0,967	0,418	0,175	0,148	1,787	2,313	0,021	
	Zeybek, 2016c	0,819	0,411	0,169	0,012	1,625	1,989	0,047	
	Zeybek, 2016d	1,218	0,432	0,186	0,372	2,064	2,822	0,005	
	Yıldırım, 2016a	0,308	0,233	0,054	-0,148	0,765	1,324	0,186	
	Yıldırım, 2016b	0,075	0,237	0,056	-0,388	0,539	0,318	0,750	
	Yıldırım, 2016c	2,163	0,295	0,087	1,585	2,740	7,339	0,000	
	Karagül, 2017a	0,037	0,296	0,088	-0,544	0,618	0,126	0,899	
	Karagül, 2017b	2,264	0,382	0,146	1,515	3,014	5,924	0,000	
	Karagül, 2017c	2,388	0,391	0,153	1,622	3,154	6,112	0,000	
	Karagül, 2017d	0,698	0,306	0,093	0,099	1,297	2,285	0,022	
	Karagül, 2017e	2,010	0,366	0,134	1,293	2,727	5,496	0,000	
	Yıldız, 2018	0,368	0,240	0,058	-0,102	0,839	1,534	0,125	
	Yılmaz, 2019a	0,641	0,294	0,087	0,064	1,218	2,177	0,029	
	Yılmaz, 2019b	0,724	0,296	0,088	0,143	1,305	2,442	0,015	
	ÖZdemir, 2019a	0,095	0,238	0,057	-0,372	0,562	0,398	0,691	
	ÖZdemir, 2019b	1,255	0,261	0,068	0,743	1,766	4,808	0,000	
	ÖZdemir, 2019c	0,295	0,239	0,057	-0,174	0,764	1,232	0,218	
	ÖZdemir, 2019d	0,341	0,240	0,058	-0,130	0,811	1,420	0,156	
	Kahraman, 2020a	1,565	0,370	0,137	0,840	2,289	4,233	0,000	
	Kahraman, 2020b	1,063	0,345	0,119	0,387	1,739	3,084	0,002	
	Bayer, 2022a	1,885	0,343	0,118	1,213	2,557	5,496	0,000	
	Bayer, 2022b	1,879	0,312	0,098	1,267	2,491	6,016	0,000	
Random		0,802	0,095	0,009	0,616	0,988	8,446	0,000	

Figure 4. Effect Size Values of Studies Not Combined with Forest Plot for Effect Size

Findings Related to the Second Sub-Aim

"Does the impact of the layered curriculum on academic achievement vary depending on the publication type of the studies?" is the second sub-objective of the research. The query has been addressed. Table 8 displays the effect sizes of the studies according to the kind of publishing.

Table 8. Effect Sizes by Publication Type

Moderator Variable					95% Confidence Interval	
	Qb	p	N	ES	Alt	Top
Publication Type	0.26	0.60				
Master's Degree			17	0.85	0.62	1.09
PhD			24	0.76	0.50	1.03

As seen in Table 8, the homogeneity value (Qb) between the groups obtained on the axis of the publication type of the studies was found to be 0.26. In the X^2 table, the critical number corresponding to 95% significance level and one degree of freedom was determined as 3.84. Within the parameters of the publication type of the research, no statistically significant difference between the groups was found since the homogeneity value between the groups was less than the critical value.

Findings Related to the Third Sub-Aim

In the third sub-objective of the research, the question "Does the effect of the layered curriculum on academic achievement differ according to the institutes where the studies were conducted? The question is answered. Effect sizes according to the institutes are shown in Table 9.

Table 9. Effect Sizes According to the Institutes where the Studies were Conducted

Moderator Variable					95% Confidence Interval	
	Qb	p	N	ES	Alt	Top
Institutes	0.43	0.50				
Education Sciences			31	0.83	0.60	1.05
Social Sciences			10	0.70	0.39	1.01

According to the institutes where the investigations were carried out, the homogeneity value (Qb) between the groups is 0.43, as shown in Table 9. The crucial value, which corresponds to one degree of freedom at a 95% significance level, was determined to be 3.84 in the X^2 table. According to the institutes where the research were done, there was no statistically significant difference between the groups established since the homogeneity value between the groups was less than the crucial value.

Findings Related to the Fourth Sub-Aim

In the fourth sub-objective of the research, the answer to the question "Does the effect of the layered curriculum on academic achievement differ according to the experimental process duration of the studies?" is sought. The effect sizes of the studies according to the duration of the experimental process are given in Table 10.

Table 10. Effect Sizes of the Studies According to the Duration of Experimental Procedures

Moderator Variable					95% Confidence Interval	
	Qb	p	N	ES	Alt	Top
Experimental Procedure Periods	3.79	0.15				
4 Weeks and Below			9	0.83	0.41	1.24
5-9 Weeks			16	0.59	0.40	0.79
10 Weeks and Over			16	1.01	0.61	1.41

The homogeneity value (Qb) between the groups created based on the experimental procedure durations of the research was determined to be 3.79, as shown in Table 10. In the X^2 table, the critical value that corresponded to the 95% significance level and two degrees of freedom was found to be 5.99. There was no statistically significant difference between the groups created based on the length of the experimental procedure since the homogeneity value between the groups was less than the critical value.

Findings Related to the Fifth Sub-Aim

In the fifth sub-objective of the research, the answer to the question "Does the effect of the layered curriculum on academic achievement differ according to the sample sizes of the studies?" is sought. The effect sizes of the studies according to the sample sizes are given in Table 11.

Table11. Effect Sizes of Studies According to Sample Sizes

Moderator Variable	Qb	p	N	ES	95% Confidence Interval	
					Alt	Top
Sample Sizes	18.41	0.00				
20-39			6	1.12	0.81	1.43
40-59			15	1.08	0.73	1.44
60-79			13	0.44	0.24	0.63
80 and Above			7	0.71	0.15	1.28

The homogeneity value (Qb) between the groups created based on the study sample sizes was found to be 18.41, as shown in Table 11. In the X^2 table, 7.82 is the crucial value that corresponds to the 95% significance level and three degrees of freedom. There was a statistically significant difference between the groups created based on the study sample sizes since the homogeneity value between the groups was higher than the critical value.

DISCUSSION, CONCLUSION and RECOMMENDATIONS

In today's education system, the importance of the layered curriculum, which is one of the student-centred approaches, is increasing. Traditional education methods are insufficient to meet the needs of students with different learning styles and speeds. This may negatively affect individuals' learning experiences and reduce their academic achievement. Cascade teaching allows individuals to maximise their potential by providing students with customised learning paths. This method helps students to progress at their own pace and to interact with content that suits their interests. In addition, this approach encourages students' active participation in the learning process. This increases their motivation and learning quality (Nunley, 1998, Seiler, 2024). It is stated that cascaded teaching practices are effective in increasing student participation and meeting individual learning needs, and that it has become a critical necessity for educators to adopt such programmes in order to respond to modern educational needs. In studies conducted in the field of educational sciences, it has been determined that the layered curriculum has positive effects on the retention of knowledge as well as increasing students' academic achievement (Durusoy, 2012; Kılınçaslan & Özdemir, 2015).

Considering the effect of the layered curriculum on academic achievement, it was found that it contained a moderate effect size on the positive axis according to the effect size classification expressed by Cohen et al. (2021). This indicates that the effect of the graded curriculum on academic achievement is positive. When the literature (Bayer, 2022; Doğuş, 2009; Durusoy, 2012; Gün, 2012; Güzel-Baydoğan, 2024; Kahraman, 2020; Üzüm, 2017; Yılmaz, 2019) was examined, it was concluded that the effect of the layered curriculum on academic achievement was more successful than traditional methods. Similarly, studies conducted by Lasovage (2006) and Noe (2008) also reported an increase in the academic achievement of learners. These findings support the results of our research.

Conversely, in the study by Başbay (2006), it was found that students loved the class, their engagement rose, and the layered curriculum significantly contributed to the learning journey. In addition, the opinions of learners, teachers and curriculum development specialists and current observations show that the learning environment has become more meaningful. In another study conducted by Yılmaz (2010), it was stated that the layered curriculum helped students to show more interest in science education and to participate more effectively in this field. In the study conducted by Gün (2012), it was emphasised that students' interest and participation in the lessons increased and the process became more enjoyable for the learners. In Öner's (2012) study, positive results different from the traditional approach on issues such as activity selection, challenging stages, liked activities, and how these methods can be applied in other courses were revealed. In another study by Durusoy (2012), it was found that the layered curriculum with creative drama not only contributed to the academic achievement of the learners but also increased the permanence of their current achievements.

In the study conducted by Koç (2013), it was observed that the programme was important in developing the metacognitive awareness and problem solving skills of the learners in the experimental group. It was observed that the programme offered a fun environment in the lesson with student-centred activities with increasing difficulty levels step by step. The layered curriculum provides students with awareness through various activities, encourages them to produce creative solutions to the problems they encounter, develops their critical thinking and allows them to choose activities suitable for their own learning styles. In addition, students reinforce their learning by transferring what they have learnt to different fields and discover different ways of learning. In Yıldırım's (2016) study, it was found that the programme had a more positive effect on students' cognitive and affective development than the existing teaching methods. In the study conducted by Zeybek (2016), it was revealed that the step-by-step

teaching programme contributed to the level of knowledge and comprehension. In Caughie's (2016) study, it was concluded that the layered curriculum had a positive effect on learners' participation and overall performance.

In his study, Üzüm (2017) emphasised that the layered curriculum not only increased the academic achievement of the students but also provided a fun and motivating perspective to the learning process. Students participated more actively in the lesson as they took responsibility for their own learning. On the other hand, it was observed that the curriculum in question improved reading and writing, listening and speaking language skills as well as basic skills. Students stated that they increased their success in both written and practical exams with the effect of this method. Karagül (2017) stated that in addition to academic achievement, the layered curriculum positively affected students' attitudes towards Turkish lessons and enabled them to learn the lessons in a fun and enjoyable way. Students adopted this method in Turkish lessons and made the lesson more effective and enjoyable. In the study conducted by Ilıman (2018), it was stated that the layered curriculum is both fun and interesting, at the same time, it improves students' language skills and offers different learning opportunities through individual and group studies.

The layered curriculum allows pupils to take charge of their own education, according to Özdemir's (2019) research. It was shown that students actively participated in the teaching-learning process, and that the selection of tasks in this process was significantly influenced by elements including task convenience, instructiveness, and learning style fit. In a study conducted by Yılmaz (2019), it was concluded that the layered curriculum contributes to the classroom climate through group work, but may lead to problems of indiscipline in the classroom. This situation reveals that attention should be paid to discipline management when implementing a layered curriculum. In addition to this, it was emphasised that the layered curriculum can be preferred instead of traditional mathematics teaching methods since the curriculum develops problem solving skills and helps students to exhibit positive attitudes towards mathematics course.

In the study conducted by Kahraman (2020), it was observed that the layered curriculum increased students' confidence in the lesson and they felt more comfortable. Yavuz (2022), on the other hand, reached the view that teachers generally teach with traditional, teacher-centred methods, but in order to ensure permanent learning, methods in which the student is at the centre should be used. These studies show that, as a student-centred approach, the layered curriculum offers advantages such as actively involving the student in the education process, positively affecting the classroom environment, making learning fun by removing monotony and increasing the retention of knowledge, as well as contributing to academic achievement. On the other hand, it is understood that this programme helps students to gain self-confidence as well as developing problem solving skills.

Based on all these findings, it can be said that the layered curriculum, as a student-centred approach, not only increases students' academic achievement but also makes the learning process more meaningful, interactive and enjoyable. This teaching method encourages active participation in learning by providing learning paths suitable for students' individual speeds and interests. In addition, it creates positive effects in important areas such as problem solving skills, cognitive awareness, self-confidence development and improvement of language skills. Unlike traditional teaching methods, layered curriculum helps to increase learning retention by providing students with customised learning experiences. On the other hand, it encourages students to take responsibility, collaborate through group work and produce creative solutions. However, some practical difficulties such as discipline management may arise during the implementation of this teaching method. In conclusion, beyond increasing academic achievement, the layered curriculum has an important place as a method that reinforces students' cognitive and affective development and makes learning processes more efficient and effective. This method offers a more comprehensive educational experience than traditional approaches by making learning more active, participatory and personalised.

When the effect of the layered curriculum on academic achievement was examined in terms of the publication type of the studies, it was seen that the positive effect size was valid for both types. This situation indicates that master's and doctoral studies have a positive effect on academic achievement. However, it was observed that the distribution of the effect size of the studies classified on the axis of publication types was homogenous. As a matter of fact, although the effect size of master's studies is larger, there is no significant difference between them. The present finding can be interpreted as a consistent effect of the layered curriculum regardless of the type of publication. At the same time, the similar results of master's and doctoral studies may indicate that the programme can be evaluated as an effective tool at postgraduate education levels. On the other hand, when the literature (Akyol, 2022; Akyüz, 2022; Ekemen, 2017; Ekinci-Ünyeli, 2024; Gürsu, 2022; Gündüz & Kutluca, 2019; Oral, 2022) is analysed, it is seen that similarly, no difference was found in terms of publication type in these meta-analysis studies.

When the effect of the layered curriculum on academic achievement was analysed in terms of the institutes in which the studies took place, it was seen that the effect size was positive and homogeneous in both institutes. It was observed that the effect size in educational sciences was higher than in social sciences. These findings indicate that the effect of the layered curriculum on academic achievement positively affects the studies conducted in both institutes and that there is no significant difference between the groups. This situation can be interpreted as more adaptation to the learning processes of the layered curriculum in the field of educational sciences, while less adaptation is achieved in the field of social sciences.

It was discovered that the effect sizes were positive and consistent across all experimental process periods when the impact of the layered curriculum on academic success was examined in terms of the studies' experimental process timeframes. This suggests that the groups are not significantly different from one another. However, it also demonstrates that one of the determining factors of the research is not the length of the experimental procedure. Nonetheless, the experimental procedures that lasted 10 weeks or more had the largest impact size, whereas those that lasted 5 to 9 weeks had the smallest. Though the optimal range is 10 weeks and beyond, the current scenario shows that all experimental method lengths have a beneficial influence on the effect of the layered curriculum on academic accomplishment. Simultaneously, the homogeneity between the experimental procedure's duration and effect size may be understood as meaning that the program's efficacy remains steady throughout the short and long term, regardless of the durational difference. The length of the experimental procedure, however, caused a notable variation in the meta-analysis studies carried out by (Akyüz, 2022; Altıntaş, 2022; Kaşarcı, 2013 and Üzüm, 2022), according to the literature review. The results of our investigation are supported by meta-analysis studies by Ekinci-Ünyeli (2024), Kundakçı (2021), and Topan (2013), which demonstrate no significant differences in the experimental procedure length.

The effect size had a positive and varied distribution in all samples when the impact of the layered curriculum on academic success was analyzed in terms of the study sample sizes. It is possible to take this conclusion, which shows a substantial difference between the groups, as evidence that sample sizes are one of the determining factors in the research. The program had a significant impact, as evidenced by the sample size reaching the largest effect size in the 20-39 range. This can be interpreted as that small groups can be effective by providing more individual interaction and in-depth learning opportunities. As a matter of fact, in the meta-analysis studies conducted by Akyüz (2022) and Üzüm (2022), similarly, it was observed that there was a significant difference between sample sizes. In addition to this, Üzüm (2022) found that the effectiveness of studies with a sample size of 90 or more was quite low and that the sample group should not be crowded in order to obtain effective results. These findings support the results of our study. On the other hand, it is seen that effective results were obtained in groups with a sample size of 40-59. This situation suggests that medium-sized groups can increase the effect of training programmes. However, the decrease in the effect size as we move to larger groups may indicate that individual participation and interaction may decrease. As a matter of fact, the significant decrease in the effect size in the groups of 60-79 and over 80 may indicate that the effect of larger sample sizes may weaken and this may limit the ability of the programme to meet the educational needs. It can be considered that large sample groups may lead to increased heterogeneity by making it difficult to control variables and thus reduce the overall impact of the programme. In this respect, it may mean that more effective results can be obtained with fewer but more carefully selected participants. However, it can be concluded that the most appropriate sample size in educational applications should be carefully determined according to the programme. While small and medium-sized groups can provide better results by encouraging individual learning experiences and interactions, larger groups can be considered as negatively affecting the effectiveness of the programme.

According to the results of the research, the following suggestions can be made:

- In the research, it was concluded that the effect of the layered curriculum on academic achievement was at a moderate level. Therefore, in the context of supporting the academic achievement of learners, stepped teaching programmes should be included and awareness should be created.
- Within the scope of this research, the effect of the layered curriculum on academic achievement was examined. The effect of the current programme on attitude and retention can be examined from a broader perspective.
- In the research, the studies in the National Thesis Centre of the Council of Higher Education were used. As a matter of fact, it may be important to include theses, articles and papers from abroad within the scope of the research.
- Since holistic evaluations are reached in meta-analysis studies, it is known that it is important to present descriptive statistics, especially arithmetic mean, standard deviation and sample size clearly in the studies. In this context, researchers should be encouraged to present these statistics clearly.
- The scope of the study can be expanded by adding educational levels and various courses to the moderator variables of the study.

- In order for the layered curriculum to become more effective in education, it can be used systematically in different education levels and courses. Teaching the knowledge and skills related to this programme, restructuring the classroom environments in accordance with the programme and arranging them according to the individual learning speeds of individuals can lead to the adoption of the programme as an effective educational tool.

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