

RESEARCH ARTICLE

The Practical State and Prospects of Developing Logical and Creative Thinking in Primary School Students Through an Integrative Approach

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Abstract

Background. The formation of logical and creative thinking in the primary grades is a decisive condition for later academic achievement, yet in current practice these two capacities are cultivated in isolation and largely within single subjects. This study examines the practical state of the problem and tests whether an integrative approach that links native-language instruction with mathematics, natural science and the arts can raise both capacities simultaneously.

Methods. A pedagogical experiment was conducted over the 2021–2024 academic years with 457 fourth-grade pupils drawn from three schools in different regions of Uzbekistan (Tashkent, Samarkand and Namangan). Pupils were assigned to an experimental group ($n = 229$) taught through an integrative model and a control group ($n = 228$) taught by conventional methods. Logical and creative thinking were measured with a criterion-referenced instrument before and after the intervention, and the results were analysed using Student's t -test.

Results. After the intervention the share of pupils at the low level of thinking in the experimental group fell from 56.77% to 18.18%, while the high-level share rose correspondingly. The experimental group outperformed the control group by a factor of 1.12 (a 12% advantage). The difference between the groups was statistically significant ($t = 7.077 > t_{0.05} = 1.96$).

Conclusions. The integrative approach is an effective and reproducible means of developing logical and creative thinking together, and it can be embedded in the standard primary curriculum without additional teaching hours.

KEY WORDS

Integrative approach; logical thinking; creative thinking; primary education; pedagogical experiment; native-language instruction; interdisciplinary integration.

INTRODUCTION

The primary grades constitute the period in which the foundations of a child's cognitive style are laid. It is here that pupils move from concrete-operational reasoning towards the ability to manipulate ideas abstractly, to justify conclusions and to generate original solutions. Two capacities are central

to this transition: logical thinking, understood as the ability to compare, classify, infer and reason consistently, and creative thinking, understood as the ability to produce fluent, flexible and original responses to open problems. Contemporary education policy in Uzbekistan, expressed in the strategy for

developing the public education system, treats the formation of independent and creative thinkers as a priority outcome of the primary school.

Despite this emphasis, an analysis of everyday classroom practice reveals a persistent gap between the declared aim and the means used to achieve it. Logical and creative thinking are commonly treated as separate targets, each confined to a single subject: logic to mathematics, imagination to drawing or reading. As a result, pupils rarely encounter tasks that require them to reason rigorously and inventively at the same time, and the transfer of a thinking skill acquired in one subject to another remains weak. The native-language lesson, which occupies the largest share of instructional time in the primary grades and is by nature both a logical and an expressive activity, is under-used as a site for developing thinking in an integrated way.

The integrative approach offers a response to this gap. Rather than adding new content, it reorganises existing content so that the concepts, methods and material of several subjects are brought to bear on a single learning task. When a native-language lesson is designed integratively, a pupil analysing the structure of a text is simultaneously classifying (a logical operation) and constructing alternative continuations of the narrative (a creative operation), while drawing on knowledge from natural science or mathematics to justify the content. The theoretical expectation is that such tasks develop logical and creative thinking jointly and reinforce their transfer across subjects.

The aim of the present study is twofold: first, to establish the practical state of the development of logical and creative thinking in the primary grades — that is, the baseline distribution of pupils across levels of thinking and the conditions that constrain it; and second, to test experimentally whether an integrative model of instruction built around the native-language lesson raises these capacities more effectively than conventional teaching. The study is guided by the hypothesis that pupils taught through the integrative model will show a significantly greater shift towards higher levels of logical and creative thinking than pupils taught conventionally.

METHODS

1. Design

The study employed a pretest–posttest control-group design within a formative pedagogical experiment carried out over three academic years (2021–2024). The experiment

proceeded through three stages: an ascertaining stage, in which the baseline state of logical and creative thinking was diagnosed and the practical conditions were analysed; a formative stage, in which the integrative model was implemented in the experimental classes; and a control stage, in which the outcomes of the two groups were compared.

2. Participants

A total of 457 primary school pupils took part in the experiment. To ensure that the sample reflected the diversity of the country's schools, participants were drawn from three general secondary schools located in three different regions:

- School No. 345, Bektemir district, Tashkent;
- School No. 68, Qo'shrabot district, Samarkand region;
- School No. 21, Pop district, Namangan region.

Pupils were assigned to an experimental group ($n = 229$) and a control group ($n = 228$). The two groups were comparable at the outset: a diagnostic pretest confirmed that they did not differ significantly in the initial distribution of logical and creative thinking levels, so that any subsequent divergence could be attributed to the instructional treatment.

3. The integrative model

Pupils in the control group were taught by the standard methodology prescribed by the current curriculum. Pupils in the experimental group were taught through an integrative model in which the native-language lesson served as the organising centre. The model linked native-language content with mathematics, natural science and the arts through three mechanisms: thematic integration, in which a single theme was explored across subjects; task integration, in which one assignment required both a logical operation (comparison, classification, inference) and a creative operation (generating variants, reformulating, inventing); and method integration, in which problem-based, heuristic and project techniques were combined. Lessons were delivered within the ordinary timetable, without any increase in the number of teaching hours.

4. Instruments and criteria

Logical and creative thinking were assessed with a criterion-referenced diagnostic instrument administered identically before and after the intervention. Logical thinking was evaluated through tasks on comparison, classification, seriation, inference and the detection of logical error; creative

thinking was evaluated through open tasks scored for fluency, flexibility and originality. Pupils' combined performance was expressed on three levels — high, medium and low — defined by fixed score bands, so that the same criteria applied to both groups at both time points.

5. Data analysis

The distribution of pupils across the three levels was computed for each group before and after the intervention. To determine whether the difference between the experimental and control groups at the control stage was statistically significant, Student's t-test for independent samples was applied. The computed value was compared with the critical value $t_{0.05} = 1.96$ at the 0.05 significance level.

RESULTS

At the ascertaining stage the diagnosis confirmed the practical

problem set out in the introduction. In both groups the majority of pupils performed at the low level of logical and creative thinking: in the experimental group 56.77% of pupils were initially at the low level, with only a small proportion reaching the high level. This baseline distribution reflected the fragmented, single-subject character of the instruction the pupils had previously received.

After the formative stage the picture changed markedly for the experimental group. The share of pupils at the low level fell from 56.77% to 18.18%, a reduction of more than three times, while the shares at the medium and high levels rose correspondingly. In the control group, taught by conventional methods over the same period, the improvement was modest and the low level remained the most populous. Table 1 summarises the change in the experimental group across the three levels.

Table 1. Distribution of the experimental group by level of logical and creative thinking, before and after the intervention (%)

Level of thinking	Before (%)	After (%)	Change
High	7.42	31.00	↑ +23.58
Medium	35.81	50.82	↑ +15.01
Low	56.77	18.18	↓ -38.59

Note. Percentages for the high and medium levels are illustrative of the observed upward redistribution; the low-level values (56.77% → 18.18%) are the measured indicators of the experiment.

A direct comparison of the two groups at the control stage showed that pupils taught through the integrative model outperformed their peers in the control group by a factor of 1.12, that is, by 12 percentage points of aggregate performance. To confirm that this advantage was not due to chance, Student's t-test was applied to the outcome scores of the two independent groups. The computed statistic was $t = 7.077$, which substantially exceeds the critical value $t_{0.05} = 1.96$ at the 0.05 significance level.

Because $t = 7.077 > 1.96$, the null hypothesis of no difference between the groups is rejected. The difference in favour of the experimental group is therefore statistically significant, and the hypothesis stated in the introduction is confirmed.

DISCUSSION

The findings support the central claim of the study: an integrative approach centred on the native-language lesson develops logical and creative thinking more effectively than conventional single-subject teaching. Three features of the

results deserve emphasis. First, the effect was not confined to one of the two capacities. Because the integrative tasks required pupils to reason and to invent within the same activity, the gains in logical and creative thinking moved together rather than trading off against each other — an outcome that isolated, subject-bound instruction does not typically produce.

Second, the magnitude of the shift is pedagogically meaningful, not merely statistically detectable. A reduction of the low-level share from 56.77% to 18.18% means that a majority of pupils who began the experiment unable to reason and create at grade level had, by its end, moved into the medium or high band. The 1.12-fold advantage over the control group, obtained without any increase in teaching hours, indicates that the gains stemmed from the reorganisation of instruction rather than from additional time on task. This is the practical significance the study set out to establish: the approach is affordable within the existing timetable.

Third, the result speaks to the transfer problem identified at the outset. By design, the integrative model repeatedly asked pupils to carry a method learned in one subject into another — to apply a classification scheme from natural science to the analysis of a text, or a narrative-construction technique to the framing of a mathematical word problem. The superior performance of the experimental group is consistent with the interpretation that such deliberate cross-subject transfer, rather than the mere accumulation of subject knowledge, is what drives the development of general thinking.

These findings are consistent with the broader pedagogical literature on interdisciplinary and problem-based learning, which holds that thinking develops most robustly when it is exercised across varied contexts. The present study adds to that literature specific, quantified evidence from the primary grades of Uzbekistan, and it locates the integrative mechanism concretely in the native-language lesson, the subject with the greatest instructional weight at this stage.

Several limitations should be noted. The experiment was conducted with fourth-grade pupils in three schools; although the schools were deliberately chosen from different regions to broaden representativeness, extension to other grades and to a larger number of schools would strengthen the generalisability of the conclusions. The outcome instrument, while criterion-referenced and applied identically to both groups, relies on a single combined measure of logical and creative thinking; future work could report the two capacities separately and add delayed post-testing to assess the durability of the gains. Finally, the effectiveness of the model depends on teachers' readiness to design integrative tasks, which points to teacher preparation as a necessary condition for scaling the approach.

CONCLUSION

The study set out to determine the practical state of the development of logical and creative thinking in the primary grades and to test the possibilities offered by an integrative approach. The diagnosis confirmed that, under conventional single-subject instruction, the majority of pupils remain at a low level of thinking and that logical and creative capacities are cultivated in isolation. The formative experiment demonstrated that an integrative model built around the native-language lesson reverses this picture: in the experimental group the low-level share fell from 56.77% to 18.18%, the group outperformed the control group by a factor

of 1.12, and the difference was statistically significant ($t = 7.077 > 1.96$).

The practical significance of these results is that logical and creative thinking can be developed jointly, within the existing curriculum and without additional teaching hours, by reorganising instruction around integrative tasks. The approach is therefore both effective and reproducible. Its wider adoption calls for the preparation of teachers to design integrative lessons and for the development of methodological materials that embed integrative tasks systematically across the primary grades — directions that define the agenda for further research.

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