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THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF DESIGNING AN INDIVIDUAL LEARNING TRAJECTORY FOR DEVELOPING STUDENTS' FUNCTIONAL LITERACY THROUGH NEUROPEDAGOGICAL TECHNOLOGIES

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Abstract. This article examines the theoretical and methodological basis for constructing individual learning trajectories aimed at developing students' functional literacy with the support of neuropedagogical technologies. Functional literacy is interpreted as a learner's capacity to mobilise knowledge, skills and attitudes for solving authentic problems in reading, mathematical and scientific contexts, as well as in everyday decision-making. Drawing on findings from educational neuroscience, cognitive psychology and the theory of personalised learning, the study argues that an individual trajectory becomes effective only when it is aligned with the learner's neurocognitive profile, including attention regulation, working memory capacity, emotional engagement and patterns of self-regulation. The author synthesises the principles of brain-compatible instruction, describes a four-component model (diagnostic, design, implementation and reflective-evaluative) for planning and adjusting individual routes, and proposes a sequence of methodological procedures that teachers can apply in general secondary education. Particular attention is paid to the role of formative feedback, spaced and retrieval-based practice, multimodal presentation of content and an emotionally safe classroom climate. The article concludes that integrating neuropedagogical tools into trajectory design strengthens the transfer of school knowledge into practical competence and creates conditions for students' autonomy and sustained motivation.

Keywords: neuropedagogy; educational neuroscience; functional literacy; individual learning trajectory; personalised learning; executive functions; self-regulated learning; formative assessment.

INTRODUCTION

Over the last two decades, the purpose of school education has shifted from the accumulation of subject knowledge towards the formation of competences that allow young people to act effectively in a rapidly changing environment. International assessment programmes, most notably PISA, have made functional literacy a central indicator of educational quality, describing it through students' readiness to apply reading, mathematical and scientific knowledge to real-life situations [OECD, 2019]. In the Republic of Uzbekistan, this orientation is reflected in the Law "On Education" (2020) and in the ongoing renewal of national curricula, which emphasise practical skills, critical thinking and the ability to learn independently.

At the same time, classroom practice shows that students reach the same learning outcomes by very different routes. Differences in attention span, processing speed, prior knowledge, emotional attitude towards a subject and self-regulation skills mean

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that a uniform pace and identical tasks rarely suit all learners. A teacher who ignores these differences risks overloading some pupils while leaving others insufficiently challenged; in both cases, the development of functional literacy slows down. The concept of an individual learning trajectory offers a way out of this contradiction, because it treats the learner's path through content as something that can be planned, monitored and adjusted.

Neuropedagogy, which translates validated findings of neuroscience and cognitive science into instructional decisions, provides a scientific foundation for such planning [Tokuhama-Espinosa, 2011; Dehaene, 2020]. Knowledge about how attention is captured, how memory traces are consolidated and how emotions modulate learning enables the teacher to design trajectories that respect the natural mechanisms of the brain rather than work against them. Nevertheless, the link between neuropedagogical technologies, individual trajectories and functional literacy has not yet been described as a coherent methodological system, especially with respect to the conditions of general secondary schools in Uzbekistan.

The aim of this article is therefore to substantiate the theoretical foundations and to outline a methodological framework for designing individual learning trajectories that foster students' functional literacy by means of neuropedagogical technologies. To achieve this aim, the study sets the following objectives: to clarify the key concepts; to identify the neuroscientific principles relevant to trajectory design; to develop a structural model of the process; and to formulate practical recommendations for teachers.

MATERIALS AND METHODS

The research is theoretical and analytical in nature. It relies on a systematic review of scholarly publications in educational neuroscience, cognitive psychology, didactics and the theory of personalised learning, together with an analysis of international frameworks for assessing functional literacy and the normative documents regulating general education in Uzbekistan. The following methods were applied: comparative analysis of definitions and approaches; theoretical generalisation and synthesis; modelling of the pedagogical process; and the systemic-activity approach, used as a methodological lens through which the learner is regarded as an active subject who constructs knowledge in purposeful activity.

The selection of sources followed two criteria. First, priority was given to works that discuss empirically grounded mechanisms of learning rather than popular claims about the brain, since the spread of so-called neuromyths remains a serious problem for teachers [Howard-Jones, 2014]. Second, preference was given to studies that connect cognitive mechanisms with concrete instructional practices, which made it possible to transform the findings into methodological recommendations.

RESULTS

1. Conceptual basis of the study

Analysis of the literature shows that functional literacy is an integrative quality rather than a collection of separate skills. It embraces reading, mathematical and natural-science literacy, as well as financial literacy, global competence and creative thinking, all of which share a common core: the ability to understand a problem situation, select relevant information, choose a strategy, carry it out and evaluate the result. From a neurocognitive perspective, this core is supported by executive functions — working memory, inhibitory control and cognitive flexibility — which

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develop throughout childhood and adolescence and are highly sensitive to the quality of instruction [Diamond, 2013].

In this study, an individual learning trajectory is understood as a personally oriented route of mastering educational content, built jointly by the teacher and the learner on the basis of diagnostic data and adjusted according to the results of ongoing monitoring. Unlike a rigid individual plan, a trajectory is dynamic: its pace, the sequence of tasks, the level of complexity and the forms of support may change as the learner progresses. This interpretation agrees with the idea of the zone of proximal development, according to which instruction should lead development by offering tasks that the learner can accomplish with reasonable assistance [Vygotsky, 1978].

Neuropedagogical technologies are defined as a set of teaching methods, techniques and digital or non-digital tools whose design is grounded in knowledge about how the brain functions during learning. They do not constitute a separate subject; rather, they represent a way of organising any lesson so that attention, memory, emotion and motivation work in favour of understanding.

2. Neuropedagogical principles of trajectory design

The synthesis of the reviewed sources made it possible to identify six principles that should guide the construction of individual trajectories.

Active engagement of attention. Attention is a limited resource; therefore, each task should begin with a clear purpose, a problem or a question that arouses curiosity, while unnecessary visual and verbal noise should be removed from learning materials.

Management of cognitive load. Since working memory can hold only a few elements at a time, new material should be divided into meaningful portions, accompanied by worked examples and gradually transferred to independent performance [Sweller, 1988].

Emotional safety and personal relevance. Emotions are not an obstacle to thinking but an integral part of it; learners retain better what they perceive as personally meaningful and what they study in a climate free from threat [Immordino-Yang & Damasio, 2007].

Active retrieval and spaced practice. Durable knowledge is formed when students repeatedly recall information at increasing intervals instead of simply re-reading it. This directly supports the transfer that functional literacy tasks require [Dehaene, 2020].

Multimodal representation. Presenting the same idea through text, diagrams, physical action and discussion creates several access routes to knowledge, which is especially important for learners with different strengths.

Feedback and metacognition. Timely and specific feedback helps the brain correct errors, while regular reflection develops self-regulation, enabling students to plan, monitor and evaluate their own learning [Zimmerman, 2002; Hattie, 2009].

3. Structural model of designing an individual trajectory

On the basis of these principles, a structural-functional model for designing individual trajectories was developed. It consists of four interrelated components, which are summarised in Table 1.

Table 1. Components of the model for designing an individual learning trajectory

Component	Purpose	Neuropedagogical tools
Diagnostic	To determine the	Entry tasks based on

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	learner's initial level of functional literacy and neurocognitive profile	real-life situations; short checks of attention and working memory; questionnaires on interests and motivation; observation
Design	To set personal goals and select content, pace and level of difficulty	Learning maps; tiered tasks; goal-setting conversations; planning of spaced review
Implementation	To organise learning activity and provide support	Problem-based and case tasks; worked examples; multimodal materials; movement breaks; work in mixed groups; adaptive digital platforms
Reflective-evaluative	To monitor progress and adjust the trajectory	Formative assessment; retrieval quizzes; learning journals; self- and peer-assessment; portfolio

The diagnostic component is decisive, because the quality of the whole trajectory depends on how accurately the starting point is identified. It is recommended to combine performance-based tasks, which reveal how a student applies knowledge in context, with brief indicators of attention and memory and with information about the learner's interests. The design component converts this information into a route: the teacher and the student agree on short-term and long-term goals, choose the level of tasks and plan the moments at which previously learned material will be revisited.

The implementation component is where neuropedagogical techniques become most visible. Lessons are organised into cycles of approximately 10–15 minutes, each containing a focusing activity, a portion of new content, active processing and a brief retrieval check. Tasks are framed around authentic contexts — reading a public transport timetable, comparing mobile tariffs, interpreting a medicine label or analysing a news article — so that the learner clearly sees the purpose of knowledge. The reflective-evaluative component closes the cycle: data from formative assessment are used not to grade the student but to decide whether the trajectory should be accelerated, slowed down or redirected.

4. Methodological algorithm for teachers

In practice, the model is realised through a sequence of steps. First, the teacher conducts a diagnostic session at the beginning of a unit and records the results in a learner profile. Second, the profile is discussed with the student, and two or three priority goals are formulated in accessible language. Third, the teacher prepares tasks at three levels of complexity — reproductive, applied and creative — so that each learner can enter at an appropriate level and move upward. Fourth, short retrieval activities and checkpoints are used throughout the unit to collect evidence of progress. Fifth, at the end of the unit, the learner completes a reflection sheet, and the teacher

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and the student jointly decide how the next segment of the trajectory will be organised. Repeated over several units, this cycle gradually shifts responsibility for learning from the teacher to the student.

DISCUSSION

The proposed framework is consistent with international experience of personalised learning, which indicates that students benefit when instruction is matched to their needs and when they take part in setting their own goals [Pane et al., 2017; Tomlinson, 2014]. At the same time, it adds a neuropedagogical dimension: the trajectory is designed not only according to what the learner knows but also according to how the learner attends, remembers and feels during learning. This makes the approach particularly relevant for functional literacy, since the transfer of knowledge to unfamiliar situations depends heavily on well-consolidated memory and flexible control of attention.

Several limitations and risks should be acknowledged. First, teachers must avoid simplified interpretations of neuroscience, such as dividing students into "left-brained" and "right-brained" types or tailoring instruction exclusively to so-called learning styles, since such ideas are not supported by evidence [Howard-Jones, 2014]. Individualisation should rely on observable learning data rather than on labels. Second, designing individual trajectories requires time and methodological competence, which implies the need for targeted professional development and for digital tools that simplify the collection and analysis of data. Third, individual routes should not isolate learners: collaborative tasks remain essential, because social interaction itself stimulates motivation and deepens understanding.

Future research should test the model empirically in secondary schools of Uzbekistan, develop diagnostic instruments adapted to the national curriculum and establish criteria for evaluating the effectiveness of individual trajectories in terms of students' growth in functional literacy.

CONCLUSION

The study leads to several conclusions. Functional literacy is an integrative outcome of schooling whose development depends on executive functions, motivation and the ability to transfer knowledge to real situations. An individual learning trajectory is an effective means of responding to learner diversity, provided that it is grounded in diagnostic data and adjusted flexibly. Neuropedagogical technologies supply the scientific rationale for such design by showing how to manage attention, cognitive load, emotion, memory and feedback. The four-component model and the methodological algorithm presented in this article can serve as a basis for teachers seeking to organise personalised, brain-compatible instruction aimed at developing students' functional literacy.

REFERENCES

1. Dehaene, S. (2020). How we learn: Why brains learn better than any machine… for now. New York: Viking.
2. Diamond, A. (2013). Executive functions. Annual Review of Psychology, 64, 135–168.

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3. Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. London: Routledge.
4. Howard-Jones, P. A. (2014). Neuroscience and education: Myths and messages. Nature Reviews Neuroscience, 15(12), 817–824.
5. Immordino-Yang, M. H., & Damasio, A. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education. Mind, Brain, and Education, 1(1), 3–10.
6. Law of the Republic of Uzbekistan “On Education” No. ZRU-637 of 23 September 2020.
7. OECD. (2019). PISA 2018 assessment and analytical framework. Paris: OECD Publishing.
8. Pane, J. F., Steiner, E. D., Baird, M. D., Hamilton, L. S., & Pane, J. D. (2017). Informing progress: Insights on personalized learning implementation and effects. Santa Monica, CA: RAND Corporation.
9. Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12(2), 257–285.
10. Tokuhama-Espinosa, T. (2011). Mind, brain, and education science: A comprehensive guide to the new brain-based teaching. New York: W. W. Norton.
11. Tomlinson, C. A. (2014). The differentiated classroom: Responding to the needs of all learners (2nd ed.). Alexandria, VA: ASCD.
12. Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.
13. Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. Theory Into Practice, 41(2), 64–70.