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Development of functional reading literacy in biology classes using higher order questions

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Keywords:

Reading, functional literacy, techniques of working with text in biology lessons, Higher Order Thinking Skills, tasks in the PISA format.

I. Introduction

In today's world, functional literacy plays a crucial role in empowering individuals to effectively navigate daily life activities and actively participate in meaningful social roles (Grajo & Gutman, 2019). However, findings from PISA paint a concerning picture of the state of **functional reading literacy** among students in Kazakhstan. Over the various PISA cycles, there has been little to no significant change in Kazakhstan's reading performance – lower than the OECD average.

This lack of proficiency in crucial skills, such as logical thinking, assessing unfamiliar texts, and extracting relevant information, poses a considerable challenge for students as they progress in their academic and personal lives.

The findings indicate that incorporating active learning, with a focus on critical thinking and diverse reading strategies, can improve reading comprehension skills (Hosseini et.al, 2012).

The present study aims to examine the impact of implementing **Higher-Order Thinking Skills (HOTS) strategies** on improving functional reading literacy among students in grades 8 and 10. By exploring the potential impact of these questioning techniques, we hope to contribute valuable insights to the ongoing efforts to improve reading abilities and empower students to thrive in an increasingly complex and information-rich world.

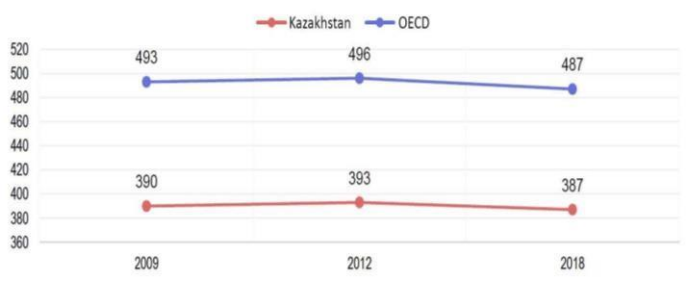

Figure 1. *Reading literacy scores on PISA of Kazakhstani students in 2009, 2012 and 2018 (2022).*

II. Methodology

Participants

- NIS students in grades 8, 10.
- N=84 (students in 8th grade =48, students in 10th grade =36).

Design

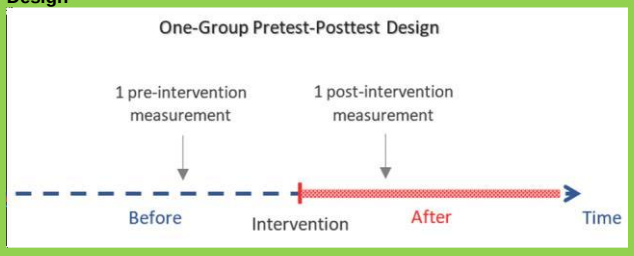

Figure 2. *Research design*

Measurement – A questionnaire with 4 questions on reading comprehension and ability to work with the text. The most important 2 questions were used for the results:

1. Do you easily perceive scientific texts? (Answers: yes, no or with someone's help)
2. Do you understand what you read well? (Answers: yes, no or not immediately)

Intervention

- Giving short text materials, dedicated reading time during the lessons, and providing various higher order thinking skills tasks related to those texts.
- Teaching different pedagogical methods designed for working with text (Gin, 2001).
  - Highlighting key words, INSERT, Clusters, and so on.

Example of an intervention

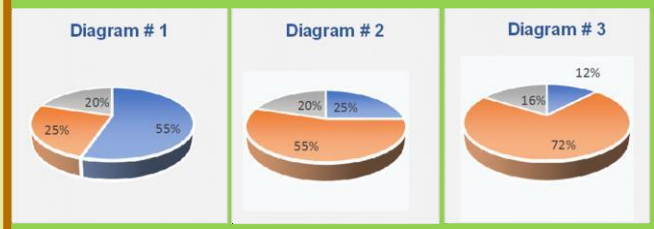

Figure 3. *Illustration of a higher order thinking skills question. Where **blue** - organic matter, **orange** - inorganic matter, **gray** – water.*

Questions for discussion based on the diagrams:

- Can young children be forced to walk early? Explain your answer.
- Do you think physical education and sports affect the development of bone tissue? Explain your answer.
- Which age groups (young or old) are more likely to break bones? Explain your answer.

Length

- From September to April, with three classes per week.

III. Results

➢ **No significant effect**

- For question 1 on how easily students perceive scientific texts, the chi-square statistic is 3.7015. The p-value is .157123. The result is not significant at $p < .05$.

➢ **Significant effect**

- For question 2 on reading comprehension, the chi-square statistic is 27.326. **The p-value is < 0.00001**. The result is significant at $p < .05$.

IV. Conclusion

The introduction of **higher-order thinking skills tasks resulted in notable enhancements in reading comprehension for students in grades 8 and 10**, as evidenced by questionnaire responses. However, there was no significant positive impact observed on the ease of comprehending scientific texts.

The results imply that use of higher-order thinking strategies in teaching can empower students to approach texts with a more analytical mindset. This approach encourages them to ask questions, consider multiple perspectives, and draw connections between various pieces of information. As a result, students become more adept at understanding the context, purpose, and implications of written materials, contributing to improved functional literacy.

V. Limitations and future directions

- The limited number and quality of questions in the questionnaire.
- Limited sample size.
- Limited grade levels and schools.

1. Conduct further research to investigate the influence of HOTS strategies on enhancing functional reading literacy across various grades and schools in Kazakhstan.
2. Guide teachers in developing and implementing effective Higher-Order Thinking Skills (HOTS) strategies to improve students' reading skills.

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