THE FIRST VIEW AT MATHEMATICAL EDULARP IN PRIMARY EDUCATION IN CONTEXT OF CONTEXTUAL TEACHING AND LEARNING APPROACH

Dominika KUŠNÍROVÁ, Iveta SCHOLTZOVÁ
University of Presov, Faculty of Education (Slovakia)
dominika.kusnirova@smail.unipo.sk, iveta.scholtzova@unipo.sk

Abstract

The paper explores how mathematics can be applied in real-life situations for primary school students by creating tasks that connect mathematical learning to everyday contexts. This approach is grounded in the concept of Contextual Teaching and Learning (CTL). The aim of the paper is to introduce the CTL concept and examine its potential in primary education. Specifically, the article focuses on the use of Education Live Action Role-Playing (EduLARP) as a method for implementing CTL in primary-level mathematics education. The EduLARP method has been chosen as the main method for introducing CTL in our research. Additionally, the paper presents examples of international mathematical EduLARP projects.

Keywords: mathematics, contextual teaching and learning, EduLARP, primary education

1. Introduction

Improving the quality of education is also a priority in the Slovak educational environment, where systematic efforts to enhance educational outcomes – including in mathematics – are evident. One such initiative is the proposal by the *State Pedagogical Institute*, which developed the document *Concept for Improving Mathematics Education in Primary and Secondary Schools in the Slovak Republic* (2019). This document is based on the results of the PISA and TIMSS assessment studies and highlights the dissatisfaction of employers who believe that graduates are insufficiently competent in applying acquired knowledge to real-life situations.

The document presents recommendations, including the need to actively involve students in mathematical activities, promote learning through the application of knowledge to real-life situations, and establish connections between mathematics and other subjects. The emphasis on learning for life is also reflected in the current curriculum reform. This reform aims to shift the focus from memorization and rote learning to contextualizing knowledge, with the goal of deepening the learning process and developing the ability to make connections and apply knowledge in various contexts (Ministry of Education, Research, Development and Youth of the Slovak Republic, 2023). This idea has been addressed in the context of mathematics education by Costello (2022), who described students' mathematical problem-solving as blindly following procedures. This phenomenon manifests in the educational process as a gap between lesson objectives and the actual learning experiences achieved by students, as they apply mathematical operations in an automated manner – without deeper reflection. According to the author, the problem lies in the lack of real-life context.

Considering these findings, we decided to explore ways to strengthen mathematical knowledge and skills among younger students. We chose the EduLARP method to implement tasks set in real-life situations, based on the concept of learning in context. The potential of this method in Slovakia was discussed by Grenčíková, Petrušová, and Krajčo (2018), who found that its application in the Slovak educational context is currently minimal.

2. The Concept of Contextual Teaching and Learning in Educational Processes

According to Johnson (2002) CTL is a pedagogical approach that suggests meaning emerges from the relationship between content and its context. The broader the context in which learners can make connections, the more meaningful the content becomes to them. The teacher's role is to provide this context for students. CTL facilitates the linking of learning content to real-life situations. It is recommended to be taught in an integrated, multidisciplinary manner, enabling students to apply the knowledge and skills they have acquired in applicable contexts (Berns & Erickson, 2001). The goals of education should extend beyond the acquisition of knowledge to its practical application (Johnson, 2002).

The implementation of contextual learning into the educational process can be achieved through active and authentic learning techniques (Hudson & Whisler, 2007; Blanchard, 2001; Osika et al., 2022). According to Meyers and Jones (1993), active learning techniques transition learners from passive recipients to active participants, thereby maximizing the impact of learning on students. Bean (2011) recommends employing case studies, role-playing, small group work, and creative activities that develop thinking skills and can be applied to specific situations.

In addition to the previously mentioned use of active and authentic learning techniques, specific Contextual Teaching and Learning (CTL) strategies are identified. Blanchard (2001) includes: emphasizing problem-solving; recognizing the need for learning in context; teaching students to monitor and manage their own learning; embedding instruction in students' life contexts; promoting peer learning; and employing authentic assessment.

Johnson (2002) identified eight components of CTL that complement Blanchard's (2001) strategies. Both authors agree on the necessity of guided and reciprocal learning, authentic assessment, and linking learning to meaningful life contexts. Additionally, Johnson (2002) highlights collaboration, the development of critical and creative thinking, and the pursuit of improved performance as essential components of CTL.

Research by Selvianires and Prabawanto (2017) and Spooner (2023) offers recommendations for effective CTL implementation. Both studies emphasize, alongside collaboration and activity (as noted by Johnson, 2002), the integration with other content areas to provide students with more complex contextual understanding.

Interdisciplinarity in mathematics education has been the subject of scholarly studies, including the work of Dewolf et al. (2011), building upon the research of Säljö, Riesbeck, and Wyndhamn (2009). The researchers investigated the impact of the subject taught on students' problem-solving abilities. The results revealed significant differences in solving the same problem across two different teaching subjects. The authors interpreted this difference as a result of expected and typical responses in mathematics instruction, where students accept numerical solutions without considering the broader real-world context – a claim also made by Costello (2022). Research suggests the need to develop more authentic tasks that simulate real-world problems and integrate interdisciplinary approaches into mathematics education. This integration aims to extend students' mathematical thinking beyond the confines of the mathematics classroom.

The aforementioned strategies for effective CTL implementation ’re complementary and overlapping. Therefore, the REACT strategy – comprising Relating, Experiencing, Applying, Cooperating, and Transferring – can be considered a unifying CTL framework. According to Herlina (2022) and the Center for Occupational Research and Development (CORD, 2023), REACT serves as the primary CTL strategy.

REACT encompasses the elements identified by Blanchard (2001), Johnson (2002), and Selvianiresa and Prabawanto (2017), forming a coherent CTL approach. We present this strategy and its components in more detail in Table 1.

Table 1. REACT Strategy

REACT	
Relating	the context of everyday life enables students to connect familiar situations with new knowledge;
Experiencing	the method for developing knowledge involves exploration, discovery, and problem-solving;
Applying	learning through the application of new concepts and information within real-life contexts;
Cooperating	sharing, responding, and communicating with peers through group activities and projects;
Transferring	applying acquired knowledge to new situations and contexts.

The components of the REACT strategy should be integral to every teaching unit that embodies the core principles of the Contextual Teaching and Learning (CTL) approach.

3. Elements of the EduLARP Method

Building upon the recommendations for integrating Contextual Teaching and Learning (CTL) into the classroom, we have chosen to implement this concept through the EduLARP method. EduLARP evolved from traditional Live Action Role-Playing (LARP) games (Stark, 2012). Bøckman (2003) defines LARP as a role-playing game in which participants assume the roles of characters and enact a fictional narrative. In academic literature, two variations of the term exist: the capitalized "EduLARP" (e.g., Mochocki, 2013; Veselková, 2017) and the lowercase "edularp" (e.g., Sandberg, 2004; Stark, 2012; Geneuss, 2019; Rönnåsen, 2022). According to Stark (2012), the differences in terminology arise from the domestication of the term "LARP." In Nordic countries (Finland, Sweden, Denmark, Norway), "LARP" has been adapted into the language as a full-meaning word, like how "laser" (Light Amplification by Stimulated Emission of Radiation) and "radar" (Radio Detection and Ranging) are used and is written without capital letters.

In the context of EduLARP, participants are divided into:

- Player Characters (PCs): Students who actively participate in the game by assuming roles and improvising within the narrative, thereby applying their learning in dynamic, real-world scenarios.
- Non-Player Characters (NPCs): These participants do not engage in the game through character roles. Instead, they facilitate interactions with PCs, possessing crucial information that can be revealed to the PCs at strategic points during the game.

- Game Master (GM): The GM oversees the entire game, providing NPCs with instructions as needed to ensure the smooth progression of the narrative and gameplay.

In the educational context, the term EduLARP is used to denote a specific category of LARP games designed for pedagogical purposes (Maragliano, 2019). EduLARP refers to a form of role-playing that conveys predetermined educational content (Balzer & Kurz, 2015). According to Hyltoft (2010), an educational EduLARP game must fulfill the following criteria:

- Educational Goal: The primary element of an EduLARP game, applicable across various lesson types – whether introducing new knowledge (Hyltoft, 2010; Mochocki, 2013) or reinforcing learning (Kundrát, 2022);
- Live Action: The game is based on interactive participation among individuals;
- Role-Playing: Incorporation of role-playing elements, including a narrative, characters, and rules (Hyltoft, 2010).

The structure of EduLARP can be examined concerning its phases (Maragliano, 2019) and its organization (Balzer, 2009; Kundrát & Doleček, 2014). Specifically, Maragliano (2019) delineates the phases of EduLARP into five parts (Figure 1).

Figure 1. Phases of EduLARP

- Ice-Breaking Phase: This phase focuses on preparing the group and creating a welcoming atmosphere. Preparatory activities are used to establish a non-judgmental environment conducive to open participation;
- Workshop Phase: Participants are introduced to the rules and boundaries of the game. During this stage, they become familiar with their assigned roles and the structure of the EduLARP;
- Game Phase: This is the core stage, during which the EduLARP is actively implemented, and participants engage in role-playing based on the defined narrative and objectives;
- Deroling Phase: This phase facilitates the transition out of character, allowing participants to gradually return to their real identities after the game concludes;
- Debriefing Phase: In this reflective phase, participants provide feedback and discuss their experiences. It serves to process the emotional and cognitive impacts of the game. This includes areas of reflection such as Emotions, Individual experiences, Analysis of the gameplay, Contextualization and real-life connections, Generalization, Educational insights (Maragliano, 2019).

The organizational structure of EduLARP design has been addressed by various authors, including Balzer (2009) and Kundrát & Doleček (2014). A detailed classification of the organizational steps proposed by these authors is presented in Table 2.

Table 2. Organizational Structure of EduLARP

EduLARP Organizational Structure	
Preparation phase, constraints	The requirements of the game should be specified before the start of development (e.g., number and type of participants, age category).
Educational content	Define the educational content and objectives that the game is intended to convey.
Creation phase - Storytelling	Define elements related to the game's story, such as the selection of a key theme or fictional world, choice of genre, development of the initial concept, and creation of characters (with the option for players to complete or customize their characters).
Game mechanics	Define the rules of the game, including both regulatory and constitutive elements.
External settings	Identify the elements related to the game that are not an immediate part of gameplay (e.g., preparation, warm-up, debriefing).
Game materials	Specify the materials and texts that players will have access to before, during, or after the game.

These categories can serve as inspiration for the development of original EduLARP games. Balzer (2009) emphasizes that the number and structure of these categories can be adjusted to suit the specific needs of an individual EduLARP.

In Slovakia, EduLARP has received minimal attention, as noted by Grenčíková, Petrušová, and Krajčo (2018). In contrast, some of Slovakia's neighboring countries have shown slightly more interest in this educational approach. In Poland, the pedagogical potential of EduLARP was discussed by Mochocki (2013), who attributes the initial mention to the literary playwright Szej. Szej argued that Tabletop Role-Playing Games (TTRPGs) could lead to similar educational outcomes as dramatic techniques. Despite this, Mochocki (2013) highlights that the method remains largely unfamiliar within the Polish educational context and stresses the need for broader awareness.

In the Czech Republic, EduLARP development is supported by the organization EduLudus, which is dedicated to the creation and implementation of educational LARP games. In 2018, EduLudus developed and validated five EduLARP games – *Magic Guilds, Mesozoic Park, Orteg´s challenge, Singularity, TeraforMars* – focusing on mathematics at the lower secondary level, with interdisciplinary links to other science subjects (EduLudus, 2018).

4. Methodology

Based on the literature reviewed, our research focuses on a model of contextual learning aimed at strengthening the mathematical thinking of primary school students through real-life contexts. Drawing from theoretical knowledge of CTL strategies and the organizational phases of EduLARP, we will design a mathematical EduLARP aligned with the 4th-grade primary education curriculum objectives and requirements. Specifically, we are interested in:

- The problem-solving procedures employed by students when addressing problems that simulate real-life situations;
- The relationship between the type of mathematical problem and students' ability to apply knowledge in solving it;
- Students' evaluation of the EduLARP educational environment and the EduLARP method itself.

We have chosen qualitative research, employing the Design-Based Research (DBR) methodology. This approach was inspired by the STARS (Student Activating Role-playing Games) study, which applied this methodology to validate EduLARP games in primary schools in Bavaria (Geneuss, 2019). The DBR methodology involves iterative cycles of design, implementation, analysis, and refinement to create effective educational interventions. The stages of our research correspond to the characteristics of DBR and include:

1. Designing a mathematical EduLARP;
2. Creating mathematical tasks that connect real life with mathematics;
3. Conducting a DBR cycle to validate the difficulty of the mathematical tasks – Implementing the tasks in classroom settings, collecting data on student performance, and analyzing the appropriateness of task difficulty.
4. Qualitative Analysis of Collected Data – analyzing students' solutions, responses, and observation sheets to assess problem-solving procedures.
5. Implementation of Mathematical EduLARP
6. Analysis of Results – Evaluating the EduLARP game through: Qualitative content analysis of students' answers, Analysis of written solutions, focusing on problem-solving procedures, Examination of observation sheets to identify patterns;
7. DBR Interventions – Implementation of new elements – refining and enhancing the EduLARP intervention based on analysis results, incorporating new elements to improve effectiveness.
8. The final mathematical EduLARP game.

5. Conclusion

The analysis of the theoretical foundations of the CTL suggests that its application in primary-level mathematics education can effectively facilitate the transfer of knowledge to real-life contexts. We assume that the experiences gained through the EduLARP game, along with individual role-playing activities, can enhance students' understanding of how mathematics is used in practical, everyday situations.

Acknowledgements

This article was supported by the Scientific Grant Agency of the Slovak Republic (VEGA) project No. 1/0734/25 Contextual Teaching and Learning in Mathematics Education – Research on the Possibility of Integrating Domain and Cross-Cutting Literacies in the Context of Curricular Transformation.

References

Balzer, M., & Kurz, J. (2015). *Learning by Playing – Larp As a Teaching Method*. https://nordiclarp.org/2015/03/04/learning-by-playing-larp-as-a-teaching-method/

Bartenstein, L. (2024). Live Action Role Playing (Larp) in Cognitive Behavioral Psychotherapy: A Case Study. *International Journal of Role-Playing*, (15), 92–126. https://doi.org/10.33063/ijrp.vi15.322

Bean, J. C. (2011). *Engaging ideas: The professor's guide to integrating writing critical thinking andactive-learning in the classroom (2nd ed.*). San Francisco, CA: Jossey-Bass.

Berns, R. G., & Erickson, P. M. (2001). *Contextual Teaching and Learning: Preparing Students for the New Economy.* https://files.eric.ed.gov/fulltext/ED452376.pdf

Blanchard, A. (2001). *Contextual Teaching and Learning*. Cambridge: Cambridge University Press.

Bøckman, P. (2003). The Three Way Model: Revision of the Threefold Model. In: Gade, M., Thorup, L., Sander, M. (Eds.). *As LARP Grows Up. Frederiksberg: Projektgruppen KP03.* https://nordiclarp.org/w/images/c/c2/2003-As.Larp.Grows.Up.pdf

Center for Occupational Research and Development. (2023). *REACTing to Learn: Student Engagement Strategies in Contextual Teaching and Learning.* https://www.cord.org/wp-content/uploads/2023/05/REACT-flyer-ABE-revised-footer.pdf

Costello, D., (2022). *Mathematizing Student Thinking: Connecting Problem Solving to Everyday Life and Building Capable and Confident Math Learners*. Canada: Pembroke publishers.

Dewolf, T., et. al. (2011). Upper elementary school children's understanding and solution of a quantitative problem inside and outside the mathematics class. *Learning and Instruction 21*(6) 770–780. https://doi.org/10.1016/j.learninstruc.2011.05.003

EduLudus. (2018). *Matematické edularpy.* https://www.eduludus.cz/matematicke-edularpy/p-ixmtewoa/1/

Geneuss, K. (2019). The Use of the Role-playing Technique STARS in Formal Didactic Contexts. *International Journal of Role-Playing*, (11), 114–131. https://journals.uu.se/IJRP/article/view/286/195

Grenčíková, A., Petrušová, D., & Krajčo, K. (2018). Possibilities of Using Edularp in Education in Slovak Republic. *ERAZ 2018: Knowledge Based Sustainable Economic Development Conference Proceedings*. 506–512. https://eraz-conference.com/wp-content/uploads/2019/12/eraz_2021.pdf

Herlina, E. (2022). The Implementation of REACT Strategy in Training Students; Higher Order Thinking Skills (HOTS). *Ta'dib Journal*, (25) 47–57. https://ejournal.uinmybatusangkar.ac.id/ojs/index.php/takdib/article/view/5049

Hudson, CH. C., & Whisler, R. W. (2007). Contextual Teaching and Learning for Practitioners. *Systemics, Cybernetics and Informatics*, (6), 54–58. https://www.iiisci.org/Journal/pdv/sci/pdfs/E668PS.pdf

Hyltoft, M. (2010). Four reasons why edu-larp works. In: Dombrowski, K. (2010) *LARP: Einblicke. Aufsatzsammlung zum MittelPunkt.* Germany: Zauberfeder, 43–57. https://thenoon.ru/files/documents/file_74d48f19a41a0db0c5fe0dcd15763464.pdf

Johnson, E. B. (2002). *Contextual teaching and learning: what it is and why it's here to stay*. Thousand Oaks, Calif.: Corwin Press

Kundrát, J. (2022). Roots and and Anchoring of EduLARPs. In: Benešová, T. et al. (2022) *Mathematics Edularp, Educational live action role playing game in Mathematical Context*. 11–18. https://edularp.vsb.cz/wp-content/uploads/2022/09/mathematics_edularp_2022.pdf

Kundrát, J., & Doleček, J. (2014) *Metodika pro tvorbu larp do školní výuky, jako jedné z moderních metod výuky.* Centrum dopravního výzkumu, v.v.i., Brno. https://www.cdv.cz/file/metodika-prace-s-larp-pro-vychovu-a-vzdelavani-deti-a-mladeze-03/

Lankard, B. (1995). *New ways of learning in the workplace*. https://files.eric.ed.gov/fulltext/ED385778.pdf

Maragliano, A. (2019). Edu-larp Paths in Education: A Pedagogic Research on Ethnic Prejudice and Empathy through Games. *International Conference the Future of Education*, (9), 455–462. https://conference.pixel-online.net/files/foe/ed0009/FP/5814-LGM3956-FP-FOE9.pdf

Maragliano, A. et. al. (2021). Starflyer: An edu-larp Project for Ethic and Math teaching and Learning. *Proceedings of the 15th European Conference on Game Based Learning.* Brighton: Academic Conferences International Limited, 947–955.

Meyers, C. & T. B. Jones (1993). *Promoting Active Learning: Strategies for the College Classroom. SanFrancisco*. CA: Jossey-Bass

Mochocki, M. (2013). Edu-Larp as Revision of Subject-Matter Knowledge. *International Journal of Role-Playing.* (4), 55–75. https://journals.uu.se/IJRP/article/view/229/308

Ministry of Education, Research, Development and Youth of the Slovak Republic (2023). *Štátny vzdelávací program pre základné vzdelávanie.* https://www.minedu.sk/data/files/11808_statny-vzdelavaci-program-pre-zakladne-vzdelavanie-cely.pdf

Osika, A. et. al. (2022). *Contextual learning: linking learning to the real world.* The University of Queensland. https://www.timeshighereducation.com/campus/contextual-learning-linking-learning-real-world

Rönnåsen, M. (2022). *Leading With Larp Magic* https://nordiclarp.org/2022/10/17/leading-with-larp-magic/

Sandberg, C., (2004). Genesi. LARP Art, Basic Theories. In: Montola, M. & J., Stenros (2004). *Beyond Role and Play tools, toys and theory for harnessing the imagination.* 265–286. https://nordiclarp.org/w/images/8/84/2004-Beyond.Role.and.Play.pdf

Säljö, R., Riesbeck, E., & Wyndhamn, J. (2009). Learning to model: coordinating natural language and mathematical operations when solving word problems. In L. Verschaffel, B. Greer,W. Van Dooren, & S. Mukhopadhyay (Eds.), *Words and worlds: Modelling verbal descriptions of situations.* 177–193. Rotterdam: Sense Publishers.

Selvianiresa, D. & Prabawanto, S. (2017). Contextual Teaching and Learning Approach of Mathematics in Primary Schools. *Journal of Physics* (895). https://iopscience.iop.org/article/10.1088/1742-6596/895/1/012171

Spooner, K. (2023). Using mathematical modelling to provide students with acontextual learning experience of differential equations. *International Journal Of Mathematical Education in Science and Technology*, *55*(2) 565–573. https://doi.org/10.1080/0020739X.2023.2244472

Stark, L. (2012). *Leaving mundania: Inside the transformative world of live action role-playing games.* Chicago, IL: Chicago Review Press.

Surya, E., Putri A., F. & Mukhtar, M. (2017). Improving mathematical problem-solving ability and Self-confidence of high school students through Contextual learning model. *Journal on Mathematics Education*, (8), 85–94. https://files.eric.ed.gov/fulltext/EJ1173627.pdf

Syaiful Syamsuddin, Edi Istiyono; The effectiveness of mathematics learning through contextual teaching and learning approach in Junior High School. *AIP Conf. Proc.* 21 September 2018; 2014 (1): 020085. https://doi.org/10.1063/1.5054489

State Pedagogical Institute (2019). *Koncepcia skvalitnenia matematického vzdelávania na základných a stredných školách v SR.* https://www.statpedu.sk/files/sk/pre-verejnost/verejne-pripomienkovanie/koncepcia-skvalitnenia-matematickeho-vzdelavania/koncepcia_navrh.pdf

Veselková, I. (2017). *EduLARP – cesta k zážitkové pedagogice.* https://www.rizeniskoly.cz/casopisy/rizeni-skoly/edularp-cesta-k-zazitkove-pedagogice.m-3238.html