IMPLEMENTING STORYTELLING, GAMIFICATION AND IMPLICIT LEARNING INTO DIGITAL LEARNING ENVIRONMENTS – THE CASE OF BRAINIX

Bianca Höppner, Rebecca Pape, Lena Zitzelsberger, Heiner Böttger

Catholic University of Eichstätt-Ingolstadt, Germany

06/29/2023

THE PRESENT STUDY (HÖPPNER ET AL., 2023)

(BASED ON BÖTTGER, 2022, P.3)

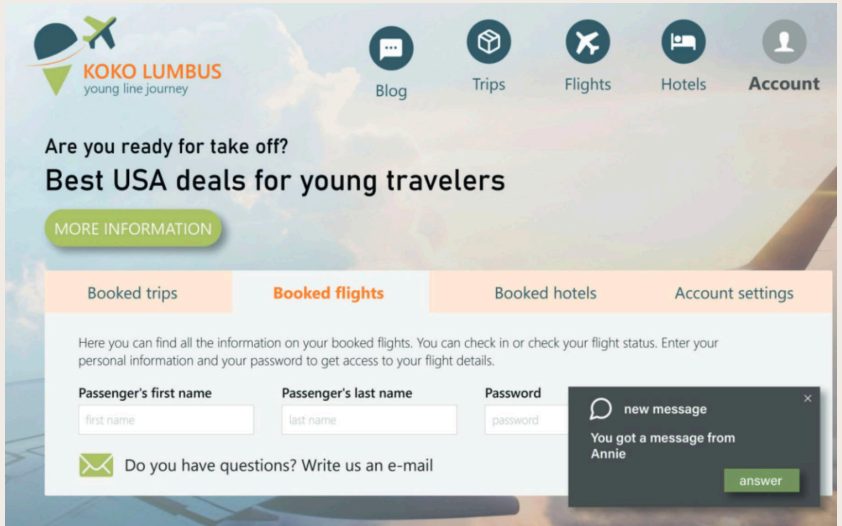
Question

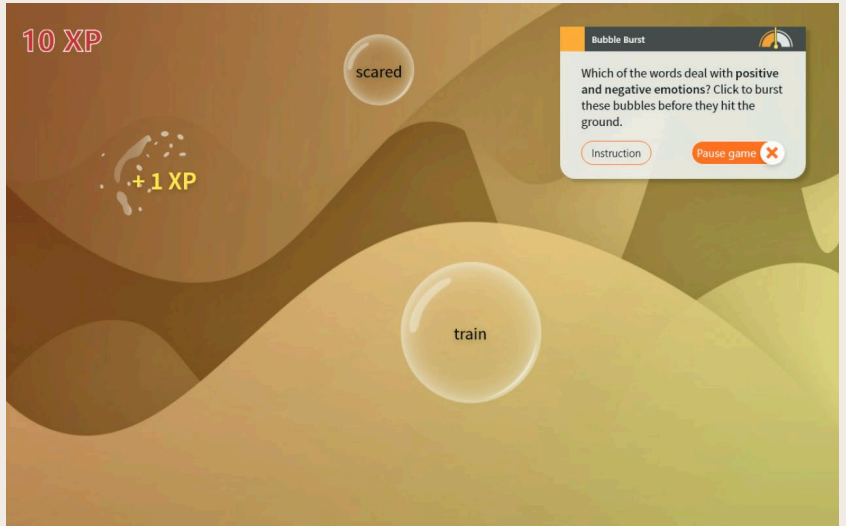
How does the digital learning environment (DLE) *Brainix* implement these three pillars?

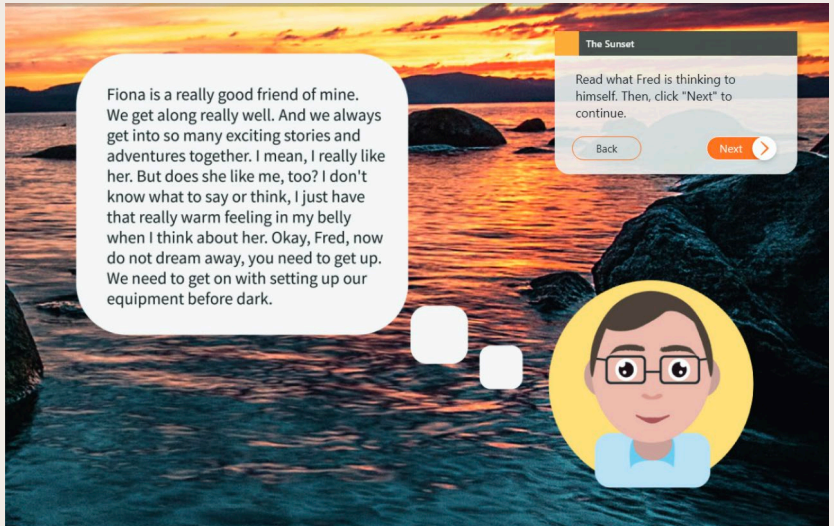
Aim

Develop a framework for digital learning environments, including identified realization approaches.

BRAINIX IMPRESSIONS (WWW.BRAINIX.ORG)







STORYTELLING IN TEACHING

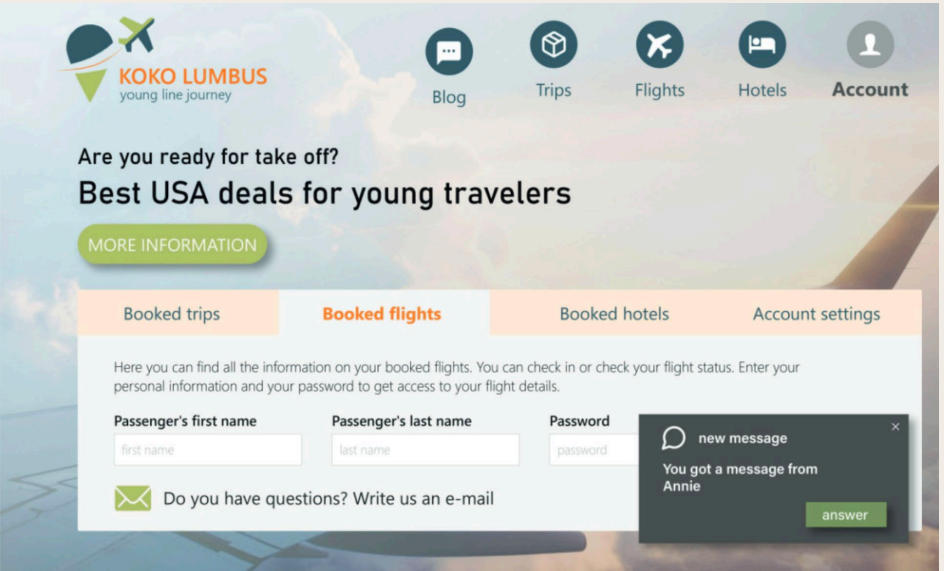
- Stories are one of the oldest forms of teaching and offer a valuable way to share knowledge (Landrum et al., 2019).

- **Stories‘ purpose** in the teaching context (Green, 2004):

> “(a) create interest, (b) provide a structure for remembering course material, (c) share information in a familiar and accessible form, and (d) create a more personal student–teacher connection.” (Landrum et al., 2019, p. 248)

STORYTELLING AND EDUCATIONAL (NEURO)SCIENCES

- Stories are independent of space or time, allow to connect old with new experiences, and establish new neuronal networks (cf. Yang & Wu, 2012).
- Research in neuroscience has revealed that brains react in similar manner to stories as they do to real life experiences (cf. Landrum et al., 2019, p. 249).
- Akgün & Akgün‘s meta-analysis (2020) identified a strong positive effect of digital stories on academic achievement in all school levels.

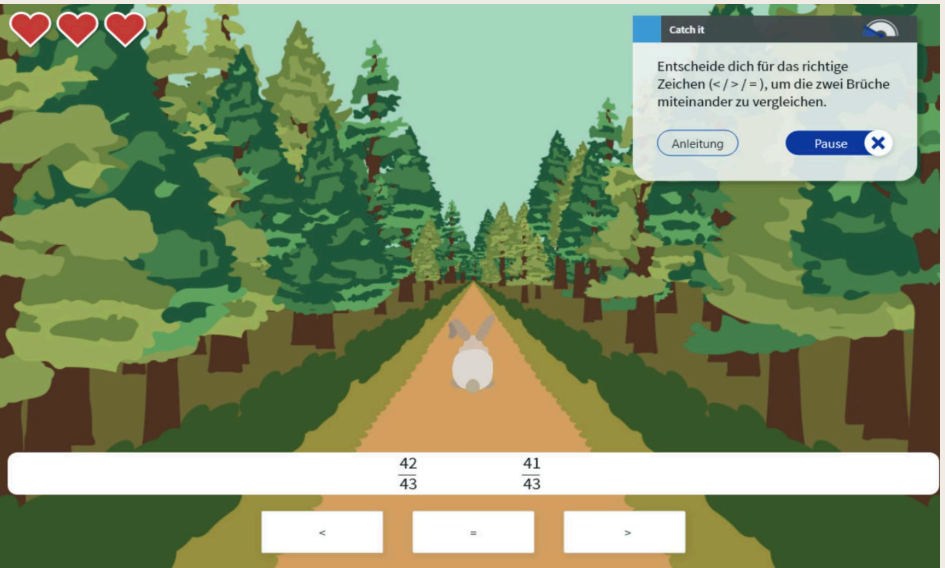


GAMIFICATION IN TEACHING

- **Gamification:** “The use of game elements [...in non-]game contexts.“ (Dehghanzadeh et al., 2023, p. 2)

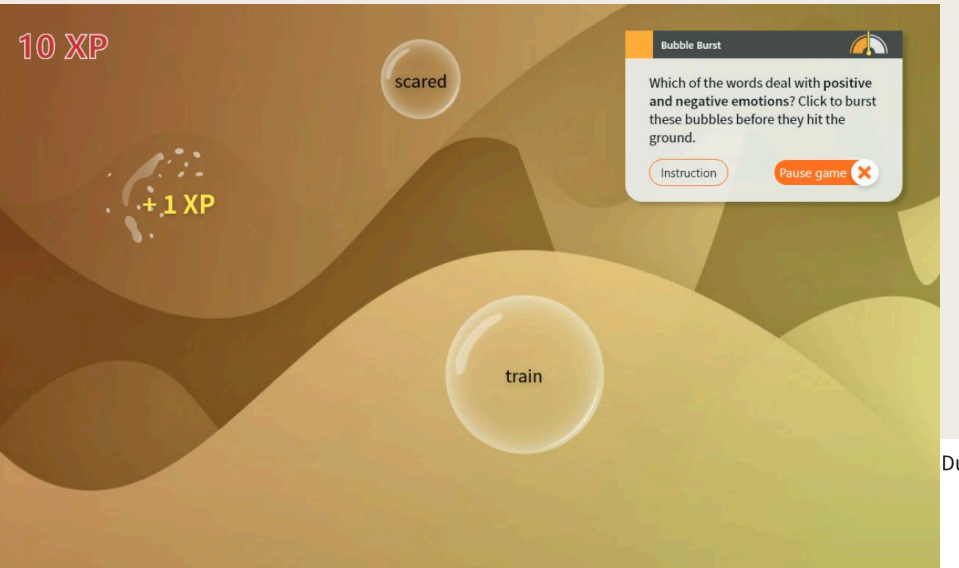
- Gamification has repeatedly been revealed benefical for...
  - ✓ student engagement
  - ✓ student motivation
  - ✓ and learning achievement.

  (cf. Mohammed & Ozdamli, 2021; Divjak & Tomić, 2011)



GAMIFICATION AND EDUCATIONAL (NEURO)SCIENCES

- Gamified learning is closely connected to rewards and the feeling of success. In this case, dopamine – the so-called happiness hormone – is released.
- Gamified learning often implies a non-restrictive environment in which students can learn without fear. Sergzi et al. (2020) further revealed that stress reduction can be one positive outcome of gamification.

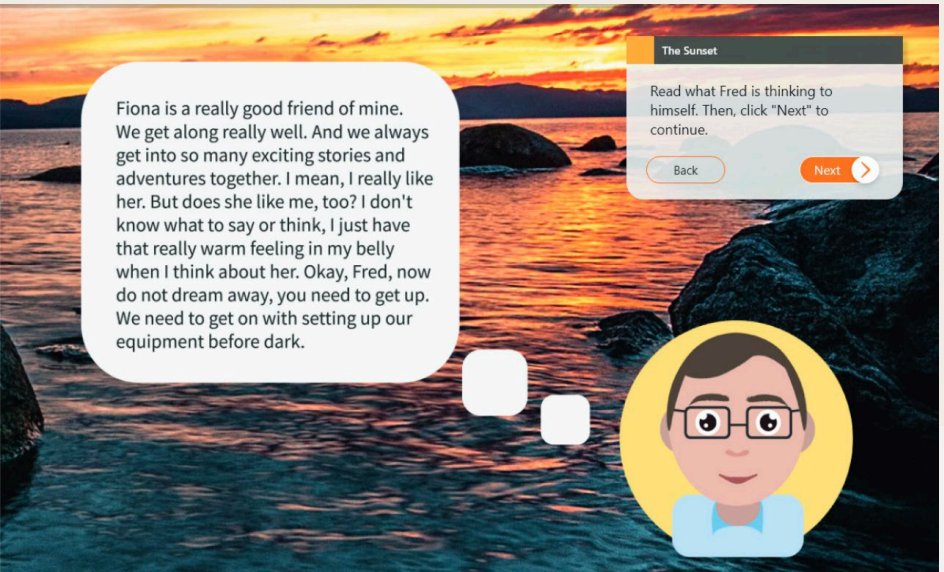


IMPLICIT LEARNING IN TEACHING

- **Implicit learning:** A process in which learners acquire knowledge about a rule-governed subject area without explicitly intending to do so (cf. Reber, 1967).
- Four characteristics of implicit learning exist according to Stoffer (2000, p. 220, transl.):

  (a) complexity of stimulus structures, (b) casualness of learning, (c) novelty of stimulus material, and (d) almost exclusively nonconscious learning.

IMPLICIT LEARNING AND EDUCATIONAL (NEURO)SCIENCES



- Knowledge acquired in implicit manner remains in memory longer than if explicitly acquired (Alan & Reber, 1980).
- Implicit learning is less likely to be influenced by the affective state of learners (e.g. based on test anxiety) than is the case for explicit learning (Rathus et al., 1994).
- Successful implicit learning seems to be possible even with low cognitive ability (Gebauer & Mackintosh, 2007).

METHODOLOGY

Qualitative content analysis following the approach by Kuckartz & Rädiker (2022, p. 106)

Two major limitations of this approach are possible biases and restricted (time) resources. Correspondingly,...

a) ...learning units from *Brainix* were selected by random sampling.	b) ...a review cycle to minimize biases was added.	c) ...analysis was stopped after content saturation was reached.

RESULTS FOR STORYTELLING

Analyzed storylines in *Brainix*

- are age-appropriate
- span over several learning units
- maintain a recurring structure
- include interaction possibilities with characters of the story
- integrate learning companions

Analyzed storylines in *Brainix*

- are repeatedly interrupted due to
  - insufficiently working AI (e.g. limited responses in conversations)
  - calculation and grammar entries as well as exercises
- often allow for little unstructured interaction opportunities with characters of the story

RESULTS FOR GAMIFICATION

Analyzed learning units in *Brainix*

- include multiple learning games (e.g. Bubble Burst) and escape games
- often offer the possibility to collect experience points and gadgets
- often allow students to choose the order of their learning paths
- allow for distinct interaction methods (e.g. voice message, keyboard, pen)

Analyzed gamified sections in *Brainix*

- often focus on reproductive exercises (e.g. repetition of vocabulary)
- only include a limited selection of rewards (e.g. experience points), and seldomly the possibility to use them (e.g. buying gadgets)

RESULTS FOR IMPLICIT LEARNING

Analyzed learning units in *Brainix*

- implement exercises in difficulty-increasing manner
  - alternation of familiar and novel contents
  - from reproductive to productive and creative exercises
- encompass audio, visual and haptic stimuli

Analyzed learning units in *Brainix*

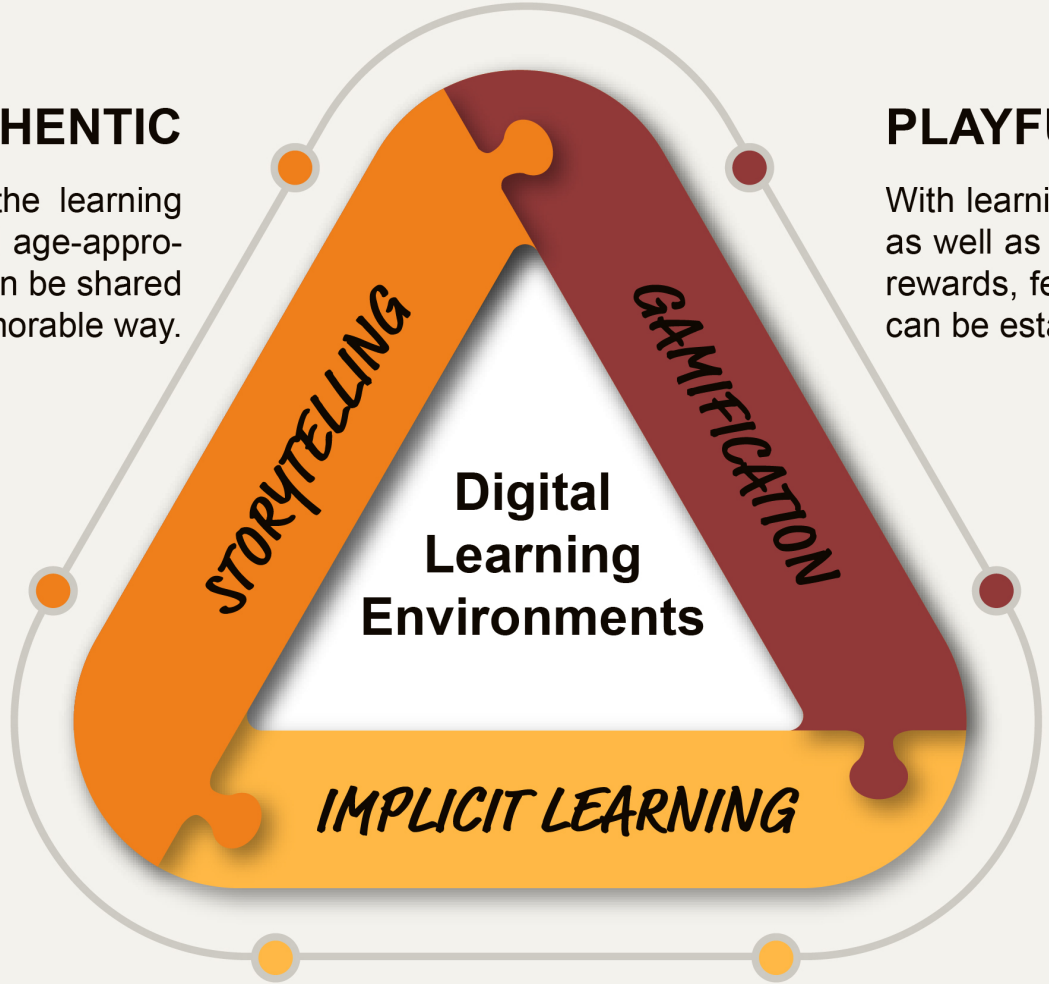
- lack interactive video material
- often lack individual learning paths based on students‘ prior knowledge and their performance of previous tasks

AUTHENTIC

With a familiar structure of the learning units, an unit-overarching and age-appropriate storyline, information can be shared in a memorable way.

PLAYFUL

With learning and escape games as well as points and gadgets as rewards, feelings of achievement can be established.



EMOTIONAL

With interaction possibilities and learning companions, interest and personal connections can be created.

PERSONALIZED LEARNING PATH

With varying learning paths, input and interaction methods, individual learning experiences can be fostered.

DIFFICULTY-INCREASING

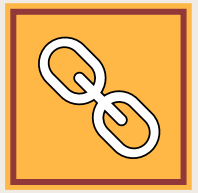
With exercises balancing the alternation of familiar and novel contents and exercises increasing in complexity from reproductive and closed to productive and creative formats, learning casually can be encouraged.

MULTISENSORY

With a rich variety of exercises including audio, visual and haptic stimuli, non-conscious learning can be initiated.

(Present Study, Höppner et al., 2023 p. 3)

CONCLUSION



The three pillars (storytelling, gamification, implicit learning) are highly interlinked and interdependent.

DLEs should base on authentic and emotional storylines, playful and personalized learning paths as well as multisensory and difficulty-increasing inputs or exercises.

The designed framework can be used by researchers and practitioners to create engaging and motivating digital learning environments.

Further research should focus on how interaction can be enhanced further for the three pillars.

REFERENCES

Akgün, M. & Akgün, I. H. “The Effect of Digital Stories on Academic Achievement: A Meta-Analysis”, Journal of Education and Learning, 9(6), 2020, 71–83.

Allen, R. & Reber, A. S. “Very long term memory for tacit knowledge”, Cognition, 8(2), 1980, 175–185.

Böttger,H. “Säulen einer (digitalen) LERNwerk-Architektur“, 2022, https://www.researchgate.net/publication/371366884_Saulen_einer_digitalen_LERNwerk-_Architektur

Brainix [Computer software]. Brainix GmbH, 2020, https://www.brainix.org

Dehghanzadeh, H., Farrokhnia, M., Dehghanzadeh, H., Taghipour, K., & Noroozi, O. “Using gamification to support learning in K-12 education: A systematic literature review”, British Journal of Educational Technology, 2023, 1–37.

Divjak, B. & Tomić, D. “The impact of game-based learning on the achievement of learning goals and motivation for learning mathematics - Literature review”, Journal of Information and Organizational Sciences, 35(1), 2011, 15–30.

Gebauer, G. F. & Mackintosh, N. J. “Psychometric intelligence dissociates implicit and explicit learning”, *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(1), 2007, 34–54.

Green, M. C. “Storytelling in Teaching”, 2004, https://www.psychologicalscience.org/observer/storytelling-in-teaching

Höppner, B., Pape, R., Zitzelsberger, L., & Böttger, H. „Implementing Storytelling, Gamification and Implicit Learning into Digital Learning Environments – The Case of Brainix“, 2023

REFERENCES

Kuckartz, U. & Rädiker, S. “Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung“, 5th ed., Beltz Juventa, 2022, 104–156.

Landrum, R. E., Brakke, K., & McCarthy, M. A.. “The Pedagogical Power of Storytelling”, Scholarship of Teaching and Learning in Psychology, 5(3), 2019, 247–253.

Mohammed, Y. B. & Ozdamli, F. “Motivational Effects of Gamification Apps in Education: A Systematic Literature Review”, Broad Research in Artificial Intelligence and Neuroscience, 12(2), 2021, 122–138.

Rathus, J. H., Reber, A. S., Manza, L., & Kushner, M. “Implicit and explicit learning: Differential effects of affective states”, *Perceptual and Motor Skills, 79*(1), 1994, 163–184.

Reber, A. S. “Implicit learning of artificial grammars”, Journal of Verbal Learning & Verbal Behavior*,* 6(6), 1967, 855–863.

Sergzi, N. M., Ordoni, M., Besharatnia, M. S., Dastamooz, M. R., & Abravan, M. J. H. “Impact of Educational Computer Games on Academic Motivation and Stress Reduction in Students”, International Journal of Elementary Education, 9(3), 2020, 71–76.

Stoffer, T. H. “Implizites Lernen von Reizstrukturen: Ist ein Erwerb impliziten musikalisch-syntaktischen Wissens allein durch Musikhören möglich?“, Unterrichtswissenschaft, 28(3), 2000, 218–238.

Ulum, H. “The effects of online education on academic success: A meta-analysis study”, Education and Information Technologies, 27, 2022, 429–450.

Yang, Y. C. & Wu, W. I. “Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study”, Computers and Education, 59(2), 2012, 339–352.