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E-learning Environments Program

**ATTILA ÉRSEK**

# ASSESSMENT AND DEVELOPMENT POSSIBILITIES OF THE COGNITIVE ELEMENTS OF CRITICAL THINKING EMBEDDED IN HISTORICAL TEACHING MATERIALS IN THE CASE OF ELEVENTH- AND TWELFTH-GRADERS IN AN E-LEARNING ENVIRONMENT

Doctoral Dissertation Theses

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## The relevance and aim of the research

Improving critical thinking is one of the key tasks in American education within social sciences, however, in Hungary only a few works dealt with this topic until the last decade. This dissertation aims to fill this research gap. As a secondary school teacher in public education, I performed a subject-specific pedagogical research which can be categorized as development research. The goal was not to develop the e-learning environment, it only served as a tool to explore the research questions and the hypotheses. The dissertation attempted to find a skill developing solution in the area of pedagogy which is closely connected to the development of critical thinking in an e-learning environment. The focus is on assessing and developing the cognitive elements of critical thinking embedded in historical teaching materials.

The present research aims to provide skill developing opportunities for teachers which they can use in practice while combining two areas: the research assists the assessment and development of cognitive elements in critical thinking within an e-learning environment and in the framework of a specific subject: History. The reviewed literature only examines these areas (e-learning, critical thinking) separately; no research has been conducted that studies them together.

Owing to the complexity of the task and the complex conceptual framework, there has been only a few empirical studies in the field of critical thinking which can be regarded as successful. However, the pedagogical interpretation of the concept has begun in Hungary (*Molnár*, 2002.; *Tóth*, 2007.; *Kovács,* 2009.; *Fábián,* 2014.). The RWCT (Reading and Writing for Critical Thinking) supports the development of the field with its methodological elements. The Anglo-Saxon pedagogy focuses on conceptual clarification and on the exploration and summarization of the structural elements of critical thinking (*Elder – Paul*, 2006.; Lai, 2011).

The present pedagogical experiment was executed within the Neo LMS application, an e-learning environment. During the pedagogical experiment, I shared a two-week skill developing material (which was not part of class activities) with the students connected to the topic, and I assisted the learning processes of students as a tutor. Altogether 330 subjects participated in the experimental and control groups.

## Research questions and hypotheses

From the perspective of cultural anthropology, at the level of the individual, the condition for success is autonomy, and within that the ability to learn (*Fábián*, 2014, pp. 9-11.). The pedagogical goal of the present research experiment was to assist and establish the quality and efficient autonomous existence of eleventh- and twelfth-graders in a secondary grammar school.

The research focused on the following **research questions** in order to increase the efficiency of students:

1. Which variables can be regarded as the cognitive elements of critical thinking within the framework of a specific subject: History?
2. How can the students' skills be developed related to the cognitive elements of critical thinking embedded in historical teaching materials?
3. How can the students' performance be assessed related to the cognitive elements of critical thinking embedded in historical teaching materials in an e-learning environment?

The **hypotheses of the present research** are as follows:

$H_1$: The success rate of solving a History test which is related to the cognitive elements of critical thinking depends on the level of prior knowledge in the field of History.

$H_2$: Students' performance related to the cognitive aspects of critical thinking embedded in historical teaching materials is significantly influenced by becoming familiar with the Neo LMS skill developing materials.

$H_3$: The students' test results are more successful in an e-learning environment than in the case of paper-based tests when it comes to the assessment of the cognitive elements of critical thinking embedded in historical teaching materials.

$H_4$: There is a significant difference between the subsamples', which were formed based on the different classes, cognitive elements of critical thinking embedded in historical teaching materials.

$H_5$: The performance of male students is significantly better in the case of the test which assesses the cognitive elements of critical thinking embedded in historical teaching materials than that of female students.

$H_6$: Students' preference towards History considerably determines their performance in the case of the test which assesses the cognitive elements of critical thinking embedded in historical teaching materials.

$H_7$: The students' cognitive elements of critical thinking embedded in historical teaching materials are not influenced by the parents' educational qualifications.

$H_8$: The text interpretation of those eleventh- and twelfth-graders is efficient who are motivated towards History.

## Theoretical frameworks, the structure of the dissertation

In the present dissertation, I explore the theoretical frameworks and at the same time summarize the different views on the concept and structure of critical thinking. Then I review the elements of source interpretation in historical teaching materials. The following conceptual approach by Facione and Halpern was my starting point when defining critical thinking: **Critical thinking is a set of situation-dependent general cognitive skills; a purposeful, self-regulatory process of forming judgement and of evaluation during which the individual uses cognitive skills or strategies which increase the probability of reaching the desired result or making the desired decision.**

Based on my research, I created a critical thinking taxonomy which can be applied within the context of History:

(1) *argumentation*,

(2) *highlighting the important points* (from texts, from pictures etc.),

(3) *inferencing* based on sources (textual sources, pictures, etc.),

(4) critical *analysis* of sources (textual sources, pictures, etc.),

(5) *identifying* a concept (based on pictures, on textual sources, etc.),

(6) *interpretation* of sources (figures, texts, tables, graphs etc.),

(7) *exploring* causes, goals.

The above-mentioned elements were refined with the help of the *Anderson-Krathwohl* (2001) model for educational objectives. With the help of the cognitive process dimensions (categories and cognitive processes), I identified the cognitive elements of critical thinking embedded in historical teaching materials and determined their frequency in the secondary school framework curriculum by performing an exploratory content analysis. The importance of critical thinking has increased recently in History instruction.

"*In the international context of History instruction, two main approaches gained ground in the last few years. One approach states that developing critical thinking and source analysis are the main tasks of History instruction, the other approach regards History instruction as the preserver of collective memory (Jancsák, 2019)*." The simultaneous application of the two approaches in pedagogy might create the appropriate added value for the new generation.

In the second half of the theoretical framework chapter, the e-learning environment is described. The interpretive possibilities regarding learning environments are described, furthermore, the conceptual explanation of the e-learning environment is provided as well as the design-oriented definition of e-learning (*Komenczi,* 2009). The Neo LMS[1] e-learning platform is a learning content management system (LCMS). The system is not subject specific, it works only as a framework, and the tutor adds the content to it.

[1] It is the product of CYPHER LEARNING, a company (the headquarters are in San Francisco) that specializes in providing educational platforms for organisations all around the world. The platform is available here: https://www.neolms.com/ (2019. 10. 30.).

For teachers, the summary of the theoretical material about 21st century skill development is useful, however, applied methodological solutions can be directly adapted in the everyday educational practice. Students must become independent human beings who think critically, since this is one of the key expectations at school as well as a key 21st century skill on the labour market. Based on the World Economic Forum's report from 2018, critical thinking will be the second most important skill in 2020 that an employee must possess. The "4 C" model also focuses on the 21st century skills (*Communicate! Critically Think! Collaborate! Create!*) which encourages students to be innovative. The digital skills and basic skills are closely connected to this.

The second chapter of the thesis, which deals with the research, presents my own exploratory research cases aiming to enable the realization of the digital transition by exploring the current state of affairs. The results of my development research (the development experiment was carried out on the Neo LMS platform) are detailed in the third chapter. Based on my own qualitative research, I establish the cognitive processes of critical thinking embedded in historical teaching materials as well as establish its interpretive framework. In my research, I was able to incorporate the critical thinking elements which are present in the framework curriculum into the two-dimensional (cognitive and knowledge dimensions) model. Furthermore, I identified those cognitive elements and levels – and the test types and tasks connected to them – which were utilized in the assessments carried out with paper-based and electronic test tasks.

## Research protocol (sampling, tools, methods)

I performed a development research, which was preceded by several exploratory research connected to critical thinking and the e-learning environment. The first assessment (paper-based entrance assessment) took place in the spring of 2018, and it assessed the skills of eleventh-graders and simultaneously tested the validity of the data collection tool. This way the skill developing materials connected to the e-learning environment could be constructed based on the established taxonomy. The post course assessment was carried out among twelfth-graders

I applied probability cluster sampling in the case of the experimental group, and an additional technique was also used in the case of the control group: snowball sampling (number of participants: 213 participants in the experimental group during the paper-based test, 151 participants in the experimental group in the case of the Neo LMS platform, 179 participants in the control group). The number of experimental groups was 8, the number of control groups was 9. The distribution of participants by sex: 39% male, 61% female. In *Table 1* the research phases, the tools and the methods are summarized pertaining to the research protocol.

*Table 1: The protocol of research tools and methods*

| Research phases | Tools | Methods |
|---|---|---|
| ***Prior Research*** | | ***quantitative methods*** |
| 2004-2005<br>Assessing critical thinking in History in the case of eleventh-graders | paper-based data collection tools (own developments)<br>• knowledge assessment test in History<br>• test for the assessment of critical thinking embedded in subject-specific materials (skill assessment)<br>• questionnaire about the background information of students (for comparative investigations) | methods of data analysis: examination of the results (performance examination, quantitative data analysis)<br>• questionnaire<br>• descriptive and mathematical statistical methods<br>• two-sample t-test<br>• correlation calculation<br>• cluster analysis<br>• analysis of variance<br>• regression analysis |
| ***Research*** | | ***applying a combined model*** |
| ongoing from 2013 | scholarly literature | exploring and synthetizing theoretical frameworks |
| December 2013<br>1. exploration of the framework curriculum designed for 4-year secondary schools (as an educational expert for the Hungarian Institute for Educational Research and Development - OFI) | framework curriculum designed for 4-year secondary schools | non-intrusive research: qualitative content analysis |
| 2014<br>Using WEB 2.0 applications | online questionnaires | micro research, quantitative data analyses |
| Developing an e-test<br>2016 and 2018 | e-learning tests (preliminary tests) Socrative; Redmenta | test analysis with quantitative tools |
| May 2017 (February 2018) | main assessment tool:<br>the reading comprehension results on the National Assessment of Basic Competences (OKM) test of the group participating in the preliminary tests | regression analysis |
| October 2017<br>2. exploration of the framework curriculum designed for 4-year secondary schools | framework curriculum designed for 4-year secondary schools | intracoding (triangulation) qualitative content analysis (exploring the elements and operators of critical thinking and linking them with the |

| | | |
|---|---|---|
| | | cognitive process dimension) |
| School year 2017/2018<br>entrance testing<br>involving experimental groups | 3. version of the paper-based data collection tools (own developments):<br>test for the assessment of critical thinking embedded in subject-specific materials (skill assessment)<br>e-questionnaire | examination of the results (performance examination, quantitative data analysis) and trend analysis (comparing the data from 2004 and from 2018)<br><br>analysing background variables |
| ***Developing phase*** | | ***exploratory combined model school-oriented subject-specific pedagogical research*** |
| School year 2017/2018<br>entrance testing, developing, post course testing | assessment of the dependent variable (paper-based)<br>testing the level of knowledge<br>applying an independent variable (Neo LMS methodology material - own development)<br>assessing the dependent variable with an e-test | single-case experiment |
| School year 2018/2019 Autumn<br>developing and post course testing<br>involving experimental and control groups | Revised version of the Neo LMS methodological material - own development<br><br>online questionnaire | control group experiment<br><br>analysing background variables |
| ***Summarizing and complementing the research results*** | | ***quantitative and qualitative methods*** |
| School year 2018/2019 Winter and Spring period | the databases of the research | examination of the results (performance examination, quantitative data analysis)<br>analysing background variables |
| Summer 2019 | preparing conceptual maps: characteristics of critical thinking in History instruction | qualitative data analysis (non-structured cognitive map with stimulated recall with questions) |

I explored the beliefs and attitudes of History teachers towards critical thinking in the framework of a small sample-sized research. The sample procedure was expert sampling: the participants were secondary school History teachers. Conceptual maps were created

regarding the dependent variable: the characteristics of critical thinking in History instruction. The most important key concepts, which are closely connected to critical thinking according to the results of the research, are the following: own evaluation; an independent, conscious and reflective way of forming an opinion; systematization; recognizing and creating rules; source criticism; problem solving; conceptual transition. The research confirmed the adequacy of the shortest possible description I could create about critical thinking: it is **evaluative thinking** which helps students in finding their way in the modern age.

## The development research experiment

On the Neo LMS platform, the skill developing material was created in a targeted and thematic way sorted by source types. The development of the teaching material and the related creation of the post course e-test were preceded by a paper-based assessment concerning the cognitive elements of critical thinking embedded in historical teaching materials. Although there is no existing assessment protocol for the assessment of the cognitive elements of critical thinking connected to History, my research data shows that it is possible to create a skill developing course based on the reliability index of the paper-based tests and on the research conclusions which were drawn by relying on an appropriate sample size. The reliability index of the research (*Table 2*) was determined based on the reliability indices of the data collection and testing tools. **Relying on the test results of 2018, and on the taxonomy and task types of that research, it became possible to create a skill developing material connected to the cognitive elements of critical thinking through historical teaching materials, and then, a post course e-test could be constructed.**

*Table 2: The reliability indices of the tests (Cronbach's α)*

| Tests | Single-case experiment experiment (2018) | Assessment (2018) |
|---|---|---|
| History (knowledge) | 0.94 | – |
| Cognitive elements of critical thinking | 0.81 | 0.83 |

The entrance test (paper-based) was filled out by the experimental groups. Their results had to be compared to the results of the post course e-test which took place after the Neo LMS skill developing course. The latter was filled out by both the experimental and the control groups. The role of the e-course material created on the Neo LMS platform is crucial, because it presented an opportunity for students to practice methods and techniques for obtaining knowledge related to historical sources in a modern learning environment. The students had to use developed cognitive activities when they processed

the information with critical analysis and with comparison; they had to perform an analysis from multiple perspectives. This was assisted by the developed material.

The whole thematic structure of the course was visible to the students. The modules could only be completed in the predetermined order. The structure of the course utilized the elements of programmed learning as well. In the dissertation, I briefly present the content and didactic elements of the topics. The course consisted of 10 modules[2] and the post course e-test as the 11. part. The tasks of the e-test proved to be reliable based on the single-case experiment (Cronbach's $\alpha = 0.77$), but based on the test involving 330 participants (experimental and control groups), the reliability of the e-test is only adequate (Cronbach's $\alpha = 0.69$). There was a group in which the e-test proved to be more reliable than the average (Cronbach's $\alpha = 0.85$.)

*Table 3: The cognitive and thematic classification of the e-test tasks, and the results*

| **Tasks** | **Experimental group N=151 %** | **Control group N=179 %** |
|---|---|---|
| 1. Evaluation (argumentation) | 28.48 | 36.87 |
| 2. Analysis (caricature) | 36.20 | 35.20 |
| 3. Evaluation (Teleki) | 65.56 | 63.13 |
| 4. Cause and effect analysis (Pragmatica Sanctio) | 52.32 | 50.84 |
| 5. Picture analysis (World War I) | 30.02 | 32.22 |
| 6. Graph analysis (emigration) | 33.77 | 36.87 |
| 7. Application (secret protocol) | 41.85 | 40.87 |
| 8. Evaluation (a Hungarian political document called the “Húsvéti cikk”) | 45.30 | 48.16 |
| 9. Analysis (Klebelsberg) | 29.80 | 35.89 |
| 10. Evaluation (Great Depression) | 46.36 | 42.09 |
| 11. Evaluation (Lincoln - caricature) | 56.95 | 62.57 |
| 12. Creating (map) | 18.54 | 26.26 |

The experimental groups performed better in 5, the control groups in 7 task types. The least successful task - in terms of success rate -was the one which focused on the creating skills.[3]

[2] For the source interpretation, the key methodological manual was the material created by *Kaposi-Szabó* (2010) and the book of *Tóth* (2007).

[3] The question was the following: Why can the military campaign of Görgey in Former Upper Hungary be regarded as successful based on the map and your own knowledge? Answer the question with 2-3 sentences.

## Research results

The possibilities which are opened up by the use of digital tools can be motivating for students, but without changing the attitude of teachers, it is inconceivable to develop this area. I hope that my methodological solution – which combines the cognitive elements of the students' thinking and the methodological possibilities that develop digital competence – contributes to the transition of the pedagogical approach. The research focus of my pedagogical experiment was the following: which cognitive elements and techniques make the interpretation of different historical sources effective? The course that I developed offers specific algorithms related to the cognitive elements and thinking processes in order to improve efficiency.

My goal was to activate students in order to improve pedagogical success. Based on the results, it can be stated that more time should be dedicated to the development of the cognitive elements of critical thinking during class activities as well.

In my research, I confirmed or rejected the hypotheses with different methodological procedures.

**$H_1$: The success rate of solving a History test which is related to the cognitive elements of critical thinking depends on the level of prior knowledge in the field of History.**

With the History test tasks, the knowledge-based information of students were tested with summative assessment in the case of the single-case experiment group. Assessing the level of knowledge in the field of History made the comparative analysis of the results about knowledge and skills possible. In the case of the sample, the closest connection is between the results of the tests which assess the knowledge in History and the cognitive elements of critical thinking. It is a strong positive correlation, therefore, the level of knowledge in the field of History determines in 75% how developed the cognitive elements of critical thinking embedded in Historical teaching materials are. With the help of the partial correlation coefficient, it was possible to remove the effect of students' preference towards History (0.67). Therefore, the level of knowledge in the field of History determines in 67% with 99% probability, in the given sample, how developed the cognitive elements of critical thinking embedded in Historical teaching materials are.

**The hypothesis was confirmed.**

Based on the result, the **1. thesis** is the following: **The success rate of solving a History test which is related to the cognitive elements of critical thinking significantly depends on the level of prior knowledge in the field of History.**

**$H_2$: Students' performance related to the cognitive aspects of critical thinking embedded in historical teaching materials is significantly influenced by becoming familiar with the Neo LMS skill developing materials.**

I assumed that becoming familiar with the Neo LMS skill developing materials, and in addition, using ICT tools with a pedagogical purpose will result in the performance development of students concerning the cognitive elements of critical thinking. By comparing the results of the paper-based tests and e-tests in the case of the experimental groups, it was discovered that in the case of two groups, development indeed occurred, however, the result of 2 groups slightly fell behind their first test results. Based on the one-sample t-test, it can be stated at a 95% level of significance that the difference is not mere coincidence: the Neo LMS skill developing material had an effect on their results. In the case of the single-case experiment group, it was confirmed that the skill developing course had a significant effect on their results.

**In the case of the single-case experiment group, the hypothesis was confirmed.**

However, in the case of the other groups, the difference was not significant: the result of the paper-based test only has a 21% effect on the results of the experimental groups which became familiar with the Neo LMS skill developing material. The above-mentioned conclusion was also investigated with regression analysis, and that also confirmed that the hypothesis should be rejected in the case of the other experimental groups.

As a consequence, **the hypothesis cannot be regarded as confirmed.**

**$H_3$: The students' test results are more successful in an e-learning environment than in the case of paper-based tests when it comes to the assessment of the cognitive elements of critical thinking embedded in historical teaching materials.**

A regression analysis was performed with the results of the e-test which assessed the cognitive elements of critical thinking - the test was the dependent variable. Based on that analysis, the hypothesis was not confirmed. The hypothesis cannot be stated entirely confidently based on the results of the experimental groups. Most of the students performed more successfully than before, but this does not have significant explanatory power.

**The hypothesis was not confirmed.**

**$H_4$: There is a significant difference between the subsamples', which were formed based on the different classes, cognitive elements of critical thinking embedded in historical teaching materials.**

The difference seemed to be confirmed by the fact that there were differences between the mean values of the classes' results. However, whether these mean values indeed differ significantly, had to be determined by analysis of variance, because I had more than two one-dimensional samples. I assumed that the samples are from the same population, that is, they are homogeneous. Based on the F value, it can be stated that the groups can be seen as belonging to the same population (99.99%).

The results of the analysis of variance show that there is at least one (actually, more than one) group in the sample whose mean value differs from that of the others. With the help of the Tukey's test, it was possible to determine in pairs about the sample which of them are different ($p<0.05$).

**The hypothesis was confirmed.**

Based on the result, the **2. thesis** is the following: **A significant difference can be shown when it comes to the assessment of cognitive elements of critical thinking embedded in historical teaching materials between the performance of subsamples, which were formed based on the different classes.**

In connection with the 2. thesis, a further research task could be to investigate which variables might account for this difference besides the level of knowledge in this field (see 1. thesis).

**$H_5$: The performance of male students is significantly better in the case of the test which assesses the cognitive elements of critical thinking embedded in historical teaching materials than that of female students.**

In the case of the single-case experiment group, the performance of male students in the test that assessed the level of historical knowledge was significantly better than that of female students with a 99.9% probability (the number of males was 10, the number of females was 17). Based on the data, this was not due to coincidence, that is, the male students performed significantly better in the area of historical knowledge in the given sample. The above-mentioned statement was assumed, because historical knowledge has a significant explanatory power when it comes to the success rate of the performance concerning the cognitive elements of critical thinking.

The difference between male and female students was show with a two-sample t-test. In the investigated sample, the number of males was 76 (39%), and the number of females was 118 (61%). The hypothesis must be rejected based on the investigation. Based on the Levene's test, the variance of the two samples can be considered to be equal concerning the use of cognitive elements of critical thinking embedded in historical teaching materials

(with a 85.4% probability). The average performance percentage of females is better with 1.56%, but the difference between the two samples is not significant in the case of the paper-based test, therefore, the difference between them is most probably coincidental.

**In the case of the experimental groups and the paper-based tests, the hypothesis was not confirmed.**

However, in the case of the e-test, it was confirmed that the difference between the two samples is not coincidental. The number of males was 54, the number of females was 97 in the case of the e-test. Based on the Levene's test, the variance of the two samples can be considered to be equal concerning the use of cognitive elements of critical thinking embedded in historical teaching materials in the e-test, therefore, it was possible to perform the two-sample t-test. Based on the results, it can be stated at a 97% level of significance that the performance of male students is significantly better in the case of the e-test which assesses the cognitive elements of critical thinking embedded in historical teaching materials than that of female students.

**The hypothesis was confirmed.**

Based on the result, the **3. thesis** is the following: **The performance of male students is significantly better in the case of the e-tests which assess the cognitive elements of critical thinking embedded in historical teaching materials than that of female students.**

**$H_6$: Students' preference towards History considerably determines their performance in the case of the test which assesses the cognitive elements of critical thinking embedded in historical teaching materials.**

Based on the measure of the correlation coefficients and their significance, students' preference towards History does not significantly determine their performance when it comes to the cognitive elements of critical thinking embedded in historical teaching materials (the explanatory power is 21%). The regression analysis refined this further, and students' preference towards History had less explanatory power: based on the analysis, it only contributed to the students' performance concerning the cognitive elements of critical thinking embedded in historical teaching materials with 4%.

**The hypothesis must be rejected** with a 99.9% probability.

**$H_7$: The students' cognitive elements of critical thinking embedded in historical teaching materials are not influenced by the parents' educational qualifications.**

A regression analysis was performed (with the results of the e-test which assessed the cognitive elements of critical thinking being the dependent variable). The parents' educational qualifications do not have explanatory power in the given sample concerning the students' performance related to the cognitive elements of critical thinking embedded in historical teaching materials. The performance of students is not influenced by the parents' educational qualifications, they account for 4% of the results.

**The hypothesis was confirmed.**

Based on the result, the **4. thesis** is the following: **The parents' educational qualifications do not significantly influence the students' performance related to the cognitive elements of critical thinking embedded in historical teaching materials.**

**$H_8$: The text interpretation of those eleventh- and twelfth-graders is efficient who are motivated towards History.**

I investigated the hypothesis by establishing the connection between the reading comprehension tasks (Tasks 7-9 in the e-test) and the data related to motivation by having access to the background information of students (attitude towards History, reading historical books, grade in History). I performed a regression analysis by considering the reading comprehension tasks of the e-test which assessed the cognitive elements of critical thinking embedded in historical teaching materials to be the dependent variable, and to further verify the result, I investigated the correlation as well: a weak positive correlation can be shown, but based on the available data, the hypothesis was not confirmed.

**The hypothesis must be rejected.**

The presented results, which fill a research gap in the area of public education together with the empirical and qualitative conclusions, can form the basis for further research. One of the research possibilities is to transform the Neo LMS material which was created for skill development into a blended learning methodological material. The skill developing should be executed with assistance in the classroom, and its effectiveness could be compared to the research data presented here. In one of the groups, this method proved to be effective. The skill development result of this group is better than the average performance of experimental groups. A suggested research question: Can a blended learning methodological skill developing material improve the students' cognitive elements of critical thinking significantly?

Based on my conviction and research results, the research-based or problem-oriented learning process develop the thinking processes the most, and they proved to be the most effective from the investigated methodological elements. Solving the projects and dealing

with them in groups contribute to the 21st century skills development of students. Establishing, assessing and developing the elements of effectiveness check in this field in an e-learning environment would assist the digital transition. A suggested research question: What quantitative and qualitative research methods can be combined with the suggested effectiveness check?

The Historical Thinking Skills Rubric[4] which is related to the topic could broaden the possibilities of formative evaluation in the case of the skill developing course. The rubric mentioned above is a tool that enables assigning scores to the performance of students, which then can be evaluated on the basis of the scores. At the same time, these criteria can assist further information acquisition in the topic.

Further research might be encouraged by creating a summarizing theoretical model which focuses on the historical thinking process in an e-learning environment. It would be possible to create the improved taxonomy for e-tests in History and the related tasks as well – based on the ideas of the ARCH Historical Thinking Skills Rubric, on the elements of digital taxonomy (*Turcsányi-Szabó*, 2011), and on the created two-dimensional model of the critical thinking e-test.

[4] URL: https://tinyurl.com/Historical-Thinking-Skills (2019. 12. 02.)

## The author's publications in the topic of the dissertation


Érsek Attila (2004): *A kritikai gondolkodás mérésének eredményei történelemből a 11. évfolyamon.* Szegedi Tudományegyetem BTK, szakdolgozat.

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Érsek Attila (2014): *A módszertani továbbfejlődés irányairól, avagy ami a minősítés után jön. A web 2.0 felhasználásának lehetőségei a tanítási-tanulási folyamatban.* In: Tóth László (szerk.) (2014): *Ellenőrzés a közoktatásban.* Raabe Tanácsadó és Kiadó Kft., Budapest. F 6 pp. 1-27.

Érsek Attila (2015a): *Változó történelemtanítás. Új technikák és módszerek a történelemtanári munkában.* Nyugat-magyarországi Egyetem Kiadó, Sopron. (Szerkesztette: Bakó Balázs)

Érsek Attila (2015b): *A történelmi kritikai gondolkodás kognitív elemeinek azonosítása Edu 2.0/NEO tanulási környezetben.* In: Keresztes Gábor (szerk.). Tavaszi Szél 2015 / Spring Wind 2015. IV. kötet. Eger; Budapest: EKF Líceum Kiadó; DOSZ pp. 79-96.

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Érsek Attila (2015d): *Megváltoztatja-e az Edu 2.0 a tanítási-tanulási folyamatokat, szokásokat?* In: Kádár Judit – Szép Beáta – Nagy Krisztina – Zsámba Renáta (szerk.): International Strategies in Higher Education - Conference Proceedings. Eszterházy Károly College, Eger. (June 3-5, 2014) pp. 134-151.

Érsek Attila (2018): *A történelmi kritikai gondolkodás kognitív elemeinek fejlesztési, tesztelési lehetőségei értelmező képelemzés segítségével web 2.0-ás tanulási környezetben.* In: Agria Média 2017. Eger, Líceum Kiadó. pp. 91-97.

Érsek Attila (megjelenés alatt): *Digitális eszközök tanulókra vonatkozó kognitív hatásainak feltáró jellegű kismintás kutatásai.* Eszterházy Károly Egyetem, Eger.

## Conference presentations in the topic of the dissertation

International Strategies in Higher Education Conference 2014 (Eger, 2014. június 5.) E-learning as a tool for internationalization szekció: *Megváltoztatja-e az Edu2.0 a tanítási-tanulási folyamatokat, szokásokat?*

Agria Media 2014, ICI-13 és az ICEM 2014 Információtechnikai és Oktatástechnológiai Konferenciára és Kiállítás (Eger, 2014. 10. 09.) Az e-tananyag és rendszerfejlesztés új megoldásai szekció: *Hatással van-e a web 2.0 a tanítási-tanulási folyamatra?*

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