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Students' Knowledge in File Management After Elementary School

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Abstract

According to the Hungarian Frame Curriculum, teaching informatics starts in grade 6 as a compulsory subject, with only one class a week. By this time students are regular smartphone and/or computer users, primarily applying trial-and-error based computer problem-solving methods. In this way they gain knowledge through their own experiences and observations, without any guidance. In the Frame Curriculum the first topic is file management, which is the basis of operating system use and further data-handling procedures. Due to the late introduction of informatics in schools and the different levels of knowledge that students bring into the classes this topic is difficult to teach. In addition, this topic is not sufficiently emphasized and practiced, since both students and teachers consider it to consist of elementary, born-with knowledge. Consequently, students evaluate their knowledge as high, but practice does not justify this assessment.

Our research team invented and applied a knowledge-transfer based webtable-datatable conversion process to cover file-, elementary data- and webpage-management. In order to quantify and prove the efficiency of the method, we tested grade 9 students in experimental and control groups, covering the topic with our novel and with traditional methods, respectively. During the research period, the students were tested in two rounds: in a pre-test, before they studied the topic to record what knowledge is brought into classes, and in a post-test, after the intervention. The test included tasks involving error message interpretation, recognizing file types based on default associations and conventions, explaining algorithms, and handling data files. This article presents the results of students in the pre-test administered in grade 9, starting their secondary education. It was found that when studying this topic with the trial-end-error methods, students do not build up knowledge in long-term memory, cannot see the algorithms behind fundamental

file management processes, and consequently cannot solve real-world problems effectively. These results clearly show that there is a need for changes in the approaches adopted to file management.

Keywords: IT education, file management, elementary school

1. Introduction

The Hungarian Frame Curricula [1][2] is developed on the basis of the National Base Curricula [3]. These documents tend to follow Prensky's [4] ideas, i.e. that the members of the Z-generation are digital natives, so they do not need ICT (Information and Communications Technology) education. This resulted in a drastic reduction in the number of ICT classes in the Frame Curricula. The number of classes decreased from 9.5 [1] to 5 [2], while the amount of knowledge items present in the curricula remained unchanged. This drastic decrease may be the reason that teachers neglect the proper teaching of file management.

The results of PISA 2009 Students On Line [5] clearly shows that the Frame Curricula and the traditional methods do not develop the students' digital literacy, or their algorithmic and computational thinking skills efficiently in Hungary. The country is ranked 15th of the 19 participating countries. Furthermore, analyzing the connection between the students' PISA scores and computer use at schools reveals that in this respect Hungarian students are the weakest.

According to researchers [6][7][8][9], computational thinking is the fourth basic skill along-side writing, reading and mathematics. Consequently, like the other three skills, it should be improved and be a part of the core fundamentals of education [10][11][12]. Furthermore, ICT education should not focus on tool-, interface-, and environment-usage, but rather on problem-solving with an algorithmic focus [10][13]. Settle's [14] work at the Lab Schools demonstrates that computational thinking can be integrated into high-school courses. She considers the application and integration of computational thinking especially important in non-computational environments as well [14].

2. Students' knowledge of file management

The aim of this testing is to measure the students' algorithmic and computational thinking skills through knowledge-transfer elements connected to file management at the beginning of their secondary education.

2.1. Participants, sample

We tested first-year secondary school students' file management skills in grade 9. The measurement involved two schools in Hungary. Considering all groups, 109 students completed the pre-test.

2.2. Previous studies

In 2018 a Mini-Competence Test [15][16] with similar tasks was conducted in 93 schools with 8,880 participants. Students from grades 7 to 10 took part in the measurement. In this paper we only focus on the data of grade 7 and 8 elementary school students of the previous test, 1,562 and 1,643 students, respectively. The measurement included a self-evaluation part where the students were asked to mark how familiar they are with the given ICT topics, including file management (Figure 1).

How would you rate your knowledge on the following topics? (0: not at all, 5: excellent)

	How familiar you are with the topics?							Learn in school?	
	Circle the correct number.							yes	no
file-management	0	1	2	3	4	5		☐	☐
word processing	0	1	2	3	4	5		☐	☐
spreadsheets	0	1	2	3	4	5		☐	☐
database management	0	1	2	3	4	5		☐	☐
algorithmizing, programming	0	1	2	3	4	5		☐	☐
management of resources, credibility	0	1	2	3	4	5		☐	☐

Figure 1: An extract of the Mini-Competence Test self-evaluation part, inquiring about familiarity with the file management topic

Figure 2 reflects the results of the file management topic in the self-evaluation task. No significant differences were revealed between grade 7 and 8 students. Most of them (79.06%) choose options 3, 4 or 5, (good, very good and excellent, respectively). Note, that 32.64% of the students selected the highest (5) option. Figure 3 shows the proportion of respondents who studied file management in school, with 14.72% of grade 7 and 8 students admitting that they did not study file management in school.

In the diagram on Figure 6, the correlations between the students' answers for both their knowledge level and for the source of their knowledge are presented. Most of the students marking 3, 4, or 5 also indicated that a high proportion of them studied the topic in schools: 80%, 30.33%, 37.59%, respectively. Interestingly, those students who do not study file management in school are confident they have knowledge of this topic (mark 4-5: 40.04%). This leads to the conclusion that despite having studied the topic, the students do not necessarily feel that they have mastered the topic.

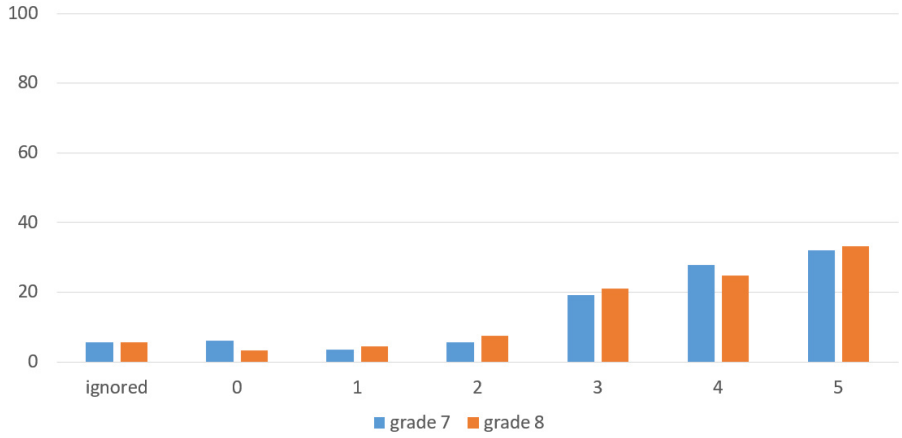

Figure 2: The self-assessment results of grade 7 and 8 students regarding the topic of file management

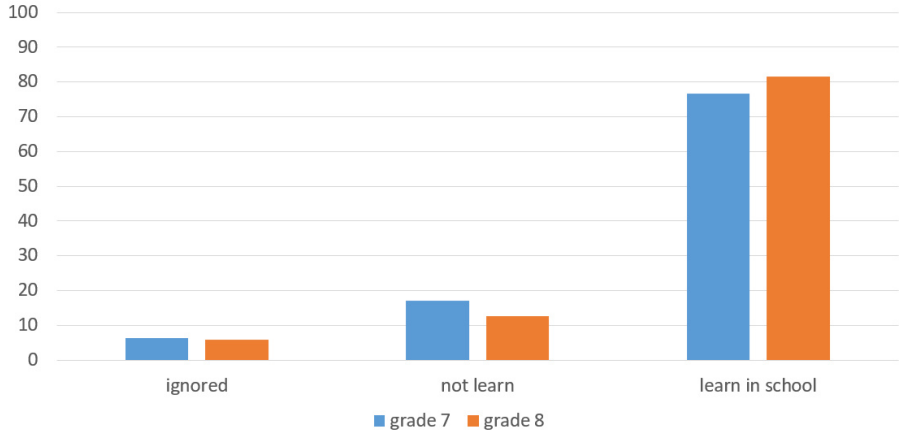

Figure 3: The results of students' answers for the self-assessment task considering whether they studied file management in school or not

2.3. Measuring prior file management knowledge in grade 9

2.3.1. Tasks and results

Task F1 (section 4) was about the interpretation of the Windows file rename warning message, where students had to choose from a number of given answers. Note that we allowed students to mark multiple answers, while only one of them was correct. 4.59% of the students marked only the correct answer; considering mul-

tiple selections, the correct answer was chosen in the lowest proportion (15.60%) (Figure 4). The high proportion of incorrect answers shows that students have no knowledge about data file types and the role of extensions.

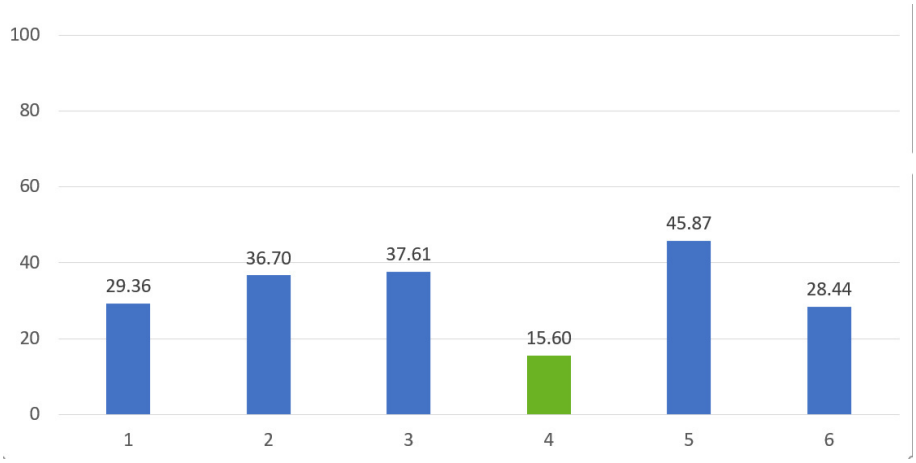

Figure 4: The distribution of the selected answers in Task F1

This statement is further supported by the results of Task F2: "What happens when we double-click on a document file?". Based on the answers, the students are only familiar with the last step (opening) of the 4-step process. This is in accordance with the results of Task F1, as students are not only unfamiliar with the roles of extensions, but with their connection with the operating system, as well.

In Task F3 the students had to provide an answer as to how a spreadsheet can be converted into a text file. Despite the task stating that only one answer was to be selected, 8.26% of the students ignored this instruction (Table 1). 38.53% of the students marked the correct answer together with others, while only 35.78% marked only the correct option (Table 1).

Task F4 inquired about the cut file operation: "What happens when you cut a file?". Similarly to the previous tasks, the students had to choose their answers from the listed options. We allowed multiple selections even though that there was only one correct answer. 35.78% of the students completed this task successfully, while 35.90% marked the correct answer besides other options (Table 2).

In Task F5, the students had to decide the types of the listed files, considering their names and extensions. Based on Tasks F1 and F2, we have found that the students are not familiar with the definition of various extensions. The results of the current task support and extend this finding. This can be explained by the widespread use of the File Explorer present in Windows systems, where the extensions of the files are hidden by default.

We accepted the options listed in the second row of Table 3 as correct solutions (if the students only marked one answer). 37.31% of the students completed the

		N	%
Conversion		16	13.68
Export		6	5.13
Modifying the extension		13	11.11
Google search		10	8.55
Save as, selecting the new filetype	correct + other	42	35.90
	only correct	39	35.78
Association		6	5.13
Import		6	5.13
Save as, changing the filetype manually		13	11.11
Online converter		2	1.71
Open in Notepad		3	2.56

Table 1: The distribution of answers in Task F3, highlighting the correct answers.

	moved to Recycle bin	deleted	appears in a new folder	nothing happens	a copy is created
%	8.26	0.92	3.67	1.83	17.43

Table 2: The distribution of student wrong answers along with the correct answer in Task F4

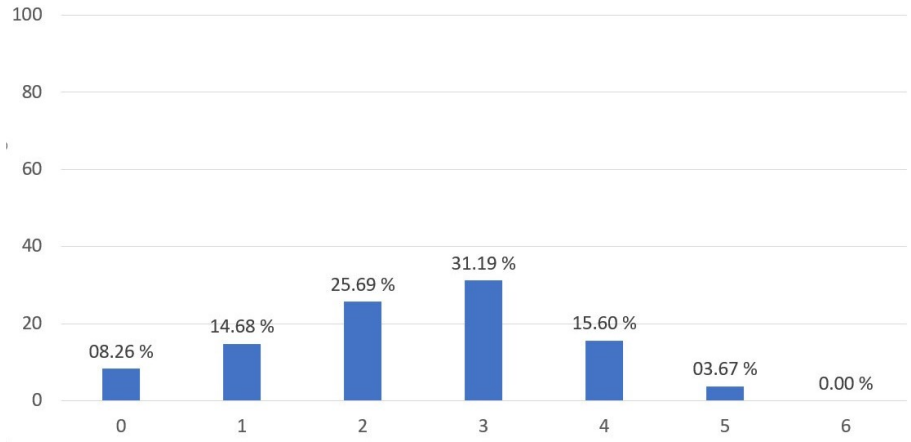

Figure 5: The number of correctly recognized the file types in Task F5

task (Table 6). Based on the diagram shown in Figure 5, there were no students who provided correct answers for each file. Most of them recognized two or three

	filename					
	A.xls.txt	B.txt.xlsx	C.csv	D.docx.	xlsx	…docx
correct answers	text file	excel-workbook	text file	neither	neither	word-document
correct (%)	67.89	39.45	27.52	8.26	22.94	57.80
multiple choice (%)	8.26	4.59	0.92	1.83	1.83	5.50

Table 3: The correct solutions and the proportions of student answers in Task F5

file types correctly.

	correct answers	%
F6_1.	T	45.87
F6_2.	F	82.57
F6_3.	F	22.02
F6_4.	T	49.54
F6_5.	F	44.95
F6_6.	F	29.36
F6_7.	T	41.28
F6_8.	F	30.28
F6_9.	F	31.19
F6_10.	F	43.12
F6_11.	F	22.94
F6_12.	T	61.47

Table 4: The solutions for Task F6 and the proportion of correct answers.

To analyze the connection between the answers, we conducted a correlation analysis using Guilford's approach [17]. Based on our matrix, no solid correlation could be found except "low correlation, relationship definite but small" [17] occurrences (±0.2–0.4).

We designed Task F6 to have multiple questions inquiring about the same knowledge items using differing approaches and phrasing. In this way we could gather data about the conscious choices and reliable knowledge of students. Each question could be answered with the following options: true, false or I don't know (Table 4). In summary, 42.05% of the students completed the task correctly.

Table 5 shows the knowledge items required for solving Task F6. The students had to be familiar with the concept of extensions, assignment, file types and opening, editing and saving files. Table 5 shows which statements rely on what knowledge items. We expected correlations between answers for statements relying on the same items.

We completed a correlation analysis of the answers, considering the knowledge items required for the solution. The results show a weak correlation between the answers (below 0.4). Interestingly, we could not find any connection between the

	knowledge-items				
	extensions	with/without assignment	file types	editing/saving files	opening files
F6_1.	+	+			
F6_2.	+	+			
F6_3.	+	+		+	
F6_4.		+			+
F6_5.		+			+
F6_6.		+	+		+
F6_7.		+	+		
F6_8.	+		+		
F6_9.			+		+
F6_10.			+		+
F6_11.			+	+	
F6_12.			+	+	

Table 5: The knowledge items required (marked with +) for correctly answering the statements

	correct answers (%)
F1	4.59
F2	22.02
F3	35.78
F4	52.29
F5	37.31
F6	42.05
total	32.34

Table 6: The rate of correct answers for each task in the file management test

correlations and the knowledge items, as the results of the analysis yielded a randomized pattern.

To summarize the results for each task, Table 6 shows the correct completion rates of the file management test. The students completed the test with varying results. Considering the whole test, 32.34% of them completed it successfully, which is a lower proportion than the results expected on the basis of the self-assessment test in section 2.2 (p=0.000).

The results of the file management test have been converted to a scale of 0-5 (Figure 7) to make them comparable to the results of the Mini-Competence Test (Figure 6). Most of the students have confidence in their knowledge, despite the fact that in the file management test none of them reached knowledge level four.

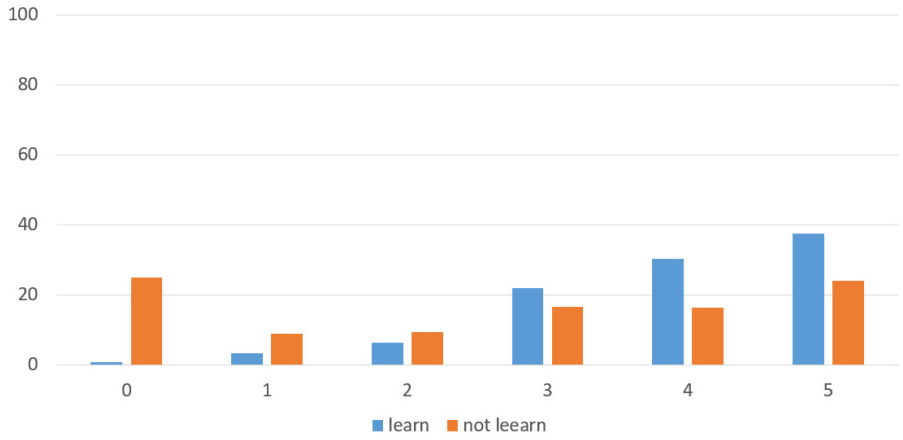

Figure 6: The summarized results in the file management self-assessment task and the proportion of those studying the topic at school

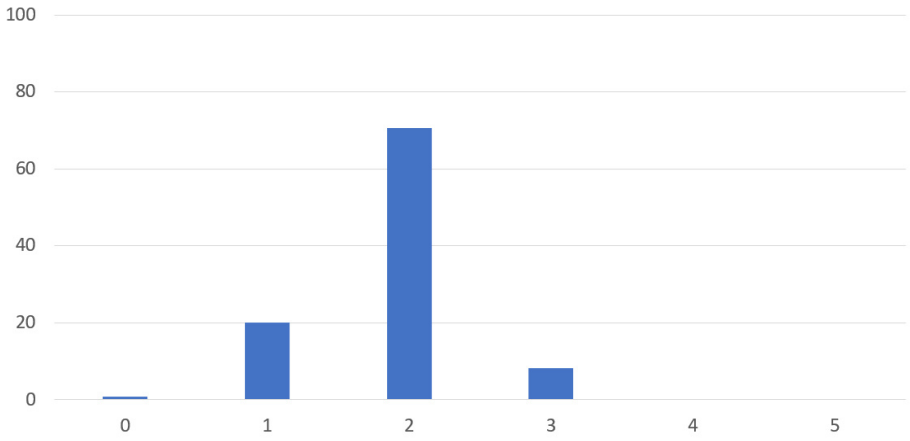

Figure 7: The results of the file management test displayed on a scale of 0-5

3. Conclusion

ICT education start as a mandatory subject in grade 6 in Hungary with 1 class per week. By that time, students are regular users of smartphones, laptops, and/or desktop computers. It follows that they met and started learning the topic of file management by themselves. This leads to students showing unsupported confidence when the topic first emerges in grade 6, causing the class to move forward to

different topics after a brief introduction. The results of the self-assessment part of the Mini-Competence Test show that students are overconfident about their knowledge. This shows a connection with the results of the PISA 2009 measurement.

The results of our file management test and measurement shows that the students lack basic knowledge in the topic, such as extensions, cut, file type, etc. As these items are frequently revisited and required in ICT education and in everyday computer use as well, this deficiency cannot be ignored. Furthermore, the knowledge students do have is fragmented, which resulted in randomized answers in the test. Moreover, their answers were inconsistent and showed no correlation in tasks requiring the same knowledge items.

The students (as digital natives) after completing primary education – with a minimum of 3 years of ICT education – do not possess the required level of knowledge of file management that would enable the conscious use of file operations and data handling. Therefore, the optimal and effective use of the available ICT lessons is recommended, but this can only be possible with novel approaches. The file management topic demands a greater emphasis within the wider subject area, accompanied by the correct and accurate use of the terminology.

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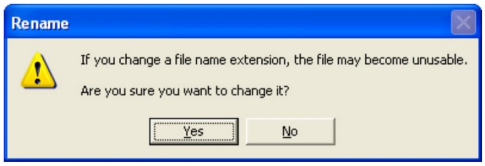
4. Appendix

F1. What action does it trigger, and how would you comment on the following message? (you can mark multiple options)



- ☐ If the extension of the file changes, the computer will not be able to recognize the file.
- ☐ Changing the extension of the file could result in data-loss.
- ☐ The extension of the file changes and the file becomes unusable.
- ☐ Changes what program is associated with the extension, but the file remains usable.
- ☐ If we modify the extension to a wrong one, the file becomes damaged and unusable.
- ☐ The different coding of the new extension makes the content unreadable by the user.

F2. What happens when we double-click on a document file? (for ex.: zz.jpg, zz.html, zz.ods, zz.xls)?

.....

.....

F3. How could you convert a spreadsheet (.xlsx or .ods) into a text document (.csv or .txt)? (you can mark only one option)

- ☐ Conversion.
- ☐ Export.
- ☐ Modifying the extension.
- ☐ Google search.
- ☐ Save as, selecting the new filetype.
- ☐ Import.
- ☐ Association.
- ☐ Save as, changing the filetype manually.
- ☐ Online converter
- ☐ Open in Notepad.

F4. What happens when you cut a file? (you can mark multiple options)

- ☐ It is moved to the Recycle bin.
- ☐ It is deleted permanently.
- ☐ It appears in a new folder.
- ☐ It is placed on the clipboard.
- ☐ Nothing happens.
- ☐ A copy is created of the file.

F5. Select what types are the following files! (you can mark multiple options)

	text file	word-document	excel-workbook	none of these
A.xls.txt	☐	☐	☐	☐
B.txt.xlsx	☐	☐	☐	☐
C.csv	☐	☐	☐	☐
D.docx.	☐	☐	☐	☐
xlsx	☐	☐	☐	☐
…docx	☐	☐	☐	☐

F6. Decide whether the following statements are true or false! Circle the appropriate letter! (true = T, false = F, I don't know = N)

1. The program associated with opening a file is based on the file's extension.	T	F	N
2. The program which opens a file is permanently associated with it.	T	F	N
3. A file is always associated with the program in which it was made.	T	F	N
4. A webpage can be opened in a text and spreadsheet program simultaneously.	T	F	N
5. A webpage can only be opened in a text editor if it is associated with its extension.	T	F	N
6. A webpage can be opened with a link (Ctrl + click) in a text editor.	T	F	N
7. The document files are associated files which open with a program.	T	F	N
8. Modifying the extension of a data file changes its type as well.	T	F	N
9. If I open a text file in a spreadsheet management environment, it automatically changes the type of the file into the spreadsheet type.	T	F	N
10. If I open a webpage in a text editor, the extension of the file is automatically changed.	T	F	N
11. Upon saving a webpage, it can be converted to a word-document type.	T	F	N
12. Tabbed text can be converted into a table in a text editor program.	T	F	N