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Teaching Mathematics and Computer Science

Computer cooking vs. problem solving

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Abstract. Computer cooking is a task-related phenomenon where students (end-users) must blindly follow a long list of orders without any connection to the content of the problem, if there is any. Despite its low efficacy, this method is widely used and accepted in informatics both in the learning-teaching process and testing. The National Base Curriculum 2020 in Hungary is in complete accordance with the 'Informatics Reference Framework for Schools', but the course books hardly use the latest results of computer education research. The present paper provides examples of how the results of computer education research can be integrated into teaching-learning materials and classroom practices and discusses the effectiveness and consequences of the different solutions, where tool-centred approaches are compared to problem-focused solutions.

Key words and phrases: informatics curricula, problem solving, knowledge-transfer, subject integration, course books.

MSC Subject Classification: 94-01.

Introduction

Classes of informatics

Computer studies and informatics has been taught as a compulsory subject in Hungary since 1995. In 2020, in accordance with the National Base Curriculum (NBC2020) and its accompanying frame curricula (FC) (OFI, 2020a, 2020b, 2020c), a new subject entitled Digital Culture was introduced. The subject is compulsory in Grades 3–11, with 1 or 2 classes per week (Table 1). In this new scenario, the number of compulsory classes is more than double the classes of

	1	2	3	4	5	6	7	8	9	10	11	12
NAT 2012						1	1	1	1	1		
NAT 2020			1	1	1	1	1	1	2	1	2	

Table 1. The number of classes per week in NBC 2020

NBC 2012 (NBC2012). The course books for Grades 5 (Lénárd et al., 2020) and 9 (Varga et al., 2020), for Grades 6 (Abonyi-Tóth et al., 2021a) and 10 (Abonyi-Tóth et al., 2021b), for Grades 3 (Lénárd et al., 2022), 7 (Abonyi-Tóth et al., 2022a) and 11 (Abonyi-Tóth et al., 2022b), and finally for Grades 4 (Lénárd et al., 2023) and 8 (Abonyi-Tóth et al., 2023) were published in 2020–2023, respectively, in accordance with the delayed introduction of the subject (NBC2020).

The timing of the publication reveals that for Grades 5 and 9 (in 2020), 6 and 10 (in 2021), and 7 and 11 (in 2022) (in the sequence of publication) the authors of the course books did not know the contents of all the previous grades. Consequently, these books cannot and do not rely on knowledge built up in previous classes. It is also obvious that books published later consist of verbatim copies of sections from previously published books, which not only do not serve to build up knowledge, but also constitute plagiarism (e.g., compare Grade 9 course book, pp. 207–227 (Varga et al., 2020) and Grade 10 course book, pp. 105–131 (Abonyi-Tóth et al., 2021b). In general, we can conclude that the first students who study according to BNC 2020 are in Grade 3 in 2022 and will finish secondary education in 2032.

Problem-solving approaches

The analysis of the published course books reveals that even though the name of the subject has changed from Informatics (NBC2012) to Digital Culture (NBC2020), and is in complete accordance with the Informatics Reference Framework for Schools (Caspersen et al., 2022), considering the problem-solving approaches, not much improvement can be detected. The contents, both the explanatory materials and the tasks, are primarily definitive (Skemp, 1971) and/or tool-centred (Baranyi & Gilányi, 2013; Baranyi et al., 2015; Wolfram, 2015, 2020), paying no attention to the students' age, background knowledge, level of abstraction, interest, cognitive load (Sweller et al., 2011), nor how fast and slow thinking works (Kahneman, 2011; Csernoch, 2017). In general, the results of both education (Hattie, 2012) and computer education research are ignored (Malmi et al., 2019), while folk-pedagogy is reinforced (Lister, 2008).

Considering the topics of the frame curricula and the course books, and these compared to the assigned classes, it is obvious that the subject cannot achieve its original aim, which is to develop students' computational thinking skills (Wing, 2006). With the planned schedule of the materials in question, there is no opportunity to harmonize computational thinking with the 3Rs. It does not provide enough time and space to practice, understand, reveal connections, nor build up knowledge-transfer elements. We can conclude that there is no place for effective learning. Furthermore, there are hardly any teachers and authors who can make a distinction between practiced and expert teachers, even though it is expert teachers who can make the difference (Csernoch, 2017). One of the consequences of ignoring these research results is that the authors of the course books cannot distinguish between novices and experts, and do not provide guidance to teachers on how to assist students with different background and need (Kirschner et al., 2006; Sweller et al., 2007).

low-mathability tool-centred	high-mathability problem-centred
glossary and dictionary materials	explanations according to the students' age and background knowledge
listed tasks without solutions and guidelines	solutions with complete guidance
tasks with tool-centred computer solutions	concept-based problem-solving
decontextualized tasks with typing	source files are provided and topics are borrowed from other subjects
ignoring knowledge-transfer	data- and algorithms-driven solutions
topics are taught in isolation	connections made between the topics of informatics
there is no effect on other subjects	informatics influences other sciences

Table 2. The type of materials and tasks in the NBC 2020 course books (left) and their high-mathability alternatives (right)

The analysis of the Digital Culture course books reveals tool-centred, low-mathability materials (Baranyi & Gilányi, 2013; Baranyi et al., 2015; Wolfram, 2015, 2020) (Table 2), which can be categorized as follows:

- *Do-What-You-Want* (DoWYW). In these tasks a sample picture is presented without any specification (sample presented in section Minimal guidance and its consequences).
- *Do-What-You-are-Told* (DoWYT). A mixture of data collection, design, creating, and discussion is presented, in a rather arbitrary order. Students are told what must be done, without leaving space for problem solving (sample presented in section Alternative solutions).
- *Do-Error-Yearn-Error* (DoEYE). These tasks belong to a group in which only erroneous solutions can be used. They are primarily time-consuming bricolage which must be avoided (sample presented in section Forced errors).

Alternative solutions

In this section, one of the many tool-centred presentation tasks and an alternative concept-based solution are described and accompanied by a short discussion section. Furthermore, since the Grade 5 book (Lénárd et al., 2020) was published earlier than the Grade 3 (Lénárd et al., 2022) and 4 (Lénárd et al., 2023), knowledge which should be built up in Grade 3 and 4 is totally ignored. In the Grade 5 book (Lénárd et al., 2020), the false assumption that students in the previous classes have not studied presentations and text management is obvious, since we can find the title "Our first presentation" and everything starts off from the very beginning. (In a similar way, in the Grade 9 book, p. 97, the title "Our first program" can be found (Varga et al., 2020), after students had studied six years of programming in Grades 3–8 (Lénárd et al., 2020, 2022, 2023; Abonyi-Tóth et al., 2021, 2022a, 2023).

The tool-centred approaches, the ignorance of previous studies and knowledge-items built up in long-term memory, and the overloaded disconnected contents take their toll: students cannot see the forest for the trees, the essence of informatics is hidden behind tools. One of the serious consequences of such course books and teaching approaches is that in spite of the new NBC and its goals (NBC2020) and the Informatics Reference Framework for School (Caspersen et al., 2022), the computational thinking skills of the students cannot be developed.

An example of computer cooking

Computer cooking (DoWYT) is a widely accepted and applied method in teaching informatics, as it is in the Digital Culture course books (Lénárd et al., 2020, 2022, 2023; Abonyi-Tóth et al., 2021a, 2021b, 2022a, 2022b, 2023; Varga et al., 2020) regardless of their being new publications. In these books, instead of focusing on real problem solving and informatics, a long list of orders is given, which students must follow blindly. This approach is called by Wolfram as 'evidenceled innovation' (Wolfram, 2015), and by Baranyi and Gilányi as 'low-mathability' (2013). Furthermore, the lack of the steps incorporated in Polya's concept-based problem-solving approach (Polya, 1945) produces a mixture of design, handling of tools, and discussion (if there is any).

Task

In this section of the paper, a presentation task from the Grade 5 course book (Lénárd et al., 2020), entitled Little Dipper (Kisgöncöl), is presented (Figure 2; sections in Figures 1, 3 and 4) and analysed (Table 3). In subsection Reformulated task, a possible concept-based problem-solving solution is detailed along with students' solutions and ideas, and in subsection Implementation in class, a possible implementation is outlined.

Little Dipper
We make a spectacular, albeit very simple presentation of the known constellation. In fact, any constellation can be presented in this way. You can download the cloud.jpg file from the book's website, but you can also download one you prefer from the internet.

Figure 1. A mixture of poorly worded task, data collection, and discussion feigning as a presentation task in Grade 5 (Lénárd et al., 2020) entitled Little Dipper

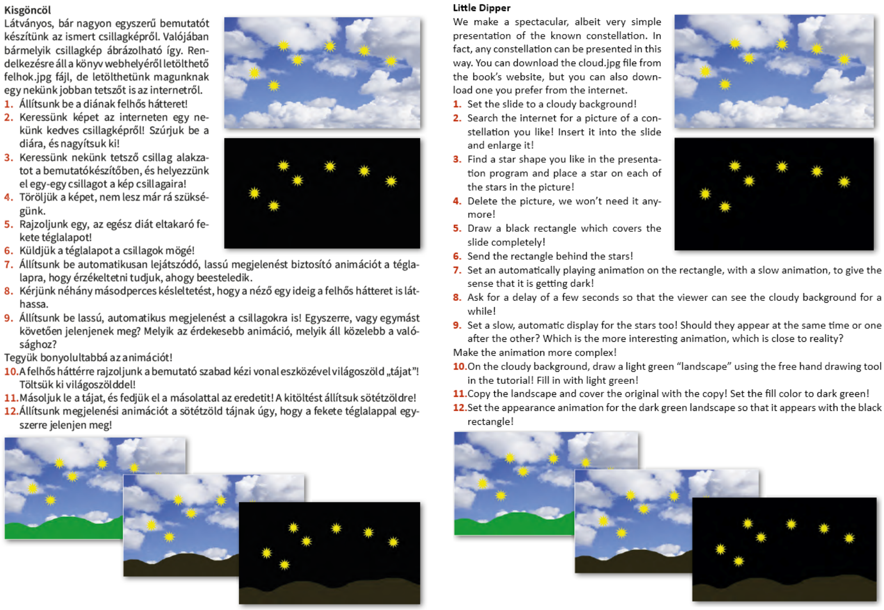
Following the introduction of the Little Dipper presentation task (Lénárd et al., 2020) (Figure 1, Table 3), the computer cooking starts (DoWYT) (Figure 3). A numbered list loaded with incorrect typographic solutions is presented (left alignment of the numbered list, unnecessary bold and red font style, justified alignment of the paragraphs, crowded text). There is neither a preparation phase, where students can analyse and understand the task, nor a design phase where the content and the solution can be outlined, and creative solutions encouraged. Students are told to do this, then that, in a long list. There is no reasoning, students must do what they are told, sometimes mixed with decontextualized options and discussions. Furthermore, instead of motivating students, a discouraging "Make the animation more complex!" sentence appears between the two sections of the list (Figure 4).

original task	explanation
Little Dipper (Kisgöncöl)	There is a spelling mistake in the title (Kis Göncöl).
We make a spectacular, albeit very simple presentation of the known constellation.	Actually, this is not the task. The task is to make a presentation where the night images come after the daylight images.
In fact, any constellation can be represented in this way.	This sentence belongs to the discussion part. First, the task should be clearly presented.
You can download the cloud.jpg file from the book's website…	This should be part of the data collection, not of the presentation of the task.
…but you can also download one you prefer from the internet.	This should be part of the data collection or the discussion, not of the presentation of the task.

Table 3. The analyses of the pretended presentation task in Grade 5 (left), its explanation and suggestions for modification (right)

Official solution

In Figures 2 and 3, the original (translation) sequence of orders to solve the presentation task of Little Dipper (Figure 1) (Lénárd et al., 2020) is presented.



Kisgöncöl

Látványos, bár nagyon egyszerű bemutatót készítünk az ismert csillagképről. Valójában bármelyik csillagkép ábrázolható így. Rendelkezésre áll a könyv webhelyéről letölthető felhok.jpg fájl, de letölthetünk magunknak egy nekünk jobban tetszőt is az internetről.

1. Állítsunk be a diának felhős hátteret!
2. Keressünk képet az interneten egy nekünk kedves csillagképről! Szúrjuk be a diára, és nagyítsuk ki!
3. Keressünk nekünk tetsző csillag alakzatot a bemutatókészítőben, és helyezzünk el egy-egy csillagot a kép csillagaira!
4. Töröljük a képet, nem lesz már rá szükségünk.
5. Rajzoljunk egy, az egész diát eltakaró fekete téglalapot!
6. Küldjük a téglalapot a csillagok mögé!
7. Állítsunk be automatikusan lejátszódó, lassú megjelenést biztosító animációt a téglalapra, hogy érzékeltetni tudjuk, ahogy beesteledik.
8. Kérjünk néhány másodperces késleltetést, hogy a néző egy ideig a felhős hátteret is lássa.
9. Állítsunk be lassú, automatikus megjelenést a csillagokra is! Egyszerre, vagy egymást követően jelenjenek meg? Melyik az érdekesebb animáció, melyik áll közelebb a valósághoz?

Tegyük bonyolultabbá az animációt!

10. A felhős háttérre rajzoljunk a bemutató szabad kézi vonal eszközével világoszöld „tájat”! Töltsük ki világoszölddel!
11. Másoljuk le a tájat, és fedjük el a másolattal az eredetit! A kitöltést állítsuk sötétzöldre!
12. Állítsunk megjelenési animációt a sötétzöld tájnak úgy, hogy a fekete téglalappal egyszerre jelenjen meg!

Little Dipper

We make a spectacular, albeit very simple presentation of the known constellation. In fact, any constellation can be presented in this way. You can download the cloud.jpg file from the book's website, but you can also download one you prefer from the internet.

1. Set the slide to a cloudy background!
2. Search the internet for a picture of a constellation you like! Insert it into the slide and enlarge it!
3. Find a star shape you like in the presentation program and place a star on each of the stars in the picture!
4. Delete the picture, we won't need it anymore!
5. Draw a black rectangle which covers the slide completely!
6. Send the rectangle behind the stars!
7. Set an automatically playing animation on the rectangle, with a slow animation, to give the sense that it is getting dark!
8. Ask for a delay of a few seconds so that the viewer can see the cloudy background for a while!
9. Set a slow, automatic display for the stars too! Should they appear at the same time or one after the other? Which is the more interesting animation, which is close to reality?

Make the animation more complex!

10. On the cloudy background, draw a light green "landscape" using the free hand drawing tool in the tutorial! Fill in with light green!
11. Copy the landscape and cover the original with the copy! Set the fill color to dark green!
12. Set the appearance animation for the dark green landscape so that it appears with the black rectangle!

Figure 2. The original Little Dipper task with an inconsistent use of exclamation marks and periods

Reformulated task

In the following, the previous task is reformulated (Figure 5) and a concept- and enquiry-based solution (Wing, 2006; Polya, 1945) – 'innovation-led evidence' (Wolfram, 2015) or 'high-mathability' (Baranyi & Gilányi, 2013) approach – is presented, which holds the following major steps:

- understanding the problem,
- collecting data,
- designing the presentation on paper,
- building the algorithm of the interpretation,
- creating the presentation,
- discussion.

In this solution, most of the steps are carried out without the presentation program, by using unplugged and semi-unplugged tools (e.g., Figure 5); the teacher

1. Set the slide to a cloudy background!
2. Search the internet for a picture of a constellation you like! Insert it into the slide and enlarge it!
3. Find a star shape you like in the presentation program and place a star on each of the stars in the picture!
4. Delete the picture, we won't need it anymore!
5. Draw a black rectangle which covers the slide completely!
6. Send the rectangle behind the stars!
7. Set an automatically playing animation on the rectangle, with a slow animation, to give the sense that it is getting dark!
8. Ask for a delay of a few seconds so that the viewer can see the cloudy background for a while!
9. Set a slow, automatic display for the stars too! Should they appear at the same time or one after the other? Which is the more interesting animation, which is close to reality?

Figure 3. The first section of the solution of the DoWYT Little Dipper task

Make the animation more complex!

10. On the cloudy background, draw a light green "landscape" using the free hand drawing tool in the tutorial! Fill in with light green!
11. Copy the landscape and cover the original with the copy! Set the fill color to dark green!
12. Set the appearance animation for the dark green landscape so that it appears with the black rectangle!

Figure 4. The second section of the solution of the DoWYT Little Dipper task

plays a coordinator role, letting students discover the possible solutions and not letting them become derailed.

Task

The original Little Dipper task (Figure 1) is reformulated by leaving out the possible sources of figures (data collection) and the indication of other constellations (discussion). Instead, the essence of the presentation is added, namely switching from the daylight scenario to the night. Furthermore, a hint to use animation is added, which only plays an explanatory role, and as such can be left out.

Little Dipper

We create a Little Dipper constellation presentation with a daylight and a night scenario, and switch from the daylight to the night scenario with an animation.

Figure 5. A possible rewording of the Little Dipper presentation task

Data collection

The second phase of the concept-based problem solving is data collection, which includes the revealing of background knowledge connected to the problem. The following list consists of the files and objects to create the presentation:

- *daylight background*: picture with sky and clouds – collected from the internet or downloaded from a private collection – and its source;
- *night background*: solid dark fill of the background of the slide;
- *stars*: shapes of the presentation program;
- *hilly landscape*: free form of the presentation program;
- *pattern of the constellation*: picture of the constellation, and its source.

Design

Design is carried out unplugged, using “old-fashioned” paper, pencil, and white board, or semi-unplugged, using digital drawing tools. (At this point, we must mention that the role of design connected to computer problem solving is first mentioned in the Grade 6 book (Abonyi-Tóth et al., 2021).

In this phase, the number of slides and the contents of the slides are decided; one of the students’ solution is presented in Figure 6:

- number of slides: 3 (original) or 4 (students’ suggestion) (see Figure 6)
  - title (students’ suggestion),
  - constellation with the cloudy scenario,
  - constellation with the night scenario,
  - sources;
- content (written and drawn on the paper slides)
  - title slide,
  - constellation slide(s): daylight/night background, stars in the constellation, light/dark hills,
  - source slide (sources of pictures, downloaded from the internet);

- layout of the slides (written on the background of the paper slides)
  – title slide: Title Slide layout,
  – constellation slide(s): Empty layout,
  – source slide: Title and Content layout;
- animation/transition (written on the background of the paper slides)
  – night scenario appears after the daylight with a delay.

Figure 6. A plan of the Little Dipper presentation created by a Grade 7 student

Algorithm of the interpretation

After deciding on the contents of the slides, the building of the algorithm of the interpretation (the creating of the presentation) follows:

(1) preparation (folder, searching for pictures if not completed in the data collection phase),

(2) creating the presentation (inserting the slides and selecting their layout according to the contents),

(3) setting up backgrounds (daylight, night),

(4) creating the constellation objects (drawing, naming, colouring, copying, grouping),

(5) creating the hilly landscapes (drawing, naming, copying, colouring),

(6) setting up the animation/transition (night slide appears with a delayed transition).

Creating the presentation (interpretation)

After the designing and planning phases (with the guidance and/or supervision of the teacher), the presentation is created. The role of the teacher primarily depends on the background knowledge of the students and the complexity of the newly introduced knowledge items. One solution with four slides is presented in Figure 7.

Figure 7. The Little Dipper presentation

Discussion: testing, debugging, generalization

The testing of the presentation is a continuous activity which accompanies the creation of the document. Any modification of the presentation calls for testing, which, in presentations, is the starting of the slide show, whether from the beginning or the current slide. The testing method is adapted from teaching programming. It is found that it works efficiently in handling digital text- or picture-based documents where it is not that obvious but accepted. The testing phase is accompanied by debugging, if necessary.

Following, or during, the testing and debugging phase, a brainstorming of possible solutions and/or the generalization of the task must take place. Some of the students' ideas are the following:

- further solutions (e.g., the original task with three slides and animation),
- further constellations on new slides,
- slide show settings (e.g., switching from daylight to night and back until a button is pressed).

Implementation in class

In a Grade 5 class with around 20 students, the Little Dipper task takes at least three hours, but four is more reasonable (missed classes, missing unplugged tools, missing presentation, unsaved files, changing computer rooms, uploading, downloading, saving files with new name(s), etc.). According to the frame curricula, altogether 1 or 2 classes are assigned to learning presentations both in Grade 3 and 4, the number of classes is 4+4 in Grades 5 and 6, and 3+3 more in Grades 7 and 8, which means that four or five similar tasks can be completed. According to the frame curricula (OFI, 2020a, 2020b, 2020c), with these four/five tasks (at the age of fourteen) studying presentations is finished, and this knowledge should be enough for the maturation exams (OFI, 2020d) and for the rest of students' lives. It is obvious that learning, and building up schemata and knowledge in long-term memory cannot be carried out in such a short time, with so few opportunities to practice (Baranyi et al., 2015; Wolfram, 2020).

One further shortening of the presentation chapter of the Grade 5 course book (Lénárd et al., 2020), and all the books of the series, is that informatics knowledge-transfer is ignored. It is never mentioned in the presentation chapter that animation is an algorithm, and this algorithm is clearly presented in the Animation Pane (Figure 8). The animation is as good an algorithm as the sequence of a micro:bit program. The Slide Show setting "Loop continuously until Esc" is nothing other than an infinite loop stopped by clicking on a button. Selection can be taught on a navigation slide with several buttons (e.g., "If you click on the English button, it takes you to the English page.", "If you click on the Home button, it takes you back to the navigation page.").

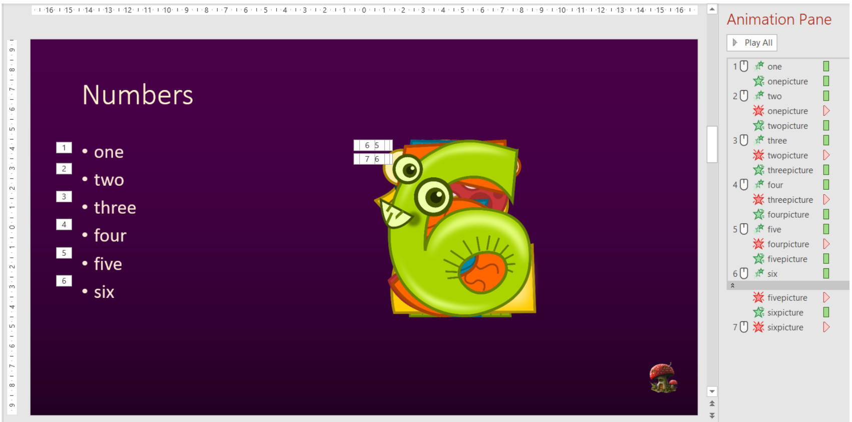


Figure 8. A slide with its Animation Pane presenting the sequence of the animation algorithm

Minimal guidance and its consequences

After years of learning text management in Grades 3–8, the Grade 9 course book presents the task shown in Figure 9 (Varga et al., 2020). The task is in accordance with the content of word processing chapters. However, there is no solution or guidance on how to solve this task properly (DoWYW) (lack of guidance; see Kirschner et al., 2006; Sweller et al., 2007), what problems, errors, difficulties can be faced in this complicated task (lack of learning from errors; see Rattenbury et al., 2017; Tulis et al., 2016; Metcalfe, 2017; McLaren et al., 2012; Ohno, 1988; Krafcik, 1988; Modig & Åhlström, 2018; Womack & Jones, 2003; Smalley, 2018; Sebestyén et al., 2022).

It is only mentioned in a later chapter (after studying text management for 6 years) that errors might occur in digital texts (pp. 9–10 and p. 28) (Ben-Ari, 1999; Ben-Ari & Yeshno, 2006; Csernoch, 2009, 2010, 2019; Csernoch & Biró, 2015), without specifying the nature and sources of these errors. These short sources only refer to three types of errors: grammatical errors, multiple spaces and enter characters, incorrect tab positions, leaving others unattended (Csernoch, 2009, 2010, 2017, 2019; Nagy & Csernoch, 2023; Csernoch et al., 2022, 2023, 2024). Studying word processing without teaching the possible errors and their categories, calling attention to their consequences, and ignoring all the research results connected with the subject leads to serious errors, bricolage, and a huge gap between studies and real world practices in text management (Rattenbury et al., 2017; Tulis et al., 2016; Metcalfe, 2017; McLaren et al., 2012; Ohno, 1988; Krafcik, 1988; Modig & Åhlström, 2018; Womack & Jones, 2003; Smalley, 2018; Sebestyén et al., 2022; Ben-Ari, 1999; Ben-Ari & Yeshno, 2006; Csernoch, 2009, 2010, 2019; Csernoch & Biró 2015; Csernoch, 2009, 2010, 2017, 2019; Nagy & Csernoch, 2023; Csernoch et al., 2022, 2023, 2024).

Word processing task without specifications

In the present section, an example of a word processing task is copied from the Grade 9 (Varga et al., 2020) course book (Figure 9) and analysed considering possible correct (Section 3.1.2) and erroneous (Section 3.1.3) solutions. In the course book, no instructions, guidelines, and/or solutions are added to the task.

Task

Students are requested to create the presented tear-out advertisement without any guidelines for the possible correct solutions (Figure 9). They are allowed to solve the problem with any possible tool. The teacher has the sole responsibility of deciding on the correctness of the students' solutions.

Prepare a tear-out advertisement as shown in the picture!

Figure 9. A DoWYW type of task in the word processing chapter of the Grade 9 course book (Varga et al., 2020). The quality of the picture is also questionable.

Correct solutions

Four possible correct solutions of the task in Figure 9 are presented in Figure 10. In these solutions, we focused on the formatting of the signature. The main ideas of the proper formatting are the following:

- a separate row for the signature, two cells in the row, and centre alignment on the paragraphs (upper left),
- a centre tabulator on the two paragraphs (upper right),
- left indentation and centre alignment on the two paragraphs (lower left),
- left indentation and centre alignment on the one paragraph; lines are broken with line break (lower right).

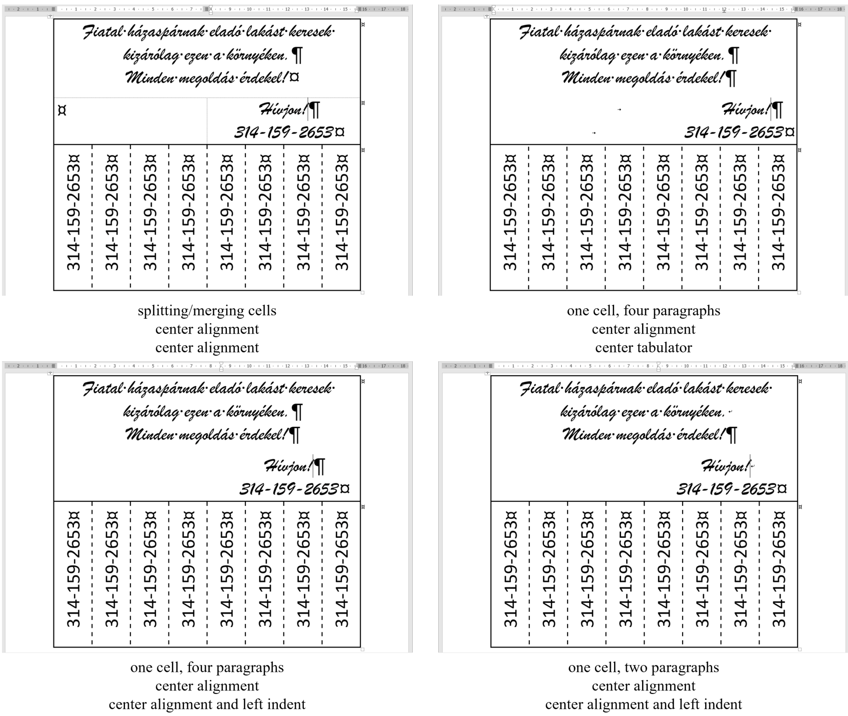


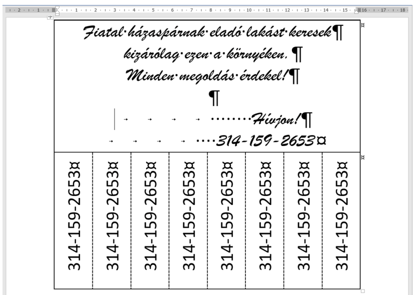
Figure 10. Four possible correct solutions of the task presented in Figure 9

Bricolage

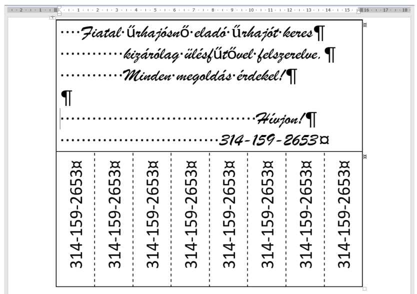
Figure 11 presents some possible incorrect solutions (bricolage; see Ben-Ari, 1999) which students and end-users frequently apply.

Evaluation

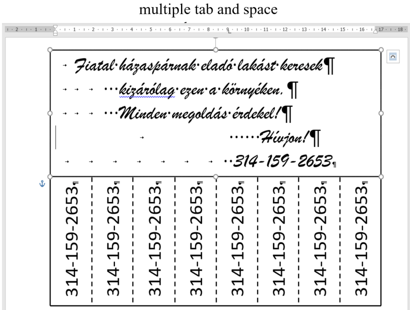
Without providing specifications (Figure 9), the goals of the task are not clear; several possible solutions can be imagined and must be accepted (Figures 10 and 11). In the previous section, the knowledge items connected to the presented correct solutions are listed (Figure 10). Depending on what the goals are, their evaluation must differ. If skills relevant to handling table cells, tabulators, indentation, paragraph- or line-breaks are focused on in the different solutions, then the different solutions have varying values. One further problem in connection with the DoWYW type of tasks is that without guidelines, incorrect solutions also fulfil the requirements – or the lack of requirements – of the task (Figure 11).



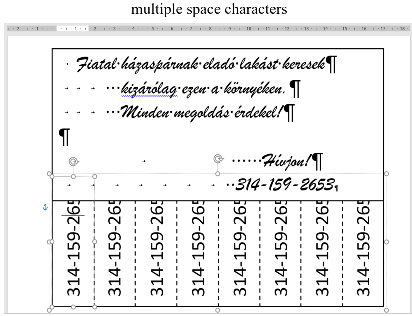
one cell, five paragraphs
center alignment
multiple tab and space



one cell, five paragraphs
words with ő and ű letters
multiple space characters



text boxes, four paragraphs
left tabulator
multiple tab and space characters



text boxes, five paragraphs
left tabulator
multiple tab and space characters

Figure 11. Four possible incorrect solutions of the task presented in Figure 8

There is one further problem with text formatting tasks in the related topics and in the discussed task (Figure 9), namely the selection of font type. In the Hungarian language, there are letters which are not included in most of the fonts.

The course books simply ignore this fact and provide examples with incorrect fonts (Lénárd et al., 2020, 2022, 2023; Abonyi-Tóth et al., 2021a, 2021b, 2022a, 2022b, 2023; Varga et al., 2020). In this case, the missing characters of a font are replaced with the characters of the Normal style as presented in the upper right sample of Figure 11.

Forced errors

There are tasks in the course books which cannot be solved correctly. They are the most harmful, because students are forced to manipulate the text (bricolage; Ben-Ari, 1999). Instead of teaching that the space character is not for formatting, and doing whatever is possible to weed out multiple spaces, tasks do not just accept but also force students to create erroneous texts (Figures 12 and 13).

A tool-centred, boring, harmful task

Task

Two character-drawing tasks are copied from the Grade 6 course book (Abonyi-Tóth et al., 2021a) (Figure 12). The authors argue that these tasks play an important role in the history of computing. However, they do not know that "Children don't care which order the techniques or tools were invented in, simply what's easy to understand and seems useful." (Wolfram, 2020).

> In the early days of computing, when the storage of digital pictures and digital drawings was rudimentary, they were composed of characters for curiosity. Draw the following figures using the characters on the keyboard, and the Courier font of constant width letters. The line spacing between paragraphs should be single and the spacing zero. (Abonyi-Tóth et al., 2021a).

The suggested technique to solve these tasks does more harm than good whatever the original intention of the authors is. Furthermore, the description of the task makes an error when it claims that line spacing is between paragraphs, which is not the case.

In the early days of computing, when storing digital photographs and drawing figures were rudimentary, they were composed of characters for having fun. Draw the following figures using the characters on the keyboard, and using the Courier font of constant width letters. The line spacing should be single and the space between paragraphs should be zero.

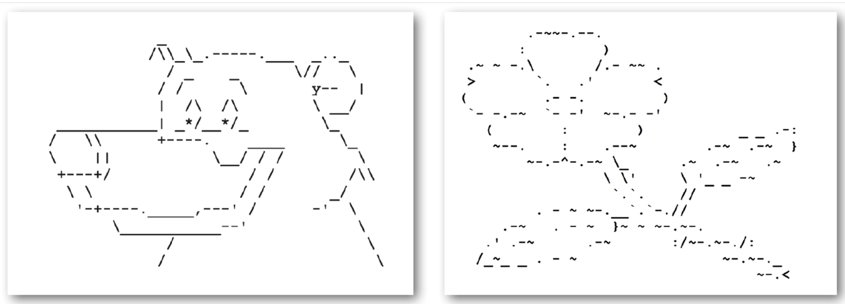


Figure 12. Two character-drawing tasks from the Grade 6 course book (Abonyi-Tóth et al., 2021a)

Solution

Figure 13 shows the solution of Figure 12. This boring, useless, harmful task took around 90 minutes to complete for a Grade 5 student.

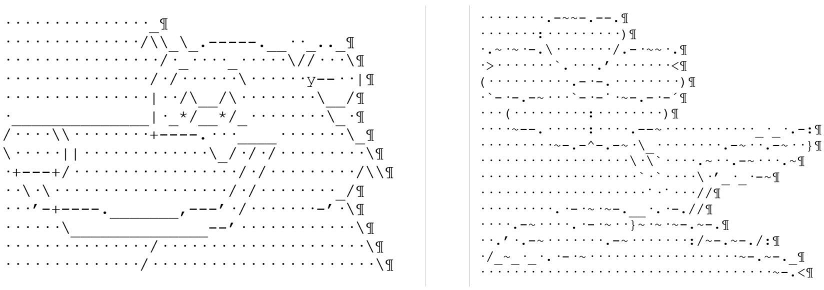


Figure 13. The solutions of the character drawing tasks

Conclusions

The analysis of the recently published Digital Culture course books reveals that although the BNC 2020 (BNC2020) is in complete accordance with the Informatics Reference Framework for Schools (Caspersen et al., 2022), the books follow the "good-old" practice of tool-centred teaching methods supported by folk-pedagogy (Lister, 2008). The tasks only focus on the interfaces and the languages of a special software programme, leaving real-world problem solving, knowledge-transfer, cognitive load, and fast and slow thinking unattended. On the one hand, this practice has already been proved ineffective. On the other hand, computer education research can offer scientifically sound, effective approaches which should be and can be integrated into novel materials (Hattie, 2012).

In the present paper, low mathability tasks are presented from the Grades 5 (Lénárd et al., 2020) and 6 Digital Culture (Abonyi-Tóth et al., 2021a) course books. It has been found and proved that the main characteristics of these tasks are that existing functions and methods provided by a system are used, and these tools are applied to solve the problems, rather than using high mathability solutions, where, based on the existing means of the system, new programs and functions can be developed for solving new problems (Baranyi & Gilányi 2013; Baranyi et al., 2015; Wolfram, 2015, 2020).

Another deficiency of the new course books is that no solutions are available for the tasks. Solving them would have helped the authors to realize how time consuming their tasks are and how they can be solved in classes with students, bearing in mind the need to collect data, plan, build up algorithms, and promote discussions. The solutions of the tasks might also help students who need some guidance. Furthermore, there are no accompanying teacher guides which would help practicing teachers with methodological advice and possible solutions of the tasks, and call attention to the misconceptions circulating in connection with the actual problems.

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