

Role of Workbooks and Teacher's Books in Lower-secondary Chemistry Education in Czechia

Role pracovních sešitů a metodických příruček ve výuce chemie na základních školách v Česku

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Textbooks as a prominent product of educational content's didactical transformation are usually published as a series. Textbooks are often accompanied by workbooks and teacher's books. These publications are designed to support teacher's work and can have a significant impact on the teaching practice. To deepen the understanding of chemical education at lower-secondary schools, the goal was to map chemistry teachers' use of workbooks and teacher's books. An electronic questionnaire containing close-ended questions as well as scales was used for this purpose. Information about workbooks and teacher's books' use, frequency of use, perceived importance and purpose were gathered. Whereas 63% of the 387 respondents reported using workbooks they consider important for the quality of education, teacher's books are only used by 24% of teachers, with only 4% reporting their frequent use. The results indicate that workbooks are mostly used during chemistry lessons or for student homework, however a significant share of teachers mentioned using them for lesson preparation. The absence of a teacher's book, coupled with the teachers' reluctance to use them even when available, also pointed to their approach to teaching preparation based on the search for educational content and specific activities rather than methodological support in a broader sense.

Key words:
science education, lower secondary school, curriculum.

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Učebnice jakožto významná pomůcka představující didaktickou transformaci vzdělávacího obsahu jsou obvykle vydávány v sadách. Často jsou doplňovány pracovními sešity nebo metodickými příručkami pro učitele. Tyto publikace jsou zpracovány tak, aby podporovaly práci učitele a mohou tak mít významný vliv na pedagogickou praxi. Pro prohloubení porozumění chemickému vzdělávání na základních školách bylo cílem zmapovat využívání pracovních sešitů a metodických příruček z pohledu učitelů. K tomuto účelu byl využit dotazník v elektronické formě obsahující uzavřené otázky a hodnotící škály. Byly shromážděny informace o využívání pracovních sešitů a metodických příruček, četnosti jejich využívání, vnímané významnosti a účelu používání. Zatímco 63 % z 387 respondentů uvedlo používání pracovního sešitu a považují ho za důležitý pro kvalitu výuky, využívání metodických příruček uvedlo pouze 24 % učitelů, přičemž 4 % uvedla časté využívání. Výsledky ukázaly, že pracovní sešity jsou nejvíce využívány během výuky nebo pro domácí přípravu žáků, nicméně významný podíl učitelů uvedl také využívání k přípravě výuky. Absence metodických příruček, potažmo neochota učitelů je využívat v případě, že dostupné jsou, ukazuje také na jejich přístup k přípravě výuky založené spíše na hledání vzdělávacího obsahu a konkrétních aktivit spíše než metodické podpory v širším smyslu.

Klíčová slova:
přírodovědné vzdělávání, základní škola, kurikulum.

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1 Introduction and theoretical background

The presented research directly follows its authors' previous work in the field of lower-secondary school chemistry textbook research. It is led by the presumption that knowledge of teachers' textbooks use sheds more light on the implemented curriculum. As far as research on textbooks is concerned, several authors' research worldwide surprisingly brings similar results. Teachers use textbooks as a primary source of instruction (Mullis et al., 2012). When preparing for their lessons, they consult textbooks as the primary source of information (Johansson, 2006; Sikorová, 2005). Whereas Sikorová (2010) reported over 30% of teachers using more than one textbook, Vojř and Rusek (2021) found over 80% use even more textbooks. This could be explained by the teachers considering textbooks a convenient source of the materials they seek, nevertheless, Bakken (2019) found that some consider textbooks obligatory. This can even escalate to teachers feeling stressed and obliged to cover everything the textbook contains in their lesson (Perkkilä, 2002). In this case, textbooks structured according to a certain time frame, not according to topic needs, could further exacerbate this effect. More research of the textbooks' didactical equipment (Rusek et al., 2020) is therefore needed.

With this strong position textbooks hold, their content, or more precisely, the way their content is didactically elaborated, affects the implemented curriculum's quality. Sikorová (2010) found that 26% of teachers followed textbooks systematically, with only 55% changing the way topics were presented in their own lesson preparations. Vojříř and Rusek (2021) proved that this approach is not influenced by the length of teachers' practice. Li (2013) as well as Orafi and Borg (2009) offered an explanation by arguing it is a combination of teachers' lack of confidence, experience or subject knowledge which makes them rely on textbooks this much. Borg (2015) even indicated this to be the reason lecturing, i.e. a teacher-centred approach based merely on a teacher's subject-matter presentation to students, is the prevalent method in contemporary education.

However, it is not only subject-matter teachers seek inspiration from. Lepik et al. (2015) and (Sikorová, 2005) found that teachers also seek methods to use in their lessons. As most textbooks are taken up with the explanatory texts (Červenková, 2010; Vojříř & Rusek, 2021), this could also be the reason for the prevailing transmissive teaching style. It is partly logical as textbooks are supposed to present the subject-matter, however, as shown in the paragraphs above, teachers prefer doing the reading themselves and then having the lecture.

In their previous study, Vojříř and Rusek (2021) discussed whether textbooks show teachers the trend or the other way round, teachers choose textbooks which fit their teaching style. One way or another, textbooks provide additional materials for teachers. It is a more detailed description of the course, additional didactical suggestions, and theoretical background knowledge (Steenbrugge et al., 2013). As far as the textbook components with the potential to activate students are concerned, workbooks as well as teachers' books need to be taken into account.

1.1 Use of workbooks and teacher's books

In spite of researchers' interest in science textbooks growing (Vojříř & Rusek, 2019b), information about other printed parts of textbook sets are rather fragmentary. Teachers' books are supposed to be structured in a way that guides the teacher through lessons planning towards educational goals. Researchers' interest was therefore targeted at particular teacher's book development with respect to their concrete focus (e.g. Fadilla & Usmeldi, 2020; Suhandi & Samsudin, 2019). Kendedes and Ratnawulan (2020) stressed specific demands put on the teacher's books in the context of science education's conceptual change. Their role within changing state-driven educational goals was also stressed by Bayindir (2010). They gain significance as long as teachers see the proposed activities as the grounds of the intended curriculum (cf. Bayindir, 2010). Nevertheless, teacher's book's perception from only the expected activities' point of view could also lead to them being negatively assessed by teachers, as shown by (Güven, 2010): teachers criticised namely the activities' time-demandingness and teaching examples' attractiveness.

One of the variables, as far as workbooks are concerned, is their price. Compared to textbooks, they usually cannot be used repeatedly by several students. Mathematics workbook's efficiency was evaluated by Fleisch et al. (2011). Their research was built on the premise new(er) math workbooks developers aim at reducing wasted instructional time and the teacher's role associated with them writing the instructions on the board. In their research, they compared lessons where only a mathematics textbook was used with lessons where a textbook set (textbook + workbook) were used. The results showed no difference between the students' improvement in either of the groups. Erol's (2017) research on 7th graders on a social studies course in Turkey argued otherwise. Their research is interesting in particular compared with the Czech environment as it describes a shift in teaching conception at the exact time a new curriculum was introduced in Czechia. It represented a shift from an autocratic perspective of teacher-centred conception in which students were only passive receivers of information to a teacher-guided, student-centred constructive learning environment. Despite the author's positive assessment of the textbook and workbooks' use in education, the study showed over 75% of students considered a workbook a type of textbook. The reason was its use mostly just for students' home preparation, which made them use these materials unwillingly, not considering them an activating agent in education. Some teachers were even found to use the workbook exercises to grade the students, they used photocopies of different student-activating sources from different materials during their lessons.

A very special version of workbook was introduced by (Nainggolan et al., 2020) who used design-based research methods to prepare a student support for laboratory courses. Their work represents an example of a STEM-oriented goal employing an inquiry-based approach into students' work. In the Czech conditions, this can be parallel to Fiala's Inquiry-diary (see Fiala & Honskusová, 2020).

1.2 Czech perspective

The textbook tradition is very strong in Czechia. Primary and lower-secondary schools are obliged to provide every pupil or student with textbooks. Nevertheless, purchasing workbooks or teacher's books remains on each school's choice. Schools receive special funding for textbooks which are granted a so-called approval clause (a special certificate by the Ministry of Education which confirms the books' suitability for use in education, according to the curriculum, methods, ergonomic, etc.). A concrete textbook's choice is fully in schools' competence. Schools are also allowed to use textbooks which do not dispose of the clause, however, this possibility is being chosen only seldom. Most commonly, there are four sets of textbooks used in lower-secondary schools – see Tab. 1 (Vojíš & Rusek, 2021).

Tab. 1: The list of commonly used textbooks

Textbook title	Published*	Authors	Publisher	Reference in the text
Základy chemie 1; 2 [Basics of chemistry 1; 2]	1993	Beneš, P., Pumpr, V., Banýr, J.	Praha: Fortuna	ZCH
Základy praktické chemie 1; 2 [Basics of practical chemistry 1; 2]	1999, 2000	Beneš, P., Pumpr, V., Banýr, J.	Praha: Fortuna	PCH
Chemie 8; 9 [Chemistry 8; 9]	2006, 2007	Škoda, J., Doulík, P.	Plzeň: Fraus	FR
Chemie 8; 9 [Chemistry 8; 9]	2010, 2011	Mach, J., Plucková, I., Šibor, J.	Brno: Nová škola	NS

*Years of first publishing; the two records relate to the two books for 8th and 9th grade.

All the commonly used textbooks dispose of the approval clause. However, there are considerable differences in their elaboration. The textbooks ZCH and PCH were published within the previous curriculum. On the other hand, the textbooks FR and NŠ were published after the contemporary curriculum was approved which is also mirrored in their overall graphical design (Vojíš & Rusek, 2020). As far as the content's structure is concerned, the textbooks FR differ from the others as they do not follow the traditional consequence of chemistry topics (general chemistry, inorganic chemistry, organic chemistry, and biochemistry).

Teachers are rather satisfied with the textbooks they use. They consider them important for lesson preparation. The textbook set teachers expressed the highest satisfaction with are the NS textbooks, i.e. modern-looking textbooks following a traditional subject-matter's structure (Vojíš & Rusek, 2021).

The obligation for schools to provide students with textbooks does not concern workbooks and schools receive no funding primarily for their purchase. The other components of textbook sets (workbooks and teacher's books) are not available for every textbook set (the publication of materials depends on commercial publishers). The commonly used textbook sets, see Tab. 1, are accompanied by workbooks. Teacher's books, however, are available only for the PCH and FR textbooks.

2 Research goals

This research focused on understanding the way chemistry textbook projects are used in Czech lower-secondary schools. As the use of textbooks has already been covered (Vojíš & Rusek, 2021), attention was paid to the other printed materials that are part of the textbook projects.

With respect to previous research in this field, the following research questions were used:

1. What proportion of lower-secondary school teachers use workbooks and teacher's books for chemistry education?
2. How often do teachers use workbooks and teacher's books and how important they consider them for the quality of chemistry education?
3. For what purposes do teachers use workbooks in chemistry education?

3 Methodology

In order to answer the research questions and generalise the findings on the whole lower-secondary school chemistry teachers in Czechia, quantitative methods based on a questionnaire were used. The data were gathered from September to November 2018 on a randomly selected sample of lower-secondary school chemistry teachers. The data were analysed descriptively. Also, an explorative data analysis using datamining was used.

3.1 Research tool

An online version of a questionnaire was used. Its content validity was checked, and the tool was piloted (Vojříř & Rusek, 2019a). It consisted mainly of close-ended questions divided into the following categories:

- respondents' characteristics,
- the textbooks that are lent to students and used for teachers' preparation for teaching,
- textbook choice,
- teachers' satisfaction with the textbook,
- the perceived textbook importance for lesson preparation,
- using of workbook and teachers' book,
- perceived importance of workbook and teachers' book for quality of chemistry education and the purposes of the workbook's use.

Satisfaction, frequency of textbook use and their perceived importance, workbook or teachers' book were assessed using five-point Likert scales where only the limiting points (1, 5) were verbalised (1 – completely satisfied to 5 – completely dissatisfied; 1 – very significant to 5 – completely insignificant; 1 – I use very often (practically in every hour/preparation) up to 5 – not using). The method of workbook use was examined with the use of close-ended questions with options. The teachers explained their use of workbooks and teacher's books for lesson preparation, lesson realisation, with respect to their students' home preparations, as well as extension activities for individual students.

3.2 Research sample

The research sample selection emerged from the total number of lower-secondary schools in Czechia in 2017/2018 (MŠMT, 2018a). A minimum sample calculated on the 95% significance level was calculated using the Raosoft minimum-sample calculator (raosoft.com). The ratio of schools with lower-secondary level to the entire number of schools was considered. Moreover, the sample was extended due to the expected one third response-rate of online surveys (cf. Nulty, 2008). The schools were randomly chosen from the Czech Ministry of Education's school address book (MŠMT, 2018b). In the end, 1536 schools were addressed via email sent to these schools' headmasters. An explanation of the research's purpose, instructions and a link to the online questionnaire were included.

This resulted in the final sum of 387 teachers from 370 schools filling in the questionnaire. The 41% response rate of schools relevant for the research was calculated. As the number of participating schools exceeded the minimum sample, and they were selected randomly, the findings are considered generalisable to all lower-secondary schools in Czechia. As the previous research showed, there is only one chemistry teacher at 69% and two teachers at 22% of lower-secondary schools (Vojříř & Rusek, 2021), the results are also generalisable to the entire lower-secondary chemistry teacher population in Czechia. Moreover, as similar findings or trends were noted in papers from different countries, the results' international validity is also considerable.

3.3 Data analysis

An exploratory data analysis was performed using datamining. For this purpose, CRISP-DM methodology (Chapman et al., 2000) was followed (see Fig. 1). This methodology's principle builds on an analytical procedure's tasks' repeated entry and meaningful relations' evaluations being discovered.

Based on an initial understanding of the data and their specifics, their evaluation was prepared, i.e. grouping and entries' adjustments for computer evaluation. In the modelling phase, the implication relations which fulfil certain statistical measures were searched for in the data. These data rules can be described in an IF-THEN rules (antecedent \Rightarrow consequent) form (Fürnkranz & Kliegr, 2015, p. 55).

To analyse the data, a datamining tool, Easyminer, using the R-framework principle (Vojříř et al., 2018) was utilised. To evaluate the discovered data rules, the *confidence*, *support* and *lift* values were evaluated. *Support* indicates the frequency of an itemset's appearance in the dataset. *Confidence* shows how often a rule was found true. *Lift* shows the measure of an attribute's dependence. A *lift* > 1 confirms an implications' truth (Hahsler et al., 2005). Firstly, the search procedures minimum values were set as follows: confidence = 0.7, support = 0.05 and lift minimum value = 1.1. For interpretation's sake, a rule length limit was set to three variables.

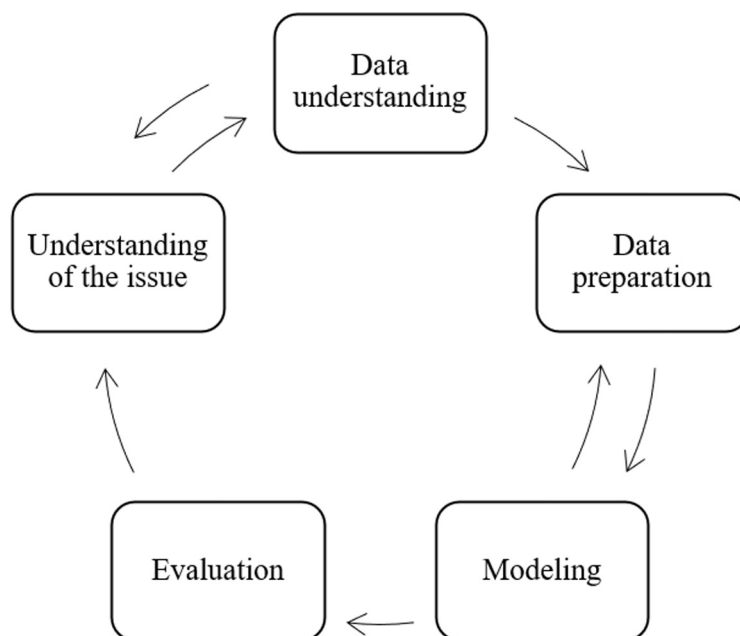


Fig. 1: Procedure of CRISP-DM

Within the modelling phase, interestingness with regards to the field of science education was evaluated for the discovered rules. Interesting rules were added into the final ruleset and interpreted later in other findings' context. In the following step, the mining procedure was in accordance with the methodology repeated with variables and rule parameters being changed in the modelling phase. The cycle of the procedure was repeated until no new rules were found.

4 Results and discussion

For transparency's sake, the results are further divided into workbooks and teacher's books parts.

4.1 Use of workbooks

The majority of the teachers (63%) answered that they use workbooks. 12% of the teachers admitted not using workbooks as they are not at their disposal or are unavailable for the textbook they use. 25% mentioned they do not use workbooks because they do not want it or do not need it (see Fig. 2). Altogether, the teachers rated the frequency of their workbook use in the middle of the scale (Med = 3). 26% mentioned they use workbooks *often* or *very often*. At the same time, the teachers who use workbooks consider them rather important for the quality of chemistry education (Med = 2).

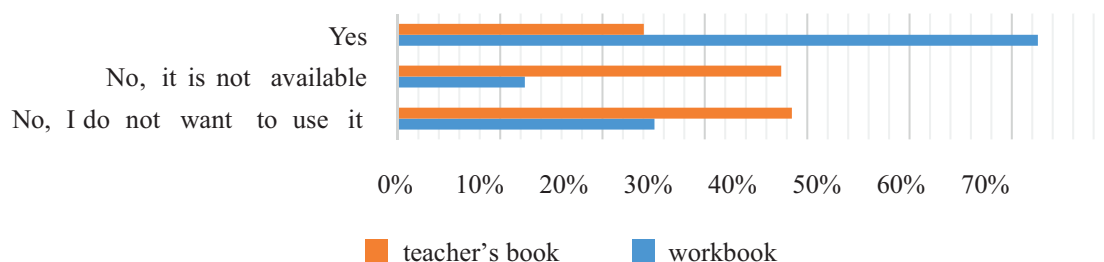


Fig. 2: Proportions of teachers using workbooks and teachers' books

These results showed the majority of the chemistry teachers consider the students' own activity when planning their lessons. This is a promising aspect towards students' scientific literacy development (Janoušková et al., 2019). Yet, a considerable amount of teachers showed in their teaching approach a strong teacher-driven transfer of information predominates (Vojíš & Rusek, 2021).

The results further showed workbooks are being used in all aspects of the educational process. The most frequent is their use directly during lessons (81%). 59% of the teachers use workbook tasks as

extension activities, i.e. individualisation of education. On top of that, 40% of the teachers mentioned using workbook tasks for student preparation. The workbooks' influence on (chemistry) education was also shown as 28% of the teachers mentioned using them for their lesson preparation. This points to their well-considered inclusion in student-activating elements of their lessons.

This finding points to a considerable share of teachers' who use the entire textbook set's components to enrich their teaching by using material compatible with the conception of the textbook(s) they use. As this conception manifests mostly via a transfer of chemistry content knowledge (Vojř & Rusek, 2020), using a workbook during lessons suggests these teachers' attention to knowledge fixation.

The teachers' attitude towards the entire textbook set proved to be an important factor. Teachers who are satisfied with the textbook they use are also more likely to use the workbook ($c = 0.687$, $s = 0.460$, $l = 1.099$). Similarly, teachers who chose the textbooks themselves are also more likely to use the workbooks ($c = 0.706$, $s = .297$, $l = 1.128$). This implication further increases if teachers chose the textbook set themselves and, at the same time, consider the textbook important for lesson preparation ($c = 0.805$, $s = 0.171$, $l = 1.287$). Similarly, teachers' satisfaction with the textbook plays a vital role. The teachers who chose the textbook set themselves and, at the same time, are satisfied with the textbook are more likely to use the workbook ($c = 0.725$, $s = 0.258$, $l = 1.159$).

These findings suggest a promising approach which could lead to chemistry teaching innovations. Having the opportunity to select a textbook they consider high-quality can identify with (cf. Laws & Horsley, 1992), and considering new teaching materials would also contain workbooks, seems to be a key towards teachers use of tasks.

Textbooks were found to play an important role in lesson preparation for the majority of teachers (Vojř & Rusek, 2021). The results showed that a considerable proportion of teachers also prepare for their lessons using workbooks. Teachers' perceived importance of the textbook for lesson preparation seems to affect their use of the workbook. If teachers consider textbooks important for lesson preparation, they are more likely to use workbooks ($c = 0.712$, $s = 0.339$, $l = 1.139$). This result showed that the teachers who seek support in textbooks also consult workbooks as another material when preparing their lessons.

This link is strengthened for teachers who consider textbooks important for lesson preparation. More than 76% of the teachers who are satisfied with their textbooks use workbooks ($s = .276$, $l = 1.222$). The perceived importance of textbook for lesson preparation positively affects the use of workbook for almost 74% of the teachers with more than 10 year teaching practice ($s = 0.248$, $l = 1.181$). This finding could be explained by the experienced teachers' full exploitation of an offered textbook set.

The fact that the use of workbooks is especially frequent for the teachers who use the NS chemistry textbook set to prepare for education, further underlines the aforementioned findings. In this result, the teachers' highest satisfaction with this particular textbook set (Vojř & Rusek, 2021) is reflected. Compared to the users of FR (52%, $s = 0.109$), ZCH (59%, $s = 0.165$), PCH (62%, $s = 0.109$), almost 74% of the teachers who use the NS chemistry textbooks also use workbooks ($s = 0.282$, $l = 1.139$). The lift values for other textbooks than those by NS are below 1 which suggests a below-average frequency for the implication validity. The lowest share of teachers was satisfied with the FR textbook (Vojř & Rusek, 2021), which is again mirrored in their lowest use of the workbook. The more frequent use of workbooks is therefore likely to be associated with the overall perception of the textbook set, i.e. the extent to which a textbook project resonates with the teachers' conception of teaching. Teachers refusing a textbook set could then lead to them searching for alternative materials (cf. Laws & Horsley, 1992), including, e.g. an alternative workbook as expressed by the research's respondent: "The textbook ZCH does not contain enough subject-matter for practice. For this reason, I rather use the workbook by Taktik which contains many tasks and tips for a concrete subject-matter's mastery." This citation strongly suggests this teacher's teaching conception – attention to lower-order thinking and subject matter transfer – a phenomenon observed in a significant group of teachers.

A significant lift of a relation was found for teachers who studied a non-chemical educational program. If these teachers are satisfied with their textbook, they are likely to use the workbook too ($c = 0.77$, $s = 0.067$, $l = 1.223$). Moreover, this association rule applies for 70% of these teachers whose teaching practice is longer than 10 years ($s = 0.072$, $l = 1.119$). This finding suggests that workbooks support the teachers with a degree from another field of education than chemistry. They have educational know-how and are probably aware of the need to use activating techniques. They may feel insecure as far as the chemistry content knowledge, and its evaluation, is concerned. This idea can be further explored. In a period of a lack of (chemistry) teachers, when chemistry is being taught by people who did not study a chemistry education, it seems reasonable to consider workbooks a significant teacher support. They have not been, however, given attention in contemporary science education textbook research yet (Vojř & Rusek, 2019b).

4.2 Use of teacher's books

Whereas most teachers use workbooks along with the textbook, teachers' books are being used only seldom (see Fig. 2). The results showed teacher's books are being used by only 24% of teachers. This is influenced by the teacher's books availability only for textbook sets PCH and FR. This state is undesirable as Heinonen (2005) found out teachers books are considered helpful by Finnish teachers, which either suggests their conception fits the teachers better, or the teachers seek methodical guidance instead of just structuring their lessons around subject-matter. Among Czech teachers, 39% of the respondents reported they either do not want to use a teacher's book nor do they need it. An additional 37% of the respondents mentioned its absence or unavailability as the reason for not using it.

Unwillingness to use a teacher's book was found to be more frequent for teachers who consider textbooks unimportant for their lesson preparation. Almost 62% of them claimed that they do not use the teacher's book because they do not want or do not need it ($s = 0.067$, $l = 1.608$). Similarly, 67% of the most experienced teachers in the sample (more than 10 years of teaching practice) chose this option ($s = 0.052$, $l = 1.732$). These teachers seem to be confident of their own experience and lesson preparation and do not feel the need for textbook support. With respect to the finding that the length of teaching practice does not significantly affect teachers' use of textbooks (Vojíř & Rusek, 2021), this finding shows that Czech chemistry teachers feel confident about their ability to prepare lessons only according to the textbook. This attitude was proven to strengthen with the increasing length of practice. However, this finding is in contrast with Finnish teachers, who express their satisfaction with the support provided by teacher's books (Heinonen, 2005).

The teachers' responses suggested the role of a teacher's book is being substituted by a textbook or a combination of textbooks. The teachers who mentioned they use a teacher's book consider it neither important nor unimportant for quality of chemistry education (Med = 3). They responded in the same way (Med = 3) about the frequency of a teacher's book's use. Only 4% mentioned they use it often or very often showing the marginality of this textbook set's element as far as its impact on teaching practice is concerned. This result then proves the majority of publishing houses' resolution not to publish teacher's books. From a didactical point of view, however, by excluding these, especially novice teachers' transfer into practice is made more difficult.

These findings only strengthen the conclusion that textbooks play an important role when teachers prepare their lessons (Vojíř & Rusek, 2021). This role is, however, not as expected – incorporating a textbook part into lesson instruction, but rather teachers drawing lesson structure, content, or even didactical transformation (order and method of teaching) of concepts from the textbooks. In this way, textbooks take over the role of teacher's books, despite the fact that their primary function targets a very different audience.

One finding seems to explain this state. Teacher's books are used by the teachers who use the chemistry textbooks by the FR publishing house ($c = 0.636$, $s = 0.127$, $l = 2.648$). This factor is even stronger with teachers who consider the use of a textbook important for lesson preparation ($c = 0.8$, $s = 0.072$, $l = 3.329$) or are satisfied with the textbooks ($c = 0.765$, $s = 0.067$, $l = 3.182$). This suggests a close link between the teachers' chemistry teaching conception and the elaboration of the chemistry textbook set. Also, the quality of the teacher's book could be mirrored in this finding.

Teachers' appreciation for textbook sets was shown not to be affected by the fact whether it contains a teacher's book or not. Although the textbooks by NS or ZCH do not dispose of teacher's books, the teachers expressed their satisfaction with them (Vojíř & Rusek, 2021). Out of these teachers, 43% (equally for both textbooks' users), expressed they do not want or do not need to use a teacher's book. The textbooks seem to fulfil their needs. However, considering the fact textbooks are originally a material designed for students, the results the structure and content suits teachers suggest students were not considered to be the primary recipients of these textbooks. This is in accordance with the results of textbooks' text-difficulty which showed text being too difficult, especially in these textbooks (Rusek et al., 2016; Rusek & Vojíř, 2019). Another explanation could be the teachers' experience and ability to construct lessons simply based on the lesson conception as suggested by textbook authors.

Although there is a teacher's book available for the PCH textbooks, teachers using them do not use the teacher's book ($c = 0.469$, $s = 0.078$, $l = 1.217$). The teachers who provide this textbook to their students and are satisfied with it especially responded that they do not want to use the teacher's book ($c = 0.625$, $s = 0.065$, $l = 1.623$). A possible explanation is in its didactical equipment (Rusek et al., 2020) as well as an overall elaboration derived from the earlier-published ZCH textbooks by the same authors (Vojíř & Rusek, 2020). Teachers' attitude towards the use of PCH and ZCH textbooks is then similar. There was no demand for a teacher's book by the ZCH users, therefore, also PCH users do not consider it important.

These findings point to the FR textbooks' rare standing. In this respect, two possible explanations come into question. First, the textbooks' unique conception probably required explanation. Second, at the time of their publishing, these textbooks represented a significant change and a positive deviation from a traditional chemistry textbook style (see Vojíř & Rusek, 2020). They might have been an option for innovative teachers seeking an alternative. Using a teacher's book explaining the ideas of the new conceptions in this case then seems logical.

Moreover, as the only one from the frequently used chemistry textbook series, it seems to keep the concept of student's "(text) book", whereas the others seem to aim at teachers too, possibly combining two different target groups' needs. In this respect, the use of a textbook series seems to reflect teachers' way of teaching and is an important indicator for lesson conception mapping.

5 Research limitations

The results of this research offer a deeper look into teachers' conception of education. One of potential limitations is in the sample selection. In spite of its size and randomised selection, online distribution via school headteachers could have resulted in less active or considerate teachers' absence in the sample. This frequent limitation is, however, reduced by the sample size.

Another possible limitation is the fact that only teachers' opinions were considered. Though teachers reveal a lot when talking about particular textbook set parts, their conception, perceived importance, (non)use, etc., only lesson observations and an analysis of their lesson preparation would bring a complete picture. Naturally, research of this scale requires a much larger project. However, it is the authors' intention to proceed in this direction too.

6 Conclusion

In this paper, attention was given to the missing piece of textbook sets – workbooks and teacher's books. Workbooks accompany every Czech chemistry textbook contemporarily commonly used in lower-secondary schools. However, teacher's books are available only for two of the textbook sets. Compared to textbooks, these materials have not been given much attention by researchers. Teachers' conception of lesson preparation and realisation shows their perceived curriculum, which can then be compared to contemporary teaching paradigms. It is through knowledge about these textbook sets' parts a clearer picture about education can be drawn.

Unlike textbooks, workbooks are not provided to lower-secondary students by schools, and they have to purchase them in case their teacher requires this material, yet this research showed the majority of teachers use workbooks, with only about a fourth mentioning they would not like to use them.

Workbooks are being used for various purposes. Individual work in the lessons (subject-matter fixation) and homework suggest themselves. The biggest proportion of the research sample mentioned the workbook's use directly in lesson realisation. However, a considerable share of teachers consults workbooks when preparing for their lessons, which suggests their promising inclination towards activity-based teaching. Teachers' use of workbook depends mainly on their perception of the textbook set as a whole. Their identification with the teaching paradigm the textbook follows affects the use significantly too.

As opposed to this, teacher's books stay behind. The majority of chemistry teachers do not use them and/or do not want to. The research results suggest textbooks take over the teacher's books role in some cases. This claim was earlier confirmed in other research by Vojíř and Rusek (2021), who found that teachers even combine more textbooks to prepare for their lessons. Understandably, some teachers draw the subject-matter content, tasks, fun facts, pictures, etc. from their textbooks. Nevertheless, this only shows their conception of teaching builds mainly on the subject-matter and does not need methodical suggestions as far as the content's didactical transformation or methods are concerned.

Apart from the information about the use of another textbook sets' components, the possibility to use a data mining procedure was tested in this research. It is common e. g. in sociology or marketing, whereas (science) education research has typically used only classical statistical hypotheses testing. The used CRISP-DM methodology offers other hypotheses' evaluation and could, in many ways, expand contemporary knowledge in areas researchers would overlook.

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