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The teacher's guide's way of communicating with the teacher – within the subject of technology

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Abstract

The materials and artefacts utilized by teachers and students play a crucial role in education. In a subject like technology, where many teachers feel they do not have sufficient competence, curriculum materials such as textbooks and teacher guides provide important support for teachers. Teacher guides, in particular, have the potential to support teachers in different ways. The guidance provided in a teacher's guide can be either directive and talk through the teacher, i.e. telling the teacher what to do, or educative and talk to the teacher, i.e. telling the teacher how to do it and why to do it this way, thereby providing the teacher with knowledge to better understand the teaching of the subject. In this study, we analyze a teacher's guide for grades 7-9 to find out what kind of support it provides the teacher. An adapted framework for the design principles of educative curriculum materials was used. The analysis shows that this particular teacher's guide mostly talks through the teacher, giving the teacher directives on how to teach but without explaining why or suggesting other possible ways. The few educative features found are short and not very detailed. The support an educative teacher's guide could provide would give the teacher agency over their teaching and a better possibility to adapt teaching to situations and students. However, we see little of that kind of guidance in the teacher's guide analyzed in this study and conclude by outlining the possible consequences for technology education.

Keywords

Technology education, teacher guides, design principles, educative curriculum materials

Introduction

The materials and artefacts utilized by teachers and students play a crucial role in education. While curriculum materials like textbooks are important for students' learning, they also provide support for teachers (Oates, 2014; Graeske, 2021). Teachers in science and technical subjects appear to use textbooks extensively, but in different ways depending on the students involved (Bachmann, 2005; Schlag & Glock, 2023). Both textbooks and teacher guides provide support for teachers in planning and organizing teaching, especially teachers who are uncertain about their subject knowledge (Driscoll et al., 1994; Englund, 2006), which is likely the case for many technology teachers in Sweden since a large proportion are not trained in the subject. A recent study on four technology textbooks (Engström et al., 2023) revealed three different approaches to how the content (industrial processes) was presented, which means that choices made by the textbook authors entail that some content is made visible while some are overlooked. Hence, the textbook used by the teacher will affect how the content is presented to the student and therefore how the student can understand, in this case, industrial processes. This highlights the difficulty, or perhaps impossibility, of including all the relevant content for a technology topic in a textbook, and the importance for teachers to be aware of this and to complement the textbook with other relevant resources. To support teachers in this, such information could be provided in the teacher's guide.

In Sweden, around 50 % of the teachers who teach technology in years 7 – 9 (students aged 13-16) are trained in technology education, which is relatively low compared to other subjects (National Agency for Education, 2024a). One challenge is that the subject of technology is sometimes perceived to be overshadowed by other school subjects, for example, a perceived lack of resources or time for collegial meetings (Nordlöf et al., 2019, Skolinspektionen, 2014). In particular, new technology teachers describe feeling uncertain about planning, implementing, and assessing technology education, whereas experienced technology teachers describe challenges related to students' varying prior knowledge and lack of understanding concerning the subject matter (Fahrman et al., 2020). Both groups can utilize textbooks with accompanying teacher guides to create a comprehensive view of relevant technological knowledge and gain confidence in their teaching. Well-structured curriculum materials can thus help the teacher to plan and enact lessons that meet the objectives of the subject's syllabus and the needs of different students. Teacher guides, in particular, can potentially support teachers in different ways (Davis, 2021). Remillard (2000) distinguishes between teacher guides *talking through* the teacher, i.e. giving direct instructions, or *talking to* the teacher, i.e. explaining the rationale for the instructions, emphasizing the need for both in order to meet different teachers' needs, although the latter is the one considered to be educative for the teacher. However, little is known about how teacher guides in technology are designed. There is a solid knowledge base about curriculum materials in mathematics, language, and social sciences, but research is lacking for the subject of technology. A recent literature study concludes that the use of curriculum materials varies widely between subjects and that research from other subjects may not be transferable to technology education (Graeske, 2021).

This study analyzes a teacher's guide in the technology subject. The aim is to investigate how the teacher's guide communicates with the teacher and further discuss what this implies for students' learning possibilities. The research questions are:

1. What kind of support does the teacher's guide provide teachers in terms of talking through and talking to the teacher?
2. In terms of talking to the teacher, which design principles for educative curriculum materials can be identified in the teacher's guide, and what do these educative features look like?

Different characteristics of teacher guides and teachers' use of them

Typically, teacher guides are designed to help teachers in shaping lessons. However, they differ in the way they communicate with teachers and in the type of guidance they provide (Remillard & Kim, 2020). Remillard (2000) distinguishes between the teacher's guide *talking through the teacher* or *talking to the teacher* (Remillard, 2000). Teacher guides that talk *through* the teacher tell the teacher what to do, while teacher guides that talk *to* the teacher explain the underlying ideas of these suggestions. In the first case, the guidance is directive, specifying what teachers and students should do or say during or in preparation for the lesson (Remillard & Kim, 2020). In the second case, the teacher's guide has the potential to be educative, which would entail telling the teacher how and why to teach in a certain way, thereby providing the teacher with knowledge to better understand the teaching of the subject, giving the teacher a greater opportunity to adapt lessons. Remillard (2000) points out that teacher guides commonly talk through teachers but argues that they should be designed to speak *to* teachers. However, Remillard and Reinke (2012) suggest that a teacher's guide can also be educative by talking *through* the teacher. This is supported by Van Steenbrugge and Ryve (2018), who emphasize that teacher guides that talk through teachers can be a support for teachers who feel insecure about the subject or are unaccustomed to teaching situations. Therefore, they recommend that teacher guides use both types of communication, *through* and *to* the teacher, thereby providing both directions and the rationales for them. The recommendation is based on their study of how teachers use the different types of support in a mathematics teacher's guide. Although the teachers used some of the support that talked *to* them, their main focus was on the more directive support, such as lesson slides and exit tickets. Similar results have been presented regarding the technology subject. Although research on curriculum materials and technology education seems to be scarce, Given and Barlex (2001) studied how teachers used a set of curriculum materials including a student book, a study guide, and a teacher's guide, for students aged 11-14. They found that the teachers used the different components of the material to varying degrees. The students' book was used the most, and the teacher's guide was used the least. Also, the study guide was generally underused, but those teachers who did use it reported that it added value to the teaching and the students' work. Most used were the components of the materials that could easily be put into practice with little or no adaptation of the teacher's plan.

Janko and Pešková (2017) found in a literature study that teachers use curriculum materials in three different ways. First, there is the fidelity approach, meaning the teacher transmits the content from the materials to the students. Second, there is the adaptation approach, meaning the teacher undertakes curriculum adjustments. Finally, there is the enactment approach, meaning the teacher creates curriculum in action according to student experience. Brown (2009) also wrote about these approaches, calling them offloading, adaptation and improvising. Studies have shown that teachers apply these approaches in different ways. For example, some use all these approaches and can move between them during a lesson (Brown, 2009; Jukić Matić & Glasnović Gracin, 2021) while others only offload, i.e., apply the fidelity approach (Snyder et al., 1992). Van Steenbrugge and Ryve (2018) relate these approaches to the design of the teacher's guide and suggest that a teacher's guide that talks through the teacher in a directive way would support offloading a lesson, while a teacher's guide that talks to the teacher in an educative way is necessary for supporting adaptation.

The design of educative curriculum materials

Distinctive for educative curriculum materials is that they include educative features specifically designed to contribute to teachers' learning, both about the content and how to conduct teaching. Based on Ball and Cohen (1996) and research stemming from Ball and Cohen, Davis and Krajcik (2005) compiled nine design heuristics that can guide both the creation of educative features and provide context for discussions about the potential of educative curriculum materials to promote teachers' learning. The underlying ideas for these design heuristics, along with results and suggestions from other studies, have been applied by several researchers to develop design principles for how educative curriculum materials can be designed to promote teachers' learning in various subject areas, such as science (Davis et al., 2017; Englehart, 2010;

Roseman et al., 2017), mathematics (Fuentes & Ma, 2017), and language (Neuman et al., 2015) as well as in teacher education (Hanuscin et al. 2025; Melton & Mikeska, 2025).

In our analysis of a teacher's guide, we will use the design principles created by Davis and colleagues (2017) to interpret what can be said to characterize the teacher's guide. They present six design principles created within science education:

1. Teachers adapt curriculum materials based on factors such as time and students' knowledge and abilities. Educative features should provide suggestions on how lessons can be adapted in various ways without losing the intended purpose.
2. Educative features should present the reasoning behind pedagogical ideas included in the guide. Representations of practice can support teachers in adopting the ideas in the material. Therefore, educative features should be contextualized in the teachers' practice, designed, for example, as stories about teachers' work and annotated examples of students' work.
3. The demand for teachers' subject knowledge is increasing, and educative features should therefore help make important content visible and explain it, for instance, by showing how it can be described to students and how it connects across multiple lessons.
4. Different teachers have different needs and adopt different types of educative features depending on the knowledge they already possess. Educative curriculum materials should therefore provide a variety of different types of educative features to meet teachers' diverse needs and their students' different needs, for example, content struggles. The rationales of the recommendations in the various educative features should be given, as well as whether, and if so how, these differ from teachers' "usual" practices.
5. Teachers engage with the practice of scientific explanation in a limited capacity. Thus, educative features should assist teachers in (a) understanding the definition, purpose, and importance of creating scientific explanations and (b) learning how to help students participate in the construction of explanations and argumentation.
6. Certain scientific practices, including making and recording observations and making and justifying predictions, were taken up effectively by most teachers. Therefore, educative features should support easier-to-enact scientific practices, with the idea of moving incrementally toward more ambitious science teaching in elementary classrooms. Designers should connect to teachers' existing teaching practices to create leverage points while helping teachers recognize salient differences.

For our analysis, we have adjusted these design principles to fit the subject of technology. This is described in the Methods section.

Methods

For our analysis, we chose the teacher's guide from one of the most commonly used curriculum materials, a technology textbook for grades 7-9, adapted to the current syllabus. The teacher's guide is digital, and it follows the structure of the students' textbook. The entire teacher's guide was analyzed.

To study how the teacher's guide communicates with the teacher, content analysis was performed in two steps. First, we coded each unit, that is each phrase, sentence, paragraph, or picture based on whether it *talks to the teacher* or *talks through the teacher*. Second, we looked at the units coded as *talking to the teacher* and further coded these units using an adapted version of the design principles created by Davis et al. (2017). We used the original design principles 1-4, but changed the last two to fit the technology subject as follows:

5. In technology education, students should try, analyze, and evaluate the working methods that occur in various technical areas. Working methods are, for example, design processes, life cycle analyses, and Environmental Impact Assessments. Thereby they can learn content, methods, and processes as they are understood within technical disciplines. *Educative features should provide teachers with examples of how work within various technical disciplines is carried out in practice, and how this can be part of the teaching.*
6. One objective of technology education is to prepare students to become conscious citizens in a society where technology plays a central role and is constantly developing. Examples encompass understanding why we recycle, different energy solutions, and transportation alternatives. Educative features must address teachers' need for support to *motivate the importance of technology education for societal and everyday life* and give examples that highlight the importance of technical knowledge to, for example, be able to make decisions both on an individual and societal level and to have a critical approach to technological phenomena.

Design principles 5 and 6 are developed by the authors. They are related to Roberts' Vision I and II (Roberts, 2007a, 2007b; Roberts & Bybee 2014). Roberts describes two competing visions of scientific literacy that are rooted in the history of school science education. He explains how Vision I derives its authenticity by looking inward to the products and procedures of the scientific disciplines themselves while Vision II is broader, deriving its legitimacy from the evident influence of science across a wide range of human endeavours, beyond just scientific practice.

In this study, the authors have drawn inspiration from Roberts' visions for science education and interpreted the content and aims within technology education, divided into two visions with similar meanings to those of Roberts. This aligns well with the curriculum for technology in Swedish primary education (National Agency for Education, 2024): one vision focuses on a more civic, educational purpose, while the other is oriented towards the working methods of technical fields and technology professions, among other things. Also, comparable divisions of the technology subject can be found in previous research (e.g., Nordlöf et al. 2022; Stoor & Popov, 2021).

The following coding scheme was used in the content analysis that was conducted:

For the first step

A. The text talks through the teacher
B. The text talks to the teacher

For the second step where we looked at the units coded as B in the first step

1. Suggestions on how lessons can be adapted in various ways without losing the intended purpose are given.
2. The unit presents the reasoning behind, and contextualized concrete examples of, the pedagogical ideas included in the teacher's guide.
3. The unit makes important content visible and explains it.
4. The unit provides support for teachers' different needs for themselves and their students.
5. The unit motivates the importance of technology education for societal and everyday life.
6. The unit provides teachers with examples of how work within various technical disciplines is carried out in practice, and how this can be part of the teaching.

To strengthen internal reliability (Robson, 2002), all three researchers started to code the first chapter both regarding step 1 and step 2. This first coding was followed by a meeting where we compared and discussed the coding. For step 1 the authors interpreted the texts with nearly 100 % alignment in the coding, as it is clear whether the content of the guide speaks through the teacher or to the teacher. For step 2, the initial coding agreement was 85 %. We discussed the coding until consensus on how to interpret the coding scheme was reached. Thereafter, the remaining chapters were divided among the researchers.

Results

The digital teacher's guide is just over 200 pages, consisting of an introduction and six chapters. The introduction describes the structure of the teacher's guide and the idea behind the textbook. It also includes a list of materials and equipment needed for the practical sessions. The following chapters are based on the structure in the textbook. In brief, the chapters cover the following content: 1) solid mechanics and materials, 2) design, constructions and drawings, 3) control and regulation technology and programming, 4) communication and internet, 5) technological systems, and 6) the relation between individuals, society, environment and technology. Each chapter in the teacher's guide has the same structure. First, there are three common parts: Introduction, Connections to the curriculum, and Assessment. This is followed by 10-12 subchapters, corresponding to the subchapters in the textbook, addressing the content in the chapter (facts and theoretical information) and projects (tasks and assignments). Throughout the teacher's guide, there is a strong link to the textbook, for instance, through images of book spreads to show the teacher which pages in the book are the focus of each section of the guide.

Text that talks through the teacher

Approximately 75% of the teacher's guide is text that talks through the teacher. A large part of the guide is the answer key to the textbook. There are also direct instructions for the teacher on how to conduct the teaching.

In each subchapter, there is a heading called *Teaching* where the guide provides direct instructions for the teacher. They follow the same structure, but subheadings can differ between subchapters. In one subchapter the subheadings are as follows: (1) read the texts, (2) explore, (3) use a checklist, (4) consider the objectives of the section, and (5) engage in a term hunt. Additionally, there is a section called *Keywords* offering suggestions for search terms and tips on conducting searches. The instructions in the guide are clear and straightforward. For example: "Let the students read the text on pages 48–55 silently or read the text aloud to them." Another example: "Use the worksheet and have students write a list of various technical solutions," or "Let students discuss and document their ideas on the worksheet." Yet another example: "Use image search and ask students to identify which term from the box on page 48 they think matches the image." The text under each subheading is structured in bullet lists. The excerpt below shows an example from another subchapter.

1. Read the texts
   - Have the students read the text on pages 10-14 silently or read the text aloud to the students.
   - Ask students to stop and answer the questions on each spread with a classmate while reading.
2. Concept associations
   - Ask students to think about what they associate the terms compressive strength, tensile strength, and flexural strength with.
   - Then have students share their associations with a classmate.
   - Collect the associations as a whole class and write them on the board.

In each subchapter, there is also an *Answer Key* that references the page in the textbook where the questions are found, restates the question, and provides the answers. The *Answer Key* thus presents answers to questions that technically do not have a single correct answer. However, it presents one answer without clarifying that there is only one possible answer and that there may be others. Of course, some questions do have only one correct answer, such as when students are asked to fill in the correct term from a list.

In all, most of the guide talks directly through the teacher, who can essentially use it as a script. Alternatively, it can be employed as a practical step-by-step guide: "Distribute the worksheet to the students, then ask them to answer the questions."

Text that talks to the teacher

The teacher's guide has a small amount of text that talks to the teacher, approximately 25 %. It is primarily in the *Introduction* sections, both the introduction to the chapter and the subchapter, where texts talking to the teacher can be found. The introduction sections outline the purpose of each chapter and subchapter, along with what the following sections cover. These sections may also describe how and why teaching can be adapted, emphasize certain key content, highlight specific challenges, or address what students may find difficult. The introduction talks to the teacher but primarily describes how the chapter is structured and what students are expected to take away. Some definitions of terms are also provided, for example: "The chapter begins with a section that describes the concept of design. Students need to understand that design involves both appearance and function. Students must also understand that design can involve a process.". The connection to core content and commentary material explains how the chapter relates to the syllabus in technology.

The assessment section in each chapter also talks to the teacher. These sections include a rubric that provides examples of student responses for the passing level and higher grade levels.

However, sometimes the text that talks to the teacher is so short or vague that it can be confusing rather than educative for the teacher. This first example is from the introduction to a section about controlling, regulating, and programming*:*

> *Different [programming]languages are suited to different tasks, and in technology [education] it is good to start learning a visual programming language.*

In the following text, there are no explanations as to why it is good to start learning a visual programming language. This information raises questions for the teacher rather than guiding how to teach.

A similar example is found in a section about a project assignment about a model of a process industry. In the student book, a visual model of a process is introduced. In the teacher's guide, the teacher gets the following information about the visual model:

> *The model lacks several steps that, for example, make the paper thinner, smoother, and whiter.*

After this, there are no further explanations. The teacher probably wonders why these steps in the model are lacking, but she will find no answers or explanations for this. In brief, the text that talks to the teacher is insufficient and thus makes the teacher's guide difficult to use.

In the following, we provide examples of how the six design principles were identified in the text.

Design Principle 1 (DP1) – suggestions on how lessons can be adapted in several ways without losing the intended purpose

DP1, which focuses on how teachers might adapt their teaching materials by providing suggestions for adjustments, timing considerations, and addressing diverse student needs, is not extensively covered. However, there are a few examples:

> *Keep in mind that this section may take more time depending on the students' prior knowledge*

> *As an alternative to the project on pages 82–83, students can design a [...], The main difference is that [...] can be placed on a frame with wheels. This way, the house can be moved between different locations.*

> *Students often find it challenging and complicated to create drawings. If they are given ample time, they usually manage to produce drawings that show simple objects with two views and measurements after some practice. Allow students extra time for this section.*

These examples illustrate occasional suggestions for adjustments based on time, alternative projects, and strategies to address common difficulties students face.

Design Principle 2 (DP2) – the reasoning behind, and contextualized concrete examples of, the pedagogical ideas included in the teacher's guide

DP2 is not very present in the teacher's guide overall. However, it is visible in the assessment section included in each chapter. The assessment sections are connected to the syllabus and its assessment criteria, presented in the teacher's guide as rubrics (see example in Figure 1). The assessment rubrics offer the teacher support in the form of examples of student answers at two levels, passed level and higher level, with examples of acceptable student answers on each level.

Objective	Passed level	Higher level
Explain how constituent parts work together in technical solutions	**Version of task 1 on page 33 in the student book:** You are tasked with constructing a bridge that is attached to a support at one end and protrudes over the water. Where should the reinforcement be placed for the bridge to have good strength? Motivate.	Same task
Assessment instructions	The student states that the bridge bends downwards at the far end and that the reinforcement should be placed at the top. **Example of student answer:** The pier is bent down at the far end and then the reinforcement must be placed at the top.	The student states that the reinforcement should be placed at the top with a clear justification linked to tensile strength. **Example of student answer:** The bridge is fixed at one end and then the bridge bends down at the far end. When the outer part of the bridge is pushed down, the upper part of the bridge is pulled apart. The steel rebars have good tensile strength and should therefore be placed at the top of the bridge.

Figure 1. Example of assessment rubric.

Moreover, DP2 is found in the introductions of the subchapters, albeit with limited examples. One such example is:

> *Many students prefer to make drawings on graph paper, which can be a good starting point. However, when adding measurements and drawing lines between the grids, a drawing on graph paper can become unclear. Drawings intended for production are always made on plain white paper. Make students aware of this and let them try drawing their sketches and drawings on white paper.*

This example illustrates how the guide occasionally provides pedagogical reasoning that connects teaching methods to practical outcomes, but these instances are sparse. DP2 often follows text that can be categorized under Design Principle 4. Frequently, a section begins by identifying something students find challenging (DP4), after which the guidance outlines a method or pedagogical approach to help the teacher guide students in understanding or completing the task.

An example of such a text is:

> *Explain to the students that there are often missing components, either due to a lack of knowledge or simply oversight. The important thing is that the students understand that these are models that can be used to explore the potential consequences a product may have for individuals, society, and the environment.*

This demonstrates how DP4 (identifying challenges) transitions into DP2 (providing pedagogical guidance to address these challenges).

Design Principle 3 (DP3) – supporting teachers' subject knowledge, making important content visible, and explaining it

DP3 appears, to varying degrees in different chapters and subchapters. For instance, in the chapter discussing technological development work, there is a stronger focus on essential subject content than in the other chapters. In the introduction, it is explained that "students must also understand that design can involve work, meaning creating new technical solutions." Furthermore, it is described that an important aspect is for "students to acquire the knowledge necessary to carry out their technological development projects." The process is depicted as a circular motion: "The circular motion refers to the frequent need to go back and improve technical solutions during development." It is also emphasized that "technological development work is not a linear process but rather consists of a circular model, involving transitions between different phases, where reflection is crucial for both the process and the outcome." The text provides a relatively detailed description of the essential content that students need to grasp. Other important elements include "understanding that a sketch is a simple drawing made freehand, while a technical drawing is precise and created with a ruler once the solution's design has been determined."

Although the other chapters contain less of DP3, some examples can be identified. In the introduction to each chapter, the text sets the scene for the teacher with a few short lines about the topic and the purpose and structure of the chapter. It is common to find examples of DP3 in these introductions, but the descriptions are seldom detailed, as exemplified in this excerpt about technological systems:

> *...what is typical for a system, is to have a purpose, parts that interact, some parts are more important, the system has a boundary with the outside world, they depend on the outside world in different ways and people are present.*

DP3 can also be observed when words and concepts are highlighted in the text. Sometimes the guide also gives a short explanation of the meaning, for example as follows, where the concept of a model is explained:

> *Students must understand that a model is a tool to try out a solution. It is therefore important that they learn to adapt their models if they do not work as intended. Point out that the model is not the same as a prototype or a finished product.*

Based on how DP3 is designed and constructed, no explanations longer than a sentence or two, to give teachers deeper knowledge of important content, are found. Further, there are no visible connections regarding important content between the chapters. Although there are examples of DP3, they are not visible throughout the texts but appear occasionally and to varying degrees in different chapters.

Design Principle 4 (DP4) – support teachers' different needs for themselves and their students

The core of DP4 is to pinpoint different needs among different teachers and different students, based on varying needs in different situations. However, this teacher's guide does not discuss this in the form of examples for different situations or comparisons for different solutions.

Examples of text talking to the teacher that can be related to DP4 are found when the guide points out content that may be difficult for students. For example, on technological systems: "To understand the system boundary can be difficult". In the following, the guide gives short examples of a mobile phone and a mobile system, but no support to the teachers in how to teach about this or explain boundaries in different situations.

Overall, the guidance focuses on supporting the teacher in addressing students' challenges, misunderstandings, and difficulties**.** For instance, the introduction to one section on the design process states that "many students are eager to draw sketches in perspective, and it is good if they practice drawing in perspective." Another example is that "students often find it difficult and complicated to create technical drawings."

Design Principle 5 (DP5) – provide teachers with examples of how work within technical disciplines is carried out in practice, and how this can be part of the teaching

DP5 is in general not very visible. There are examples in the teacher´s guide of links to various professions as a way of making technology lessons meaningful and relevant to the world outside school. Still, these examples are not discussed deeply. In one chapter, we found this example:

> *Students may think that block programming is something you do in school, but block programming is also common in industry, for example, to control industrial robots or manufacturing machines.*

However, in the chapter on technological development work, there is a significant amount that can be linked to DP5. This chapter includes an entire section on how architects work when designing a residential house, followed by a later section where the students themselves get to try working as architects. In the introduction to the subchapter, it is stated that "the purpose of this section is for students to gain insight into how one works when building a new house" and that "the architect's work is similar to industrial design, with the major difference being that the architect's work results in a single technical solution, a house, while the industrial designer's work results in many identical technical solutions."

Another example of students engaging in real-world work is a project where they are tasked with "solv[ing] problems faced by another person in their everyday life. The project involves designing an aid for a person with a functional variation." In the guidance, teachers are encouraged to emphasize that students should immerse themselves in the work of a designer.

A chapter on the consequences of technology and technological choices also describes that

> *technological development can become their future career. A large portion of job opportunities in Sweden are technology-focused, and education in technical professions is highly likely to lead to good employment. To encourage students to choose technical careers, schools need to highlight the diversity in the field and demonstrate that technology does not have to be dirty, heavy, or noisy.*

Design Principle 6 (DP6) – support teachers to make the importance of technology for societal and everyday life visible

In DP6 the core is to relate knowledge from technology education to society and everyday life. Overall, this principle is rarely noticed in the teacher´s guide. In certain chapters, DP6 is entirely absent, such as in the chapter on technological development work. However, in the chapter addressing the consequences of technology, technological choices, and sustainable development, some texts provide teachers with a foundation for the civic purpose of the content in technology education. For example, teachers are encouraged to "emphasize to students that the best approach is to minimize waste, meaning we should only buy products we truly need" and to urge students to "read about how recycling can work for materials such as plastic, cardboard, glass, metal, and food waste."

Another example is the discussion of societal implications, such as:

> *No one knows which jobs robots will handle in the future, making it difficult to predict the role humans will play. What will society look like when robots can drive our vehicles, write our newspapers and books, compose new music, or fight our wars? No one knows. One thing is certain: for us to move toward a bright future, machines must operate according to the principles of human rights and protect the environment.*

Additional examples that support civic purpose include historical perspectives, such as "a description of the combustion engine and generator that enabled transportation and electricity production" or "how the assembly line principle revolutionized manufacturing, leading to mass production during the 19th and 20th centuries."

Regarding technological systems, there are a few glimpses of DP6. In the introduction section, the aim of the chapter is related to this principle:

> *Students will also gain an understanding of how we depend on different technological systems and see examples of technological systems that they depend on in their everyday lives.*

There are a few more sentences that relate in a corresponding way to the content of the chapter on society, e.g., systems needed "for society to function well". However, except for in the introduction, the teacher's guide never takes this principle further by giving the teacher teaching support or examples of how to help students understand how to use knowledge from technology to make decisions in their everyday lives.

Discussion

As mentioned above, Remillard (2000) points out that teacher guides commonly talk *through* teachers and argues that they should be designed to speak *to* teachers to be educative, although Remillard and Reinke (2012) suggest that a teacher´s guide can also be educative by talking through the teacher. This is supported by Van Steenbrugge and Ryve (2018) who emphasize that teacher guides that talk through teachers can be a support for teachers who feel insecure about the subject or are unaccustomed to teaching situations. Here, we have analyzed a teacher's guide that predominantly speaks through the teacher and identified certain patterns that might have implications for technology education.

First and foremost, Van Steenbrugge and Ryve (2018) suggest that a teacher's guide that talks through the teacher will support in *offloading* a lesson rather than *adapting* it. Thus, we can see how the guide's structure and content shape the teacher's role in the classroom by providing direct instructions that leave little room for individual adaptation. This approach reinforces a particular view of the subject and its core content, while implicitly suggesting particular methods without explicitly explaining their purpose or rationale.

There is an imbalance in the support provided across different chapters, and we also observe that the analyzed teacher's guide aligns closely with the textbook chapters. Each chapter in the guide mirrors those in the textbook and primarily speaks through the teacher. In practice, this leads to different levels of support for teachers in different areas of technology education. Largely, the guide functions as a manual for teachers to follow. This type of teacher's guide, which mostly consists of "recipes" to follow, is suitable for inexperienced teachers who need hands-on instructions (Van Steenbrugge & Ryve, 2018). However, those seeking more in-depth information or deeper texts are left to search for other sources on their own. This approach risks reproducing the author's own experiences, perspectives, and views on the subject. We note that the guide's direct and concrete instructions to the teacher include a particular subject content and an implicit perspective on both the core content and necessary adaptations. This presents a challenge for technology education with such a teacher's guide. Teachers who do not have sufficient knowledge beyond the "manual" might struggle to answer questions and adapt tasks or content for a diverse group of students.

However, the introductory texts for each chapter and section talk *to the teacher* and follow a consistent structure. Design Principle 1, which focuses on how teaching can be adapted to time constraints, special needs, and similar factors, is largely absent and offers little or no guidance. Adaptations and important content are implicitly included in the instructions without explanation or awareness of why they are necessary. Design Principle 2, which aims to make pedagogical ideas explicit for the teacher, is often addressed alongside Design Principle 4, which highlights challenges or difficulties students may face. The assessment rubrics seem to be the primary contribution related to Design Principle 2. Texts linked to Design Principle 3, which emphasizes important content, are only a small part of the guide. This is significant because such content would be valuable for teachers responsible for delivering the material. While the guide's speaking through the teacher indirectly emphasizes important content, texts addressed directly to the teacher fail to highlight this prominently. The applications of Design Principles 5 and 6 vary between chapters. In some cases, goals related to these principles can be inferred from the introductions, but they are not presented in detail, except in a few cases. Overall, the guide is quite superficial in how it talks to the teacher. Moreover, when concrete descriptions are provided, they are sporadic and isolated.

Even though technology teachers seem to prefer curriculum materials that can easily be offloaded (Given & Barlex, 2001), other studies have shown that educative features are necessary to support teachers in choosing to complement resources to provide students with a broad and nuanced view of the topic. Engström et al. (2023) observed that technology textbooks cannot cover everything, requiring teachers to supplement them with additional materials. To support this, the teacher's guides must "speak to the teacher," which the analyzed guide fails to do.

To summarize, we can observe the following consequences for technology education: Teachers may rely too heavily on the guide, limiting adaptability to diverse classroom needs. Teachers may struggle to adapt lessons to the needs of diverse student groups, as the guide provides limited room for personal interpretation or modification. If the teacher's guide takes the form of "recipes", the teacher must remember that it is not the only way to teach. Teachers should treat it as an example and always adapt their teaching to suit their specific circumstances and the needs of their students.

Gaps in teacher knowledge or understanding could lead to inadequate explanations and support for students. Teachers, particularly those with less experience or limited subject knowledge, may become overly reliant on the guide, reducing their ability to address unexpected questions or challenges. A teacher's guide should not replace teacher education or professional development. However, it should still be functional for temporary substitutes, such as a substitute teacher, and could, if designed in an educative way, serve as part of professional development.

The emphasis on a fixed structure and specific instructions risks overlooking broader aspects of the subject, limiting students' exposure to diverse perspectives or approaches. The lack of explicit explanations for suggested methods and adaptations can hinder teachers' understanding of recommended approaches, reducing their capacity to make informed pedagogical decisions. With little guidance on adapting teaching to different experiences or needs, the guide risks failing to support inclusive teaching practices, potentially disadvantaging certain student groups.

These patterns highlight the need for a teacher's guide that not only provides structure but also empowers teachers to adapt and expand upon the material in meaningful ways.

Against this backdrop, and in agreement with Remillard (2000), we would like to emphasize the importance of designing teacher guides with more texts that speak to the teacher, not just through them. Teacher guides need to prioritize communication that empowers teachers to reflect and adapt, rather than merely follow a prescribed method. For teacher education programs we recommend providing students with opportunities to explore and compare different types of teacher guides. Encouraging them to reflect on the differences in approach and their implications for teaching practice will help them to understand and later choose curriculum materials for their teaching (Brehmer, 2023). This approach fosters a deeper understanding of the role of teacher guides and supports the development of flexible and reflective teaching practices.

The findings of this study highlight several important implications for school practice. Schools should be aware that the teacher's guide — when functioning primarily as a directive tool — may limit teachers' opportunities for reflection and professional growth. Therefore, teachers should be encouraged to use teacher guides critically and reflectively. While following clear instructions can be helpful, it is crucial that teachers see these materials as one of several tools in planning and enacting teaching. Teachers can benefit from engaging with questions such as: What is the purpose of this task? What might be missing? The study has limitations as it analyses one teacher's guide. We therefore chose the teacher's guide that accompanies the textbook most used in technology education in Swedish schools. While the study is not generalizable, we argue that it maintains a high level of credibility. Established qualitative methods and a strong contextual understanding have guided the work. Three researchers have reflected on interpretations and potential biases. The results may be applicable in other contexts, as we present the study's setting, methods, and scope. Our interpretations are firmly grounded in the data (Shenton, 2004). However, our intention is not to generalize the results but to qualitatively analyze and describe how a technology teacher's guide communicates with the teacher. With this contribution, we want to put the spotlight on curriculum materials in technology education and encourage others to start investigating the topic. We find the previous research on curriculum materials in technology education is almost nonexistent. Considering the impact curriculum materials have on how teachers plan and organize their teaching (Oates, 2014), more research is needed.

References

Bachmann, K. (2005). *Læreplanens differens. Formidling av læreplanen till skolepraksis. (*Doctoral theses). Pedagogisk Institutt, Norges Teknisk-naturvitenskaplige Universitet.

Ball, D. L., & Cohen, D. K. (1996). Reform by the book: What is–or might be–the role of curriculum materials in teacher learning and instructional reform? *Educational Researcher, 25*(9), 6–8, 14.

Brehmer, D. (2023). *Lärare lär av läromedel. Att förstå, utvärdera och utvecklas av läromedel i matematik.* [*Teachers learn from curriculum materials. To understand, assess, and develop through curriculum materials in mathematics*]. Studentlitteratur.

Brown, M. (2009). The teacher–tool relationship: Theorizing the design and use of curriculum materials. In J. T. Remillard, B. Herbel-Eisenman, & G. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (p. 17 – 36). Routledge.

Davis, E. (2021). Commentary: Instructional Materials Supporting Teachers' Professional Learning. *Journal of Science Education, 32*(7), 836-841.

Davis, E. & Krajcik, J. (2005). Designing Educative Curriculum Materials to Promote Teacher Learning. *Educational Researcher 34*(3), 3-14. https://doi.org/10.3102/0013189X034003003

Davis, E., Palincsar, A., Smith, S., Arias, A., & Kademian, S. (2017). Educative Curriculum Materials: Uptake, Impact, and Implications for Research and Design. *Educational Researcher 46*(6), 293-304. https://doi.org/10.3102/0013189X17727502

Driscoll, M. P., Moallem, M, Dick, W., & Kirby, E. (1994). How does the textbook contribute to learning in a middle school science class? *Contemporary Educational Psychology, 19*, 79-100.

Englehart, D. S. (2010). Contrast of the science teaching practices of two preservice early childhood educators. *Florida Association of Teacher Educators Journal*, *1*(10), 40-54.

Englund, B. (2006). *Vad har vi lärt oss om läromedel? En översikt över nyare forskning: underlagsrapport till Läromedelsprojektet [What Have We Learned About Educational Materials? An Overview of Recent Research: Background Report for the Educational Materials Project* (an electronic resource)]. Skolverket.

Engström, S., Sundqvist, P., Nordlöf, C., & Klasander, C. (2023). Approaches to industrial processes in technology textbooks. In S. Davies, M. McLain, A. Hardy & D. Morrison-Love (Eds.), *The 40th International Pupils' Attitudes Towards Technology Conference Proceedings 2023*. Liverpool John Moores University.

Fahrman, B., Norström, P., Gumaelius, L., & Skogh, I. B. (2020). Experienced technology teachers' teaching practices. *International journal of technology and design education*, *30*(1), 163-186. https://doi.org/10.1007/s10798-019-09494-9

Fuentes, S. & Ma, J. (2017). Promoting teacher learning: a framework for evaluating the educative features of mathematics curriculum materials. *Journal of Mathematics Teacher Education 21*(4), 351-385. https://doi.org/10.1007/s10857-017-9366-2

Given, N., & Barlex, D. (2001). The role of published materials in curriculum development and implementation for secondary school design and technology in England and Wales. *International Journal of Technology and Design Education*, *11*, 137-161. https://doi.org/10.1023/A:1011202516144

Graeske (2021). *Läromedelsbruk i skolan. En kunskapsöversikt – perspektiv och forskning*. Dnr. Komm2021/00295/U2019:04-26.

Hanuscin, D. et al. (2025). Designing Educative Curriculum Materials for Teacher Educators: Supporting Preservice Elementary Teachers' Content Knowledge for Teaching About Matter and Its Interactions. *International Journal of Science and Mathematics Education 23*, 193–213.

Janko. T., & Pešková, K. (2017). Exploring Teachers' Perceptions of Curriculum Change and Their Use of Textbooks during its Implementation. A Review of Current Research. *Zeitschrift für Geographiedidaktik | Journal of Geography Education*, *45*(1), 33–60. https://doi.org/10.18452/23097

Jukić Matić, L., & Glasnović Gracin, D. (2021). How do teacher guides give support to mathematics teachers? Analysis of a teacher guide and exploration of its use in teachers' practices. *Research in mathematics education*, *23*(1), 1-20. https://doi.org/10.1080/14794802.2019.1710554

Melton, J. C., & Mikeska, J. N. (2025). Variation in the Implementation of Educative Curriculum Materials for Elementary Science Teacher Educators in Two Course Contexts: An Exploratory Case Study. *Journal of Science Teacher Education*, 1–22.

National Agency for Education. (2024). *Curriculum for Compulsory School, Preschool Class and School-Age Educare, LGR22.* https://www.skolverket.se/publikationsserier/styrdokument/2024/curriculumforcompulsoryschoolpreschoolclassandschoolageeducarelgr22.4.7c808d9519080d9657c2.html

National Agency for Education. (2024a). Pedagogisk personal i skola och vuxenutbildning Läsåret 2023/24 [Teaching staff in schools and adult education - academic year 2023/24] https://www.skolverket.se/publikationsserier/beskrivande-statistik/2024/pedagogisk-personal-i-skola-och-vuxenutbildning---lasaret-2023-24

Neuman, S. Pinkham, A. & Kaefer, T. (2015). Supporting Vocabulary Teaching and Learning in Prekindergarten: The Role of Educative Curriculum Materials. *Early Education and Development 26*(7), 988-1011. https://doi.org/10.1080/10409289.2015.1004517

Nordlöf, C., Hallström, J., & Höst, G. E. (2019). Self-efficacy or context dependency?: Exploring teachers' perceptions of and attitudes towards technology education. *International Journal of Technology and Design Education, 29*(1), 123-141. https://doi.org/10.1007/s10798-017-9431-2

Nordlöf, C., Höst, G., & Hallström, J. (2022). Technology teachers' talk about knowledge: from uncertainty to technology education competence. *Research in Science & Technological Education*, *42*(2), 336–356. https://doi.org/10.1080/02635143.2022.2070150

Oates, T. (2014). *Why textbooks count.* Cambridge Assessment.

Remillard, J. T. (2000). Can curriculum materials support teachers' learning? Two fourth-grade teachers' use of a new mathematics text. *The elementary school journal, 100*(4), 331-350.

Remillard, J. T., & Kim, O. K. (2020). *Elementary mathematics curriculum materials: Designs for student learning and teacher enactment*. Springer Nature.

Remillard, J. T., & Reinke, L. (2012, April). Complicating scripted curriculum: Can scripts be educative for teachers. In *Annual Meeting of the American Educational Research Association.* Vancouver, BC.

Roberts, D. (2007a). Linné scientific literacy symposium. Opening remarks by Douglas A. Roberts. In Linder, C., Östman, L., & Wickman P-O. (Eds) (2007). *Promoting scientific literacy: science education research in transaction.* Proceedings of the Linnaeus tercentenary symposium held at Uppsala University, Uppsala Sweden, May 28-29, 2007.

Roberts, D. (2007b). Scientific literacy/Science literacy. In S. K. Abell & N. G. Lederman (Eds), *Handbook of research on science education* (pp. 729–780). Lawrence Erlbaum Associates.

Roberts, D., & Bybee, R. (2014). Scientific literacy, science literacy, and science education. In N. G. Lederman & S. K. Abell (Eds*), Handbook of research on science education* (Vol. Vol. II, pp. 545–558). Routledge.

Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. Blackwell.

Roseman, J. E., Herrmann-Abell, C. F., & Koppal, M. (2017). Designing for the Next Generation Science Standards: Educative Curriculum Materials and Measures of Teacher Knowledge. *Journal of Science Teacher Education*, *28*(1), 111–141. https://doi.org/10.1080/1046560X.2016.1277598

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*, *22*(2), 63-75.

Schlag, S., & Glock, S. (2024). The roles that students' ethnicity and achievement levels play in teachers' choice of learning materials in online teaching: evidence from two experimental studies. *Instructional Science*, 1-19.

Skolinspektionen. (2014). *Teknik—gör det osynliga synligt.* http://www.skolinspektionen.se/Documents/publikationssok/granskningsrapporter/kvalitetsgranskningar/2014/teknik/kvalgr-teknik-slutrapport.pdf.

Snyder, J., Bolin, F. & Zumwalt, K. (1992). Curriculum Implementation. In P.W. Jackson (Ed.) *Handbook of Research on Curriculum* (pp. 402–435). Macmillan.

Stoor, M., & Popov, O. (2021). Societal Aspects of Technology: The Swedish Lower Secondary School Curricula in International Comparison. *Techne series: Research in sloyd education and crafts science. A*, *28*(2), 140-148.

Van Steenbrugge, H., & Ryve, A. (2018). Developing a reform mathematics curriculum program in Sweden: Relating international research and the local context. *ZDM*, *50*, 801-812. https://doi.org/10.1007/s11858-018-0972-y