Received: 27 May 2020 | Revised: 6 October 2020 | Accepted: 12 November 2020

DOI: 10.1002/sce.21607

GENERAL SECTION

Science Education WILEY

Industry, science education, and teacher agency: A discourse analysis of teachers' evaluations of industry-produced teaching resources

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Abstract

This study examines teachers' evaluations of teaching resources produced by industry to support science and technology teaching. The aim is to contribute to an understanding of how teachers negotiate the usability of industrial school initiatives for compulsory school science and technology. These evaluations are conceptualized in terms of teacher agency and educational governance. The collected data consist of focus group interviews where Swedish lower secondary school teachers discuss the usability of industry-produced teaching resources. A discourse analysis was conducted and five discourses discerned regarding teachers' practical evaluations of industry-produced teaching resources: (1) *the curriculum discourse*, (2) *the educational design discourse*, (3) *the practical discourse*, (4) *the correct science content discourse*, and (5) *the partiality and bias discourse*. The teachers draw on the different discourses to different degrees, and the teacher agency achieved in specific situations will vary. Based on the results a tool aimed at strengthening teacher agency in the practical evaluations of teaching resources from the industry is proposed. The study also contributes to a critical discussion on the influence of industry on the local education policy arena and suggests directions for strengthening teacher agency in

situations where teachers evaluate and make decisions about the use of industry-produced teaching resources.

KEYWORDS

discourse analysis, educational policy, governing, industry-school cooperation, science education, teacher agency, technology education

1 | INTRODUCTION

In this study, we target the role and the work of science teachers when encountering teaching resources produced by industry and offered to schools to support science teaching. In the field of science education, there has been a long-standing concern and interest in the relationship between science education and industry. There were, already at the beginning of the 20th century, a number of contributions to the *General Science Quarterly* (now *Science Education*) concerning how science, in general, should contribute to the flourishing of national industry, how young people should be prepared for vocational life, and, what and how industrial processes should be taught in school science. Most contributions express a desire to make science education important in relation to the development of industry and the nation. For example, Whittemore (1923, p. 197) wrote: "The point is made here that we need to foster and 'boost' such an industry from an American point of view." One of the early proponents of a less subordinate position for science education in relation to the industry was Dewey (1923), who wrote, also in *General Science Quarterly*, that "[i]t seems to me that the vocational or industrial work of the schools should be directed, not to fitting for any particular calling, but be of the kind that will develop in a youth reserves to meet emergencies, to stand on his own feet, and to use his own hands, directed by his own brain" (p. 88). The relationship between science education and industry has continued to render contributions of various kinds in the journal of *Science Education* and its precursor *General Science Quarterly*.

Today also the recent research points to a reciprocal interest and concern for the relationship between science education and industry. We see, for example, various kinds of industrial and corporate actors engaging in the production of teaching resources, teacher professional development, and informal science learning resources (Andrée & Hansson, 2020). In our own research relating primarily to the national context of Sweden, we found that private companies, business, and employers' organizations in the science and technology area (e.g., energy companies, pharmaceutical companies, mining companies, and chemical business organizations), and networks of such actors have taken on the role of offering various initiatives to support science education (Andrée & Hansson, 2020). These initiatives commonly include resources for science teaching in the form of lesson plans, student tasks, worksheets, textbooks, games, quizzes, etc. These teaching resources are most often offered free to schools and teachers.

Turning to studies focussing on industry involvement in science and technology education, we found that previous research primarily pointed to the benefits of school cooperation with industrial actors. Parvin and Stephenson (2004) discussed objectives and formats for including industrial site visits in science education. They concluded that there was a long tradition of industrial engagement in the UK involving the manufacturing industry and particularly the chemical and pharmaceutical industries. Some benefits they pointed to were that school–industry collaboration may be used to challenge stereotypical perceptions of the industry as a workplace. This has also been proposed by Henriksen et al. (2015) who suggested that creating opportunities for young people to meet role models in science/technology as well as relating the teaching of science to society may serve as a means to challenge stereotypical images of science and technology, scientists, and engineers. In addition, several studies have explored the possibility of enhancing students' motivations for science education and science careers through industry collaboration. For example, Loukomies (2013) studied how teaching sequences can be designed to combine inquiry activities, industry site visits, and writing tasks to enhance students' appreciation of the relevance of science education and to promote motivation and interest in school science.

Lavonen et al. (2010) suggested a model of an industry site visit for lower secondary school science education as a form of out-of-school learning that is intended to support students' motivation for pursuing further education and careers in science. Kousa et al. (2018) explored school–industry collaboration specifically in relation to the aims of teaching science in contexts of technology, society, and environmental issues. Their study provides a practical example of a local school–company collaboration and their results point to a need for developing tools for teacher support and encouragement.

In our own previous research on the involvement of industrial actors in initiatives for science, technology, and mathematics education, we pointed to different rationales about how industrial actors legitimize their engagement in science education (Andrée & Hansson, 2020). Some of the rationales display potential conflicts of interest in relation to questions of education as a public and private good. For example, industrial actors talk about the need to secure competent labor and the need to secure economic growth (e.g., for a country), and that they want to improve the public image of the sector or of the company/organization. The overall picture is that citizen-oriented aims and critical perspectives on the role of science in society are absent and that the industrial actors tend to have very explicit aims regarding their engagement in science education. These aims often include a desire to influence the aims and content of science education to better suit their needs (Andrée & Hansson, 2020). Similarly, Davidsson and Sørensen (2010) showed that the involvement of sponsors in science centers and science museums has had the consequence of sponsors frequently (directly or indirectly) interfering with the design of the exhibitions. A recent Canadian study by Eaton and Day (2020) showed how teachers tend to adapt narratives on energy, climate change, and related problems and solutions provided by the fossil fuel industry. Another example of how such narratives are circulated comes from a Norwegian study by Skarstein (2020). The study showed that student teachers with prior experiences of working in the oil industry tended to be more skeptical than other student teachers to human-induced climate change and had less intention to teach about it (Skarstein, 2020). The studies highlight the critical role of teachers in dealing with potential conflicts of interest.

Offers to schools in the form of teaching resources for science and technology education by necessity emphasize specific contents, aims, and teaching methods. In light of previous research, which points to the benefits and constraints of industry-school collaborations, we argue for the importance of acknowledging the governing elements associated with the offers to schools from corporate and industrial actors. There is a need to scrutinize the ways in which teachers deal with such offers by industrial actors in their day-to-day work.

2 | THE LOCAL ARENA OF GOVERNING SCIENCE AND TECHNOLOGY EDUCATION

In this article, we conceptualize the day-to-day work of science and technology teachers as part of their participation within a local arena of governance—making judgments and decisions. The governing of education does not only concern the setup of formal structures for governing an education system, but also includes the different forces conditioning or influencing the outcomes of education (Daun & Mundy, 2011). The governing is related to the "cultural practices of reform that produce how judgments are made, conclusions are drawn, rectification is proposed, and the fields of existence made manageable and predictable in school reform" (Popkewitz, 2003, p. 28). However, the local policy arena does not only include teachers but also local school administrators and other actors (such as industry) seeking to influence what is going on in the classroom. Industrial actors and industry-produced teaching resources offered to schools thus become part of the local policy arena and the governing of school (Andrée & Hansson, 2020). The complex formations of policy in the local school context may be conceived of as "local assemblages of policy" (Simons et al., 2013, p. 142).

The role of teachers in local education policy work is largely the planning and conducting of teaching, including didactical analyses (cf., Klafki, 1995). For example, in the Swedish context, characterized by a highly decentralized education system, teachers are faced with tasks such as deciding what, how, and with what resources to teach.

One example is that decisions that have historically been made centrally—such as what textbooks to use—are now made by local schools and their teachers. This leaves Swedish schools more open to outside influence than more centralized education systems (Carlgren, 2009). Thus, the decentralized character of the school system enables external actors to influence the forms and content of education by engaging in the production of teaching resources, design of teacher professional development, quality-labeling of schools, and more (Andrée & Hansson, 2020).

3 | TEACHER AGENCY

In Sweden, the UK, and elsewhere, the education policy has increasingly moved away from top-down approaches to educational governance toward enabling teachers to play an active role in educational improvements (cf., Priestley et al., 2015). These approaches mark a shift from previous policy tendencies that worked to deprofessionalize teachers (Priestley et al., 2015). However, acknowledging the role of teachers in local policy also makes it important to highlight the issue of teacher agency (Priestley et al., 2013). What characterizes teacher agency in a specific situation such as (as is the case in this study) when judging and negotiating the use of industry-produced teaching materials in their science teaching?

To conceptualize the policy work of teachers we draw on a notion of agency. Agency has been used increasingly in the science education literature. However, there is a variety in how the concept is defined and often there is a lack of a clear operationalization (Arnold & Clarke, 2014). A recent review of empirical studies regarding the agency-structure dialectic in science education shows that the theoretical perspectives used in science education include sociological, critical/poststructural, and psychological perspectives (Fu & Clarke, 2019a). According to the review of Fu and Clarke (2019a), the research on agency in science education can be divided into four categories: teacher agency, teacher-and-student agency, student agency, and administrator agency. One of the theoretical models of agency focusing specifically on *teacher* agency is Biesta and Tedder's (2006, 2007) ecological approach which we use in this study. Since we are interested in how agency is achieved in practice by teachers when evaluating teaching resources we find the model especially suitable. This model of teacher agency draws on sociological and pragmatist perspectives and has been used successfully in previous science education research (e.g., Fu & Clarke, 2019b; King & Nomikou, 2018; Rivera Maulucci et al., 2015; Wallace & Priestley, 2017; Wild et al., 2018). In this study, the ecological approach to teacher agency is used to conceptualize teachers' policy work when negotiating the usability of specific teaching resources produced and offered by industrial actors.

The model by Biesta and Tedder (2006, 2007) focuses on the factors that contribute to the ways in which teachers might achieve agency. In the model, agency refers to the ways in which actors "critically shape their responses to problematic situations" (Biesta & Tedder, 2006, p. 11; see also Biesta & Tedder, 2007; Priestley et al., 2013) and as something that is "*achieved* through engagement with very specific contextual conditions" (Priestley et al., 2013, p. 188). Thus, agency is something people do or achieve by means of their environment and is a result of "the interplay of individual efforts, available resources, and contextual and structural factors as they come together in particular and, in a sense, always unique situations" (Biesta and Tedder, 2007, p. 137).

Biesta and Tedder's (2006, 2007) model builds on three dimensions of agency: the *iterational*, the *projective*, and the *practical-evaluative* dimension. The iterational dimension is rooted in teachers' previous experiences. The iterational dimension includes elements where "personal capacity (skills and knowledge), beliefs (professional and personal), and values" (Priestley et al., 2016, p. 139) are selectively reactivated by the teachers. The projective dimension of agency involves the "imaginative reconstruction of the future" (p. 140) and includes elements in the form of, for example, educational goals and motives. The projective elements can be both short term and long term. Priestley et al. (2016) argue that "people who are able to form expansive projectories about their future trajectories might be expected to achieve greater levels of agency … they have access to a wider repertoire of alternative futures" (p. 140). The practical-evaluative dimension of agency involves practical and normative judgments of

different trajectories (e.g., envisioned teaching alternatives). Thus, teacher agency is about teachers' active contributions and an important dimension of teachers' professionalism (Priestley et al., 2016).

When teachers engage in local policy work, they become "agents in the mediation and enactment of policy" (Ball et al., 2011, p. 622). Teachers are both policy subjects and policy actors (Ball et al., 2011), whose actions are realized in particular practices with particular available resources and constraints. Teachers act with and make sense of teaching (what characterizes good teaching, the roles of teachers and students, etc.) through policy concepts sedimented over time in the professional practices of teaching (Ball et al., 2011, p. 622). The notion of sediment is a metaphor borrowed from archeology to refer to constitutive rules of practice, teaching traditions, and habits, and ways of thinking about science teaching. In schools, these policy sediments constitute part of the conditions for teacher agency (cf., Priestley et al., 2016).

4 | AIM AND RESEARCH QUESTIONS

There is a need for critical discussion about the influence of industrial actors on the local policy arena, and for increased knowledge about teacher agency in situations where science and technology teachers evaluate and make decisions on the role of industrial actors in teaching. The aim of this study is to contribute to our understanding of how teachers negotiate the usability of industrial school initiatives for compulsory school science and technology. The study is based on an analysis of discursive practices employed by teachers in focus group conversations. These practices reflect the practical-evaluative dimension as well as the iterational and projective dimensions of teacher agency achieved when teachers evaluate the usability of industrially produced teaching resources. The specific research question is:

> *What characterizes the teacher agency achieved when teachers are evaluating teaching resources offered by the industry?*

5 | DESIGN OF THE STUDY

To explore how science and technology teachers negotiate the usability of industry-produced school initiatives for compulsory school science and technology we used focus group methodology. Methodologically, focus groups may be considered a qualitative data collection method in between unstructured interviews and participatory observations (Hylander, 2001; Morgan, 1997). The focus group is a *focussed* group interview that may be characterized as the creation of a situation where the participants make shared experiences. The participants read, listen to, or watch something together and the subsequent conversation is arranged to stimulate a range of personal and reflective responses (cf., Vaughn et al., 1996). Focus group interviews are commonly used in exploratory research to explore different points of view. In a focus group discussion, the research participants primarily guide the flow and direction of the conversation and comments may encourage new thoughts and ideas (Williams & Katz, 2001).

5.1 | Design of the focus group interviews

In this study, we conducted five focus groups with 20 science and technology teachers. Four of the focus groups were composed of teachers from different schools across Sweden. The participating teachers in these four groups all participated in a professional development program on teaching physics. These teachers had varying backgrounds with respect to science disciplines (on a group-level all science disciplines were

represented), number of years in their careers of teaching science (ranging from less than 2 years to more than 10 years), and schools (including schools with differing socioeconomic conditions). The fifth focus group was composed of a team of science and technology teachers from the same school. This school was chosen, in light of its previous participation in a yearly industrial STEM-education initiative. The rationale was to ensure the inclusion of teachers with extensive experience of school–industry collaborations in the study. The fifth focus group also includes teachers with varying disciplinary backgrounds (covering all science subjects), and teaching experiences ranging from less than 2 years to more than 10 years (including one teacher–student with teaching experience but no certificate).

At the beginning of the focus groups, the teachers were asked to respond to a questionnaire requesting information regarding the educational background of the participating teachers and their experiences of using industry-produced teaching resources. The focus group conversation then continued with the moderator (one of the authors using a semi-structured focus group guide) asking the teachers to share their previous experiences of using externally produced teaching resources. For example, the moderator asked when and how the teachers would search for externally produced teaching resources; and, why they choose to use, or not to use, specific resources. The next phase of the focus group discussions was organized around specific science and technology teaching resources produced by industrial actors (brought to the focus group by the moderator). During this phase of the focus groups, the moderator presented five industry-produced teaching resources (see below)—one at a time. The five teaching resources were presented to all five focus groups. During this phase, the moderator guided the discussions toward whether and how the participating teachers would consider using the specific industry-produced resources in their science and/or technology teaching. Related to this main discussion point the moderator, when appropriate, asked for clarifications and further elaborations concerning what the teachers would look for when they decided whether to use the particular resources, what they viewed as decisive in their evaluations, and about the overall rationales for and against using this kind of teaching resources. The focus groups lasted for about 1 hour each.

The teaching resources selected for inclusion as focus resources were chosen to represent a variation in terms of types of teaching resources offered by industrial actors to Swedish teachers. The teaching resources represent a variety of content areas that are more or less common to science and technology teaching in Swedish lower secondary and secondary schools. The content areas included energy, plastics, antibiotics, and forestry/ecology. The formal school subjects related to the resources thus included Physics, Chemistry, Biology, and Technology. The resources were also chosen to represent teaching resources produced by various kinds of industrial actors, including single companies as well as business and employers' organizations. In addition, the senders/producers of the resources were more or less explicitly obvious—from the use of logos on the front cover and throughout a resource—to implicit, where the umbrella organization may have been difficult to recognize as an industrial actor. Messages in the resources regarding the interests of the senders were also more or less explicit (ranging from raising awareness about energy to emphasizing the value of consuming *Swedish* meat). For an overview of the characteristics see Table 1.

A brief description of the teaching resources used follows below:

1. ***Plastics Knowledge for Compulsory School***: The resource is a textbook produced by the business and employers' organization *Chemical and Innovation Companies in Sweden* (IKEM) in collaboration with *Plastics Europe*. The resource may be used as a textbook but also as a digital resource with eight (separately downloadable) chapters on different aspects of the production and use of plastics in today's society. The overall message is that plastics are important for a broad range of human activity. IKEM describes its rationale for engaging in STEM-education as follows: "

   For companies that want to invest and produce in Sweden, access to the right competencies is an important factor. Without a functioning school with good teaching in Science and Chemistry, Sweden will lose out. Therefore, IKEM invests in schools" (https://www.ikem.se/ikem-skola/om-ikem/).

TABLE 1 Characteristics of the industry-produced teaching resources selected for inclusion as focus resources

Teaching resource	Type of industrial actor	Visibility of the industrial actor	Type of teaching resource	Science content areas
Plastics Knowledge for Compulsory School	Business and employers' organization	Explicit industrial actor although noncommercial appearance of the resource (a web address is found at the bottom of the last page of each chapter)	Student booklet, including integrated student worksheets and tasks	Chemistry and Technology: plastics (the chemistry of plastics, production processes, and uses)
The "Antibiotics School"	Business and employers' organization	Implicit industrial actor as the sender (difficult to discern who the sender is) in the worksheets. The industrial actor is explicit in the film included (contains a hashtag #Swedishmeat)	Lesson plans for a teaching sequence, including film clips and student worksheets	Biology: antibiotics
Forestry the Swedish Way	Single company	Explicit industrial actor (use of company logos and color scheme)	Lesson plans for a teaching sequence, including film clips and student worksheets	Biology and Technology: ecology, biodiversity, forestry, and products
Energy Genius	Single company	Explicit industrial actor (use of company logos and color scheme)	Student booklet, including student worksheets and tasks	Physics and Technology: energy (supply, sources, and forms)
The Book about the Forest	An umbrella organization run mainly by forestry companies with an aim to work with schools	Implicit industrial actor (difficult to discern who the sender is)	Textbook in color with text, photos, and illustrations. Can be ordered as a book or downloaded as pdf	Biology: ecology, climate and climate change, forestry products, forestry, and society

The textbook *Plastics Knowledge for Compulsory School* may be characterized as dense in terms of facts and the sender/producer IKEM is rather implicitly present in the resource. However, there is a reference to their webpage at the end of each chapter, and the resource has to be downloaded or ordered through the organization's website.

2. ***The "Antibiotics School"***: This resource is produced by the business and employers' organization *Swedish meat*. It includes a teaching sequence of six lessons targeting students and teachers in secondary and upper secondary schools. The resource includes film clips, worksheet materials, and a teachers' manual. The resource deals with "among other things, the use of antibiotics, resistant bacteria, human health, and the hunt for new antibiotics" (https://www.sveaskog.se/globalassets/trycksaker/lararhandledningar/uppdaterade/lararhandledning_lektion2.pdf). Swedish meat is not explicitly visible as the sender/producer of the resource but there is a hashtag on the front cover of the worksheets provided and on the associated web pages (*#svensktkött/köttskolan* [in English—#swedishmeat/themeatschool]). The overall objective is "to provide knowledge and spark discussion about one of the most important issues of our time—antibiotics resistance" (https://www.sveaskog.se/globalassets/trycksaker/lararhandledningar/uppdaterade/lararhandledning_lektion2.pdf), and there are also references to objectives in the Swedish national curriculum for biology education. In one of the film clips, which was also shown to the teachers in the focus groups, there is an explicit message that one should "buy Swedish meat" to contribute to decreasing global consumption of antibiotics.
3. ***Forestry the Swedish Way*** ["Skogsbruk på ren svenska"[1]]: This resource is produced by *Sveaskog*, a forestry company owned by the Swedish state. On the company website the overall mission of the company is described as follows: " Sveaskog [the forestry company] cultivates the forest so that the climate benefits; biodiversity as well as social and economic values are reinforced both now and for future generations. At the same time, forestry must be profitable and competitive. We want to be the leading forestry company and an example of a sustainable business"(https://www.sveaskog.se/om-sveaskog/). In the foreword to the associated teacher manual *Forestry the Swedish Way*, the company writes that they want to "ensure that knowledge of the forest increases" and that they want to "tell about and clarify the benefits of the forest and Swedish forestry" (https://www.sveaskog.se/globalassets/trycksaker/lararhandledningar/uppdaterade/lararhandledning_lektion2.pdf). The teaching resource includes a sequence of seven lesson plans, including film clips, worksheets, factsheets, and teacher manuals. In the teaching resource, there is an explicit message that the specific forestry company and the forestry industry in Sweden, in general, is responsible and plays an important role in meeting climate and sustainability challenges, for example, by stating (in a film which was shown to the teachers) that forestry is "a multiskilled environmental operator which is great at doing good" (https://www.sveaskog.se/forestrytheswedishway/).
4. ***Energy Genius***: This resource includes a student booklet (28 pages) with facts, illustrations, discussion points, and worksheet materials concerning the production and use of energy. It is produced by E.ON, a major energy company in the Swedish energy market with its headquarters in Germany. The sender is clearly identified with the company logo and layout used throughout the booklet. The booklet's stated objective is to "contribute to increasing knowledge of energy, and inspire you and your friends to discuss. Because one of the really big challenges of our time is to be able to ensure future access of the world's population to light, power, and heat. … And who knows—maybe it's you who will solve the energy problems of the future." In other words, the company's explicit aim with the student booklet is to influence the attitudes and knowledge of young people.
5. ***The Book about the Forest***: This resource is a textbook about the forest (54 pages) produced by an organization called *The Forest in School*. *The Forest in School* is a school program involving actors with an interest in forests (in Swedish—*skogliga intressenter*). The main mission of the organization as stated on its website is to "in a comprehensive and balanced way, explain the context for an increased understanding of Sweden's most important sector" (https://www.skogeniskolan.se/om-oss). It is not clearly stated in the resource that *The Forest in School* is an umbrella organization for forestry companies. The impact message is partly implicit and embedded in the

texts throughout the book. It states, for example, that the forest industry follows laws and regulations for forestry in Sweden and that forest owners usually do more than the law requires.

6 | DATA ANALYSIS

The focus group interviews were audio and video recorded and transcribed verbatim. The data were analyzed using Biesta and Tedder's (2006) ecological model of teacher agency. In the first step of the analysis, practical-evaluative instances of interaction—when the teachers negotiate the usability of industrial teaching resources—were identified. These instances include when the teachers respond to the teaching resources presented to them in the focus groups, or when they respond to responses of one another. For example, "it is a fun scheme they have" (Focus group 5, FG 5) and "I think the discussion questions were really good too" (FG 4).

After having identified instances of practical-evaluative interaction, the second step of the analysis was to categorize the instances by the specific types of practical-evaluative questions posed by the teachers (implicitly or explicitly) in their evaluations of the industry-produced teaching resources. Examples of such practical-evaluative questions are questions pertaining to curriculum alignment or educational design. The categories of practical-evaluative interaction, where the teachers negotiated the usability of industry-produced teaching resources, were developed as discourses. Discourses are always embedded in social situations and represent configurations of socially accepted ways of talking about teaching resources among teachers. In the course of the conversation, the discourses are intertwined with each other (Gee, 1999). The discourses were developed through a process of integration and reorganization until the discourses became stable and the authors agreed on their properties. Thus, the discourses were empirically grounded. The process of developing the discourses may be described as a process of constant comparison of the instances of practical-evaluative interaction (cf., Glaser & Strauss, 1967). In the results section, the description of the practical-evaluative discourses discerned is organized around the identified types of practical-evaluative questions raised by the teachers and illustrated with transcripts from the focus groups. The transcripts include references to the specific focus group (e.g., FG1 referring to Focus group 1).

The third step of the analysis was to identify iterational and projective elements of teacher agency. Discerning iterational elements meant to identify instances when the teachers refer to values, skills, knowledge, and experiences when evaluating the curriculum resources. For example, one teacher reactivates knowledge about students with special needs in her evaluation when saying: "[s]tudents with neuropsychiatric diagnoses might want to have resources where extraneous content is reduced" (FG 2). Another teacher reactivates experiences of a crowded curriculum and lack of time when saying: "[i]t can be difficult too, to cover everything [in the curriculum]" (FG 5). In yet another example, a teacher in a discussion on the hashtag "#Swedishmeat" (at the beginning of the film about antibiotics from Swedish meat), refers to his experiences of students being vegetarians when he says that there will be "students who are vegetarians, for one reason or another, then they might be quite skeptical of what is presented here" (FG 2). In this utterance, the teacher reactivates iterational elements in the form of prior experiences of students being vegetarians, but this utterance also includes a projective element when the teacher envisions how a group of students might react if he would show the film. Thus, projective elements concern the teachers' envisioning of possible futures. Projective elements also include how the teachers refer to the goals and motives of science and technology education. For example, when a teacher says: "really, the resources we use must be neutral" (FG 5), hereby communicating a goal—or a projective element—of enacting teaching that is neutral or unbiased.

The following example illustrates how the practical-evaluative, iterational, and projective dimensions of agency are combined and intertwined by the teachers in the focus group discussions:

1. **Teacher 6:** *And that there is like… like this one then (turns the pages of Energy Genious). Forms of energy, we have that in the curriculum and it is easy to connect to. Yes, this fits.*
2. **Teacher 7:** *Provides an overview and good.*
3. **Teacher 6:** *This one, yes this one [Energy Genious] was really good. Text and pictures. It cannot be too messy listItemke* [The Book about the Forest]. *It is too messy. This one* (points to The Book about the Forest) *I can see myself using as an information resource for myself.*
4. **Teacher 7:** *Yes.*
5. **Moderator:** *So then clarity of the resource is one such important factor.*
6. **Teacher 7:** *If you are to use it with the students (FG 2).*

In the example, the teachers make practical-evaluative judgments related to the curriculum (utterance 1), and the design/outline of the resource (utterances 2–6). These instances of practical-evaluative judgments were identified in the first step of the analysis and then used in the second step to develop the discourses. In the example, the teachers reactivate prior knowledge about the curriculum (utterance 1), and experiences of the importance of clarity in the teaching resources used (utterances 2–6). The prior knowledge and experiences reactivated constitute iterational elements of teacher agency. In addition, the teachers express goals for their teaching (more or less explicitly) related to curriculum alignment (utterance 1), and clarity/structure (utterances 2–6). These goals or visions of teaching constitute projective elements of the teacher agency achieved in the teachers' evaluations of the teaching resources offered by the industry.

The above example thus illustrates how the discursive practices enacted through the focus group conversations reflect the practical-evaluative dimension as well as the iterational and projective dimensions of teacher agency (cf., Priestley et al., 2016). It also illustrates how the dimensions of the agency achieved in the situation may be put together by the teachers in ways that make sense to the participating teachers in the particular situation (cf., Gee, 1999).

7 | RESULTS

The results revealed the discourses that the teachers drew upon when negotiating the possibilities for using the particular teaching resources presented to them during the focus group interviews. Most of the resources were new to the participating teachers (however, most of the teachers were familiar with *The Book about the Forest* and some with *Plastics Knowledge for Compulsory School*). The teachers reported that they commonly searched for teaching resources (produced by different types of actors) as part of their everyday preparation for teaching and most teachers said that they not only used search engines (e.g., Google) but also that they revisited particular websites which they knew provided "good" teaching resources (e.g., public service-combined radio and TV channel called *Utbildningsradion* [The Education Radio Station]). The teachers also reported encountering resources and various kinds of externally produced initiatives (by the government as well as for-profit and non-profit private actors) when participating in Facebook groups or STEM-education fairs. The kinds of resources they reported using as part of their everyday teaching included media in the form of films, TV programs, YouTube clips, digital calendars, etc.; lesson plans or components for lesson planning (student tasks, texts, images, graphs, quizzes); science "facts" related to specific content areas; competitions; and invited expert lecturers. The teachers reported that they used the teaching resources as additional resources for all students, as additional study material for some students, or as part of their own background reading in their preparation for teaching. However, the teachers also reported that they would commonly *not* use sets of resources in the form of a full teaching sequence.

The five discourses drawn upon by the teachers negotiating the possibilities of using specific industry-produced teaching resources were: (1) the curriculum discourse, (2) the educational design discourse, (3) the practical discourse, (4) the correct science content discourse, and (5) the partiality and bias discourse. The

discourses focused on different types of evaluative questions asked by the teachers in relation to the teaching resources. Thus, the discourses mirrored the practical-evaluative dimension of teacher agency. Below, for each of the discourses, we also describe the iterational and projective elements that contribute to the teacher agency achieved.

7.1 | The curriculum discourse

Teachers evaluated each resource in relation to the curriculum. In the context of Sweden, there is a national curriculum comprised of an introductory section with general aims and overall objectives for compulsory education and a number of subject-specific syllabuses with aims and learning goals specific to each school subject. For science, there are syllabuses for Biology, Chemistry, Physics, and Technology/Engineering. However, curriculum, as used in this article, does not only refer to steering documents but also to the enacted or lived curriculum including aims and objectives beyond formal regulations (cf., Andrée, 2007; Cuban, 1992; Goodlad et al., 1979). The curriculum discourse, therefore, includes all the teacher talk about curriculum artifacts as well as the teachers' conversations about the aims, goals, and content of science and technology education in a broader sense, not coupled directly to the steering documents. The practical-evaluative questions that were the focus of the teachers' negotiations were: How well is a resource aligned with the national curriculum? How well is the resource aligned with the enacted curriculum practice? And, finally: How may a resource contribute to realizing important aims of science education?

7.1.1 | How well is the resource aligned with the national curriculum?

In the curriculum discourse, alignment between the teaching resource and the national curriculum (e.g., in terms of aims, goals, or content) became a key question. If a teaching resource was judged to be in line with the science/technology curriculum this made the resource more usable than if the teachers found that a resource covered content that was not part of the curriculum. There were examples of general comments on alignment with the aims and goals of the curriculum, however, more specific evaluations of the alignment of the resources mostly concerned the science content and whether it was in alignment with the syllabuses. In the following example, one group of teachers evaluated the teaching resource from the energy company:

> ***Teacher 6:*** *There is, like, this one then* (turning the pages of the energy company teaching resource), *"forms of energy" that we have as part of the curriculum, and it is quick to connect, yes [in English] this is correct. (FG 2)*

Here the teacher reasons that the science content "forms of energy" is something that is part of the curriculum which then makes the resource usable. A consequence of this rationale was that a teaching material was dismissed if the content was not regarded as part of the curriculum. One teacher stated that such resources would be difficult to use due to time limitations:

> ***Teacher 7*** *: I get really stressed by the curriculum, short of time, so I feel that it is difficult to spend time on anything but what really is included [in the curriculum] (teachers 5 and 6 nod). (FG 2)*

Thus, a teaching resource was found to be more usable if the content was regarded as being aligned with the core content of the syllabuses. In some of the teaching resources, there were explicit references to the curriculum

and the stated aims, goals, and content. This was sometimes viewed as helpful by teachers: "it makes it a bit easier if you get a goal for each… you know what to use it for" (FG 4), while not so much appreciated by others:

> ***Teacher 6:*** *That work I can do myself…*
> ***Teacher 7:*** *That work you have to do yourself anyway.*
> ***Teacher 6:*** *Yes exactly. (FG 2)*

Part of the negotiation of curriculum alignment was about negotiating different school subjects in relation to each other. It could be that the resource was considered relevant for more than one school subject, or that teachers found the teaching resource (or part of it) more relevant for other subjects than science/technology such as Social Sciences or Swedish.

7.1.2 | How well is the resource aligned with the enacted curriculum practice?

A major issue of concern had to do with whether a resource fitted, not only the prescribed syllabuses, but also with the enacted curriculum practice. Mostly, the teachers talked about the science content usually taught and how their teaching was commonly organized (e.g., a specific theme might be taught during a period of a few weeks), rather than the aims and goals emphasized in their teaching. In other words, the teachers evaluated the resources with respect to how well they aligned with the established teaching practice and how a specific content was commonly taught. For example, teacher 5 in focus group 2 said "[w]e do the human body in grade 7, the basics, and then this would fit really well…" In this case, the resource, *The "Antibiotics School"*, was found to fit well with the established teaching practice regarding the Biology teaching in grade 7. Thus, when using this discourse, the teachers evaluated the teaching resources with respect to the established teaching traditions.

Their evaluations primarily concerned what content the different resources covered and to what extent the content "fitted" with the commonly taught teaching sequences:

> ***Teacher 6:*** *I start ticking on this—that species and nature can take many different forms. I think this fits pretty well with photosynthesis. Decomposition—that fits, I think. And animal tracks [in Swedish* spår-teckning*] that is, like, more, that I do not think I would have time for. Forestry, I do not know either if I… but I would want to, but I do not know how I would really fit it in, just spontaneously. (FG 2)*

In the above example, one of the teachers points to the fact that some sections in the book *The Book about the Forest* would fit well with established teaching on photosynthesis and degradation, whereas other areas, such as animal tracking and forestry, which were also covered by the book, were seen as more difficult to fit with the established teaching practice.

7.1.3 | How may a resource contribute to realizing the important aims of science education?

In addition to evaluating the industry-produced teaching resources with respect to the formal steering documents and in relation to the established teaching practices, the teachers sometimes reactivated the ideas of overall aims and goals of science teaching without explicit references to formal curriculum documents or established teaching traditions. These practical-evaluative conversations concerned the importance of the science content and the purposes of science and technology education. These aims and goals were, however, frequently formulated as personal opinions or taken-for-granted values. For example, the value of specific content was mentioned when the

teachers referred to the value of increasing student awareness about certain topics covered by a specific resource (e.g., the overconsumption of antibiotics) or instilling certain values (e.g., "the forest is our friend"). The following example concerns the values of increasing awareness of the overuse of antibiotics:

> ***Teacher 4:*** *The aim of this one is otherwise to understand that we are overconsuming [antibiotics] and to make sure that we… and that is, like, a really good aim. (FG 1)*

In another example, a teacher raises objectives of science/technology education in relation to societal issues in a more general way:

> ***Teacher 12:*** *It is supposedly included in our mission too; of course, it is still stuff that is important for society. (FG 4)*

Here the teacher argues that "stuff that is important for society" should be part of the mission of their teaching. This utterance could include a range of different views about what is important such as how technology could be used to improve society, or aims related to educating students to make complex (good) decisions (e.g., buying meat not treated with antibiotics). Another example is "we need to reach [a level where] they are able to make a choice in the future and [where] they will make a good choice" (FG 3). The aims referred to by the teachers were frequently expressed as normative in the sense of educating students to make the *right* choices in the future (and that the right choice should be specified).

An example of how broader objectives of science and technology education were raised by the teachers during the evaluations concerned the possibility of providing encounters with work life:

> ***Teacher 9:*** *Maybe it is the case that it is more important in these subjects; to get the connection… In order for students to understand that with this [science] knowledge there is an enormous labor market [accessible to them]. (FG 3)*

Thus, the aims raised by the teachers referred both to very specific goals (e.g., teaching students specific values) and more generally formulated citizen- or labor-oriented (possibilities in terms of occupations) aims. However, the practical-evaluative questions the teachers posed do not refer to the formal curriculum or other policy documents. Neither do they refer to the aims and goals emphasized in their own teaching but were formulated as a taken-for-granted good or personal opinion.

7.1.4 | Iterational and projective dimensions

In the above examples, we see how the iterational dimension of teacher agency was reactivated in terms of knowledge about the curriculum (including core content and the boundaries between different school subjects), as well as knowledge about the textbooks they use in their ordinary teaching. The iterational dimension of agency also includes knowledge and experiences of science content/themes that were valued by the teachers. Values were directly related to the aims and purposes of education which are part of the projective dimension of agency. When using this discourse to evaluate the industrial teaching resources, teachers related explicitly and implicitly to long-term and short-term goals. Teachers expressed that they were stressed by the curriculum and that they considered time to be a structural constraint. A short-term goal that emerged in the evaluations was to cover what the curriculum requires. However, there were also aims that were more long term, for example, related to topics of antibiotic resistance which was associated with more long-term aims of education for citizenship and the choices students would make in future everyday life. In other instances, the teachers refer to projectories of students'

future work life and how well prepared their students would be to face the employment requirements of different companies.

7.2 | The educational design discourse

The negotiations about the usability of the teaching resources included evaluations of the resources with respect to educational design. This discourse was composed of practical evaluative questions related to the questions: Is the teaching resource appropriately designed? Does the resource add something of value to the established teaching practice? Is the science content represented in better ways than in other resources? Is the graphic design appealing?

7.2.1 | Is the teaching resource appropriately designed?

The teachers discussed the teaching resources with respect to the overall design, whether there were useful teaching activities (e.g., exercises, things to discuss). For example, "[s]imple exercises in the middle might not be that bad" and "I think the discussion questions were really good too" (FG 4).

One issue was about the personal preferences of the teacher. The teachers would state that they "liked" or "did not like" a resource. For example, Teacher 9 in focus group 3 said: "This here, I do not like (*points to a booklet*) 'reading aloud in groups', I would not do that". Thus, making the evaluation of educational design a matter of individual preference. Later, however, this teacher added "but it depends on what group you have", thus referring to how the resource would work with a particular group of students. Other utterances focused on whether students could work independently with the resource: "if the students are to work with this booklet on their own, how many weeks would not that take?" (FG 3). Teacher 8 in focus group 3 also said that content concerning the forest would be difficult for her students to relate to, living in a coastal area. Similarly, discussing antibiotics in meat was provided as an example of what may not be relevant to a group of students where the majority identified as vegetarian or vegan.

The teachers also discussed the difficulties in working with an educational design that was not their own but someone else's construct. The teachers said that when using ready-made lesson plans they would combine parts of various resources:

> ***Teacher 14*** *: It is always the case that I want to put together something that I think is best for explaining what I want, and that maybe there is some exercise in here, and a few pages in the book, and some film from someone else. Really there are not many times when you would take a ready-made [resource] and just use it as is. (FG 5)*

Thus, the question of whether the teaching resource is appropriately designed becomes a question of whether there are elements of a teaching resource that could be used for the teaching of a specific group of students.

7.2.2 | Does the resource add something of value to the established teaching practice?

The follow-up practical-evaluative question concerning educational design has to do with whether a specific resource or element of a resource would add something new to the everyday teaching practices with respect to educational design or layout of the resource. Some teachers say that resources are valuable if they provide inspiration. Teacher 12 in focus group 4, talking about their experience of using a resource called *Day of Chemistry*

(a kit for practical experimentation in Chemistry provided by the Chemical and Innovation Companies in Sweden once a year), said:

> ***Teacher 12*** *: … and you might get impulses to do something you had not thought of. Above all, you might find tasks that you had not done that way before. That is the way I have done it sometimes. Not always, but once in a while there is something that I can use again next year. (FG 4)*

In a related vein, a lack of inspiration was regarded as a deficit:

> ***Teacher 6:*** *Really, this is, like, a lesson that I could do myself* (laughter)*; I do not need to get this resource; you want some added value.*
>
> ***Teacher 5:*** *Yes.*
>
> ***Teacher 6:*** *Right, if one is to go to someone else… this one, you could just as well have [used] a textbook; I do not need… EPA [short for "individual, pair, all"—a teaching technique for structuring classroom work commonly used in Sweden] I can do myself, anyway. (FG 2)*

Thus, the question of whether the teaching resource offers new teaching designs that differ from the ones usually used by the teachers was a factor in the teachers' evaluations. When posing questions about added value, the values reactivated included fun and/or exciting activities for the students. In the following example, a teacher describes the school being part of a competition organized by a company including a visit to a science center:

> ***Teacher 15:*** *It is a fun scheme they have. [The students] get one day in the [science center], to be there and do stuff. This year we had one class that advanced [in the competition] and that makes it even more fun. Because if you get to join in the finals then it is something totally different. Really, then it is for real in a totally different way. So that was great fun. Because [the energy company] spent a lot on the students really, for [the students] to be in the arena and to present [their work], and, yes…*
>
> ***Moderator:*** *What do you all think?*
>
> ***Teacher 16:*** *Yes, [the competition] is, like, fun; it is primarily the societal perspective that you are after and technology in society. You can use how you improve and develop a better society with technical solutions. So that inspires some pretty fun ideas sometimes. […]*
>
> ***Teacher 14:*** *Then it is like the competition format too that tickles. (FG 5)*

Here, the teachers (teacher 15 and teacher 14) emphasize the combination of a field visit and the competition format as a valuable (and fun) addition to ordinary teaching. Teacher 16 contributes to the interaction with a dimension of purpose, saying that the competition is "fun" in that it adds the societal perspective of using science to develop a better society. In this way, the field visit and the competition added value in relation to important aims of science education. In other examples, the teachers mentioned added value in the form of specific task formats offered by the industry-resources that could generate classroom interaction, for example, in-depth discussions.

7.2.3 | Is the graphic design appealing?

The educational design discourse included questions about graphic design. The teachers evaluated the graphic design of the material, for example, regarding how appealing a resource looked, how clear the text and images were, how much text or how many images were included, colors, etc: "Neat I think, appealing graphically" (FG 5), "Feels pretty easy to read and plenty of illustrations" (FG 2). Some evaluations were negative: "I thought that there were a lot of pages and so little text" (FG 3). The negotiations about usability included concerns for graphical issues, such as how images looked, the amount of text, readability, and so on. The teachers not only talked about images and text as separate, but the negotiations also included an evaluation of the coherence of the text, images, and layout, and how the teaching material could work in relation to different student groups, for example, students with special needs: "Students with neuropsychiatric diagnoses might want to have resources where extraneous content is reduced" (FG 2).

7.2.4 | Is the science content represented in better ways than it is in other resources?

The final practical-evaluative question about educational design was about how well the science content was represented in a specific resource and if the representation might be considered better than the representations commonly found in available textbooks and used by the teachers. Here, the representations used in a resource were evaluated with respect to how well they would function. For example: "I thought this was pretty good, this here, an overview of the different types of plastics, that I thought, this one I have not seen this good anywhere else" (FG 2). Here, a teacher mentions that the overview of plastics is something that he has not seen before and that this representation might be useful in his chemistry teaching. The educational design discourse included an appreciation of representations that teachers felt could add to conventional "talk and chalk" explanations in the form of "good animations, pedagogical animations that you can use when you want to illustrate instead of drawing yourself" (FG 1).

7.2.5 | Iterational and projective dimensions

There are a number of iterational elements reactivated impacting on evaluations of the industrial teaching resources in respect of the educational design. These include values of liked and disliked types of instructional activities (e.g., dislike of reading-out-loud), values of variation in educational design, and graphical design that are both appealing and accessible for all students. The teachers reactivated their own teaching experiences and things of value related to these experiences (e.g., representations used by the textbook or by the teachers themselves that could be exchanged with new and better representations offered by the industrial actors). Another value that was underscored was the sense of pride teachers experienced when developing teaching sequences themselves rather than teaching by the book or another ready-made teaching resource. This value points to a particular kind of teacher identity where the teachers position themselves as designers of teaching resources. The iterational dimension includes the reactivation of experiences from and knowledge of working with different groups of students as well as the kinds of resources (in the form of student tasks and images) that add value to existing teaching resources.

The projective elements of teacher agency related to the educational design discourse are primarily short term and related to a specific group of students. The projectories expressed involve how resources might be received by particular groups of students (could the students work independently with a resource?), how the use of a resource may contribute to messages that a teacher wants to convey to the students, and the social interaction enabled by

implementing a task (if it enables student interaction). The imagined, desirable science teaching could be described as varied and accessible in terms of teaching practice.

7.3 | The practical discourse

When negotiating the usability of the teaching resources teachers evaluated a resource in relation to its practicality. The questions raised about practicality included time for preparation, access to necessary teaching resources, and scheduling constraints. The teachers expressed their reluctance to use teaching resources that required preparation or additional resources that were out of reach (e.g., a learning management system or teaching resources such as computers and robots that are readily not available at the school). On the other hand, industry-produced resources were also seen as a potential means to overcome constraints relating to lack of time for preparation and/or inadequate budget for textbooks or study visits. The practical discourse included practical evaluative questions, such as How much preparation time is required? Does a resource require access to additional resources—and are these available? What does a resource require in terms of scheduling?

7.3.1 | How much preparation time is required?

One type of practical concern raised was about the preparation teachers require for doing in-depth reviews of a resource before they use it in the classroom. Comprehensive resources requiring more preparation time became less attractive:

> ***Moderator:*** *What makes you* not *choose a resource?*
>
> ***Teacher 3:*** *If it is too encompassing and it is, like, this thick (estimates a thick book with her fingers). If there is a whole bunch of stuff. It could for sure be [a good resource] but it is, like, not possible to work with in any sensible way.*
>
> ***Teacher 2:*** *If I have to put a lot of preparation into going through the material then that stops me because you have so little time for planning. (FG 1)*

Using industry-produced resources might require significant replanning which teachers saw as having both benefits and constraints. One teacher raised the issue of hard work involved in replanning:

> ***Teacher 16:*** *So you have to count on replanning the whole…*
>
> ***Moderator:*** *Course?*
>
> ***Teacher 16:*** *Yes, the whole semester, because it takes a lot of commitment. It is not that it is necessarily something negative, but it could just be a hassle in the end. (FG 5)*

In another example, however, teachers identified the potential for replacing their own instructional planning with a preplanned teaching sequence provided by industrial actors: "The whole energy block, energy transformations and, yes, hm, good, then we have the spring energy lesson planning done…" (FG 2).

7.3.2 | Does a resource require access to additional resources—and are these available?

Another practical concern raised by the teachers had to do with access to the necessary resources for using a specific industrial teaching resource. The teachers spoke of access and lack of access to suitable learning management systems, robots, micro bits, and a forest near the school. Inadequate budgets were reported to constrain travel for study visits, forest field trips, etc. In one focus group, the teachers reported previously having participated with their students in a corporate science and technology competition where travel was paid for by the industrial actor. In this case, the teachers considered it crucial that travel costs were covered:

> ***Teacher 15:*** *It can be difficult too to cover everything [in the curriculum] when you lose the [lesson] time, and then, like, the trips and those costs. It is not just about Maths and Science but [there were] a lot of good stuff [for the students] in [a major Swedish city] before. Then you had a hard time getting [money] for train tickets from the school budget.*

> ***Teacher 14:*** *But then it is a bit different. Yes but like these here [the corporate science and technology competition where travels were paid for by the company] that you… [who] paid for everything and the same thing with [a regional bank] that invited [the school] too. We had all eight graders on a day at the science center this autumn and they paid for buses and everything. Then that makes it easier to get it done. (FG 5)*

Industrial initiatives may also complement school budgets in other ways. The teachers said that industry-produced curriculum resources can offer a means to overcome limited local school budgets for teaching resources and textbooks: "of course there may be schools where they do not have the money anymore to buy textbooks and then you are restricted to using more of this type of resource" (FG 5). In this quote, the teacher refers to "other schools" without textbooks. Whereas most schools and teachers in a Swedish context will have access to textbooks, there are schools where science and technology education is taught without the support of textbooks. In one focus group, one teacher, having had the experience of teaching without a textbook, mentioned this as achievable, provided there was an advanced learning management system (FG 3).

7.3.3 | What does the resource require in terms of scheduling?

Another practical concern had to do with scheduling constraints. The same teacher group as mentioned above (FG 5), who had participated with their students in a company science and technology competition, raised issues about possibilities and constraints related to how science/technology is scheduled in their school.

> ***Teacher 16:*** *It is not enough to pull this off in Technology only.*

> ***Teacher 18:*** *One hour per week.*

> ***Moderator:*** *What did you say?*

> ***Teacher 18:*** *One hour per week is a bit tight.*

> ***Teacher 16:*** *What messed it up was that I had to use well more than half a semester. I mean of my lessons during half a semester—just for this, and it became larger than I had anticipated when I started.*

Moderator: *Right.*

Teacher 16: *But if you had had the Social Science teachers on board it might have been really good. (FG 5)*

Thus, the scheduled time for technology (1 hour a week) was regarded as insufficient considering the engagement that the competition required. And, while cooperation with other subject teachers was required, it raised other constraints around the schedules for these subjects. Another schedule-related issue raised in the group involved the extent to which the teaching resource can be used when there are no lessons where the class is divided into smaller groups: "Another, like, practical matter is: does it work for whole class [teaching]? Half class [teaching]? We have a whole class [teaching] in Technology now in this school" (FG 5).

7.3.4 | Iterational and projective dimensions

Iterational elements of agency that teachers drew upon in relation to their judgments about the practicality of the industry-produced teaching resources concerned the reactivation of experiences of limited resources of time, money, and teaching resources (e.g., text books). The teachers stated that complex teaching resources (e.g., elaborate teaching sequences or resources with extensive reading materials) would require more preparation time. However, experiences of limited time for planning may enable the use of externally produced ready-made teaching resources. Teachers also drew on projective elements—for example, of an imagined future trajectory of a physics teaching requiring less time for planning (cf., "good then we have the spring energy lesson planning done," FG 2), and a science teaching for which they have necessary resources available. Thus, both projective and iterational elements of teacher agency influenced the teachers' practical-evaluative judgments about practical issues.

7.4 | The correct science content discourse

When discussing the usability of the teaching resources the teachers engaged in evaluating the resources in terms of the accuracy, comprehensiveness, and newsworthiness of the science content. This discourse was composed of practical-evaluative questions related to the science content per se: Is the science content correct? Is the science content comprehensive?

7.4.1 | Is the science content correct?

The teachers revealed that assessing the correctness or accuracy of the information provided in a resource was something they routinely did: "I usually do it like this—I check through first myself. If I think that they are doing it correctly and well then I will use them" (FG 1). During the focus group interviews some teachers identified statements and questioned the correctness of the science content in the resources:

Teacher 15: *Pretty funny that they say they do not produce any carbon dioxide, but I mean all the tree cutting machines, whatever they are called, they run on petrol or diesel, diesel probably.*

Moderator: *So you are thinking that it might not be neutral in that way.*

Teacher 20: *Could be biodiesel too?*

Teacher 15: *What?*

Teacher 20: *Could be biodiesel too.*

Teacher 15: *That it could be.*

Teacher 18: *Could be different if it is clear-cut logging or, well, how much methane is emitted? (FG 5)*

In this example, the teachers were evaluating the teaching resource about forestry with questions about the accuracy of the text. The focus of the conversation was about whether it could be considered correct to say that forestry does not contribute to carbon dioxide emissions. Despite the moderator making a connection to the possibility of bias/interest, the teachers kept the focus on the question of accuracy. In a similar vein, the teachers raised questions about the correctness of other aspects of the alleged environmental friendliness of forestry such as "does forestry contribute to biodiversity? No, it rather reduces it" (FG 4). Thus, the teachers rejected and critiqued the teaching resources by reactivating knowledge of science.

A question related to the correctness of the science taught in school has to do with the potential of industry-produced teaching resources to align teaching with the latest science and technology. For example, "but I look a lot at the information […]: is there anything that I can learn, or that is not in the textbooks" and "there might be more recent knowledge/information here than there is in textbooks" (FG 2). Thus, in the evaluation of the industrial teaching resources the teachers looked for the accuracy of the science as well as the possibility of finding more up-to-date information than what was to be found in their science textbooks.

7.4.2 | Is the science content comprehensive?

Closely related to correctness was the question of whether the science content was comprehensive. The teachers would identify limitations in a resource with respect to the lack of perspective. For example, in relation to the processes of production of plastics described in the book about plastics, one teacher said:

> ***Teacher 15:*** *But I lack something about the production processes—raw oil and how it is distilled; and then there is output. But what I did a lot when I taught Technology [Engineering] was that when I finished [the teaching sequence] I would take a product that you would [review] its whole life cycle—from production, use, pros and cons with the use, and then what happened when you threw it away. Here [in the book* Plastics Knowledge for Compulsory School*], it is as though you just have some ethene and then you get some plastic. (FG 5)*

Here, the perceived lack of comprehensiveness was framed as a lack relating to what science about plastics is commonly dealt with in teaching. However, the lack of comprehensiveness borders on concerns of partiality and bias (see: Section 7.5, below). Another example in relation to the book about plastics is when one teacher stated: "I think one lacks the discussion that we have actually had quite a bit concerning whether we should use plastics" (FG 5). However, within the correct science content discourse, the practical-evaluative questions focussed on errors or lack of comprehensiveness per se and were not coupled to the potential interests of the industrial actor producing the teaching resource.

7.4.3 | Iterational and projective dimensions

The values and previous experiences reactivated by the teachers included values, such as correct, updated, and comprehensive science teaching. Knowledge of science was also reactivated. Teaching resources that added

content, that were more current than the textbooks being used were highly valued, and so was science content that added to the teachers' own knowledge. Thus, the practical-evaluative questions about the correct science content discourse also relied on the reactivation of knowledge about the ordinary textbook and what it covered with respect to science content. Also reactivated were teachers' experiences of teaching and values related to those experiences (e.g., specific content which might not be covered by the industry-produced teaching resource, such as the life cycle of plastics). Such experiences were also part of the evaluations of the industrial teaching resources. The reactivated educational values of correctness and/or comprehensiveness were directly related to projectories such as an envisioned science teaching characterized by being correct, up-to-date, and comprehensive.

7.5 | The partiality and bias discourse

The negotiations about the usability of the teaching resources included evaluations of partiality and bias. In four of the five groups, the participating teachers initiated questions of partiality and bias related to the sender/producer of a resource, the science content, and marketing-infused formats of communication. Questions central to this discourse were: How trustworthy is the sender/producer of a resource? What are the interests at stake for the sender/producer of a resource? Are the interests problematic in relation to the aims of science education? Could the resource be perceived as an advertisement by the students?

7.5.1 | How trustworthy is the sender/producer of a resource?

The questions related to the sender/producer of a resource focussed on aspects of credibility and credentials, interests and visibility in the resource itself. The aspects of credibility included assessments of trustworthiness. For example:

> ***Teacher 8:*** *As a chemist, I know IKEM [*Chemical and innovation companies in Sweden*] […] I might have used the information and some images [in my teaching] and think that IKEM is a source that I can trust…*
>
> ***Moderator:*** *Hm.*
>
> ***Teacher 8:*** *Even if I know that they like plastics (*laughter*) so they do not want to get rid of it but still, that is it…*
>
> ***Moderator:*** *It feels like a credible source to you?*
>
> ***Teacher 8:*** *Yes, but it does. It does absolutely. And then you have to like… No, but I think that it is a credible source although they still are plastics companies who produce and want to get it [plastics] out [in the market]… yes (FG 3)*

In the above quote, Chemical and Innovation Companies in Sweden is positioned as an organization that the teacher is familiar with and considers a reliable source. The teacher states that they regard the organization as credible despite the fact that it represents the plastics industry. The excerpt is therefore an example of how aspects of trustworthiness and interest may be negotiated in relation to one another. In the example, the teacher identifies an interest, but the potential problem associated with this interest is ruled out by the teacher's trust in this specific industrial actor.

7.5.2 | What are the interests at stake for the sender/producer of a resource? Are the interests problematic in relation to the aims of science education?

Another type of question that is part of this discourse concerns the identification of interests at stake for the actor producing the teaching resource. Partiality and bias could be used as rationales for not using a material. One teacher said: "yes, to me it has become a factor that would make me maybe not use it that much" (FG 3). For example, in some groups, the teachers cautioned against biases that would be potentially contentious among the students: "there might be a risk, or I would say that if I would show this film [produced by Swedish meat], although it was nice (*laughter*) then I would have a gang [of students] here that would wanna fight for [inaudible, not consuming meat/vegetarianism]. It is pretty popular right now" (FG 3). There was also one example where a teacher cautioned against exerting influence on students in ways that would put them in a difficult situation in relation to their family (if the family normally did not buy Swedish meat):

> ***Teacher 8:*** *It might become a difficult situation when you come home because if [the students] demand Swedish meat… what are the parents supposed to do? All the other parents might have Swedish meat, but I do not* (pointing at herself)*. Does that mean that my home is worse? (FG 3)*

The partiality and bias discourse was not a dominant discourse in the evaluation and was often sidelined by other discourses. In the following example, an interest was identified but then disregarded in light of an evaluation of the educational design:

> ***Teacher 15:*** *It is of course like this that here is a sender who has an objective—Swedish meat. But I still think that it is a pretty neat setup [the teaching resource]—there are films, and things the students are expected to do after the film are clearly foregrounded. (FG 5)*

Thus, when the actor's interest was identified by the teachers, they nonetheless discussed the potential for using the resource despite the interest. In other examples, questions of interest were raised as relevant but disregarded with reference to an absence of bias in the specific resource: "it is neutral, it does not come with any ulterior motives" (FG 2).

In some examples, particularly relating to the resource The "Antibiotics School" by Swedish Meat, a bias was identified in the content but the message communicated was interpreted as "good" and acknowledged as appropriate for teaching students about antibiotics. For example: "they are pretty careful to show that Swedish meat is better than anything else… and maybe that is the case, and then you have to be allowed to say so" (FG 2). In a similar way, the book about plastics was also discussed in terms of bias toward the benefits of plastics, but the bias was justified: "we have to have plastics anyhow" (FG 3).

One way of downplaying the importance of interest and bias would be to suggest the possibility of using a resource as part of the teaching of source critique. One focus group argued:

> ***Teacher 7:*** *But I think you can use [this] as a resource in that case, because it is something that [the students] should think about—who is behind this message? Could they have an intention? And so on.*
>
> ***Teacher 6*** *: Hm, absolutely.*
>
> ***Teacher 7*** *: It becomes one of the things the students should know, so in that way, it is an asset to use things someone else has made. (FG 2)*

An additional strategy mentioned by the teachers was to include other sources that may be biased in different ways, and to use them in combination, with the aim of delivering balanced teaching; clarifying different perspectives on an issue. Yet another strategy was referred to as a "public service thing"—a strategy inspired by Swedish public service television that commonly uses disclaimers in connection to the eventual display of company names. On such occasions, it might be communicated that this is one company of many producing a specific product (to decrease the advertisement value of the displayed company). The teachers suggested using similar disclaimers: "'here is an energy company of many' and then we hand [the teaching resource] out […], one of those public service things, 'there are many others [companies]'" (FG 4).

7.5.3 | Could the resource be perceived as an advertisement?

Some of the teachers mentioned that the presence of a logo might disturb either themselves or the students:

> ***Teacher 9:*** *But it bothers me a bit (*points to a logo on the cover of the booklet Energy Genius*).*
>
> ***Moderator:*** *That [the energy company] has its logo there?*
>
> ***Teacher 9:*** *Yes. It becomes so… yes it bothers! (FG 3)*

A teacher in another focus group opposed the others' reluctance to allowing logos, saying that logos would be "totally okay, [the students] see logos and advertising everywhere" (FG 4). In the end, the teachers were prepared to accept a logo on a resource if the science content was "correct" and "neutral." However, the teachers expressed concern about the possibility of students perceiving teaching resources as marketing. The teachers pointed to front cover designs and the visibility of logos. One teacher suggested the possibility of covering up front page logos (FG 3).

In particular, the teachers reacted to messages in the resources in the form of slogans such as "Swedish Forestry is a multiskilled environmental operator which is great at doing good" (verbally conveyed in a film clip produced by the forestry company). In relation to this slogan, one teacher exclaimed: "hallelujah!" (FG 5). In focus group 2, one teacher said "that was too much hallelujah," and in focus group 3, another teacher concluded that this kind of self-congratulation "need not be there, [because] then that really makes it advertisement." Teachers found bias and partiality problematic when it was too explicit.

7.5.4 | Iterational and projective dimensions

In their evaluations of partiality and bias in the industrial teaching resources, the iterational dimension of agency concerns the selective reactivation of values of knowledge such as trustworthiness, neutrality, comprehensiveness, and correctness. The value of supporting the interest (of a company or an organization, including using or not using logos) was weighed against the quality of the educational design as well as what values were being communicated to the students. "Good values", such as supporting the consumption of Swedish meat, and accurate information (e.g., that the Swedish meat industry uses antibiotics sparingly), were contemplated against potentially gratuitous support of the Swedish meat industry. Social structures reactivated in the conversations have to do with trust—what organizations and companies one should or should not trust—in light of their various interests.

The projective dimension included imagined teaching situations where the teachers organized a science and technology teaching approach that was neutral and correct while it simultaneously installed good values in the youth. Such teaching would be free from advertising and would contribute to supporting opportunities for source

critique. The teachers also made negative projections envisioning teaching that upset students or put parents in bad positions (e.g., if they would use The Antibiotics School).

8 | DISCUSSION

The aim of this study was to contribute to our understanding of how teachers negotiate the usability of industrial school initiatives for compulsory school science and technology. The aim was formulated in light of an overall objective to suggest directions for the strengthening of teacher agency in situations where teachers evaluate and make decisions on the use of educational resources offered by the industry in their science teaching. Teachers are policy actors when, on a day-to-day basis, they make decisions related to their teaching. For example, when they decide whether to use a specific teaching resource produced by industry.

With this study, we contribute to understanding the collective capacity of science teachers to exercise professional judgment in relation to industry-produced teaching resources. That is, to understand their capacity to be "active agents of their own work" and how this capacity is shaped by the everyday practices and cultures of teachers' work (Priestley et al., 2015, p. 2). Conceptualizing teacher agency, we have drawn upon the ecological approach by Biesta and Tedder (2006, 2007). The discourses discerned in this study reflect the practical-evaluative dimension of teacher agency in relation to decisions about the usability of teaching resources produced by industry actors. The results show that teachers evaluate the industrial teaching resources not only in relation to the curriculum and in relation to educational design, but also in relation to practical issues, accuracy of the science content, and in relation to potential bias and partiality in the resource. These discourses are fairly distinct in terms of the iterational (past professional and personal histories, experiences, knowledge, and values) and the projective (future-oriented) dimensions of teacher agency that the participants draw upon in their discussions (Priestley et al., 2016).

The selective reactivation of knowledge and experiences during the focus groups refer primarily to: the national curriculum; textbooks commonly used; available representations of science; experiences of how specific science content has been taught; the needs and wants of different student groups; limitations in terms of resources (time, money, teaching resources); and trust in specific industrial actors. The selective reactivation of values points to various values: values related to the science content per se (specific content as more or less highly valued and values of trustworthiness, comprehensiveness, and correctness in respect of the science content); values related to classroom practices (making science accessible to all students, taste/distaste for types of instructional activities, access to necessary resources [e.g., text books], appreciation of variation in lesson design); values related to the outcomes of teaching (communicating good values, not supporting private commercial interests); and values related to the work and knowledge of the teacher (a sustainable workload, creation of self-made resources, familiarity with the teaching resources used, that a resource adds to the teacher's knowledge of science).

The projective dimension of teacher agency concerns orientations toward the future and includes short- and long-term goals as well as different future trajectories. The short-term aspirations revolve around the here and now. For example: How might or might not a group of students engage with specific content? What could the consequences be for a family if the students are taught to buy Swedish meat? Would the resource help cover the requirements of the curriculum over a year? Would the resource contribute to putting a varied and accessible science education into practice? Would the resource enable less time-consuming lesson planning? These projectories relate to the everyday work of the teacher with particular groups of students and are as such fairly narrow in scope, although the projectory of leading varied and accessible science teaching programs suggests the more long-term professional goal of being/becoming a successful teacher. Long-term aspirations include visions of delivering updated, factually-correct, comprehensive, and neutral science teaching, delivering moral science education where certain values and norms are instilled in students, educating students to engage with source critique, and preparing students for citizenship or work life. Thus, the discourses are configured in relation to different ways of projecting

future trajectories and build on the reactivation of partly different experiences, knowledge, and values. In terms of teacher agency, the discourses afford the potential for envisaging different futures (cf., Priestley et al., 2016).

8.1 | Agency as bounded to sedimented ways of thinking about science teaching

In their evaluations of the industrial science teaching resources, teachers make use of knowledge, experiences, and values that are part of a language of policy embedded in teaching practice. This language constitutes a language of teaching where policy concepts "have been sedimented over time" (Ball et al., 2011, p. 622). These sediments are made up of societal and professional ways of thinking about science teaching (and teaching in general), as well as teaching traditions and habits. Below, we discuss teacher agency as discerned in this study in terms of three sediments: "traditional school science", "science for all" and "performativity". These three sediments constitute part of the conditions for teacher agency (cf., Priestley et al., 2016).

8.1.1 | The traditional school science sediment

The focus on science content in terms of scope and correctness, as well as references to traditions of how different areas are taught and whether the content fits as part of the curriculum, resonates with what characterizes "traditional school science" (Zacharia & Barton, 2004). This teaching tradition forms a reference, or point of departure, in many discussions about science teaching. Traditional school science is characterized by the curriculum emphasis "correct explanations'' and "solid foundation" (Roberts, 1995; cf., van Driel et al., 2008, p. 109). The teaching tradition builds on a teacher-centered view of science teaching with teacher-led lectures and experiments planned in detail aimed at transferring knowledge to the students. In this teaching tradition, the goal of science teaching is for students to "memorize scientific knowledge and procedures within the structure that was established" (Zacharia & Barton, 2004, p. 204).

In this study, we see how many experiences, habits, and values reactivated in teachers' evaluations of industrial teaching resources are closely related to the teaching tradition of traditional school science. The correct science content discourse focuses on the scope and correctness of the science content and the curriculum discourse tends to focus on science content in specific science areas (concepts and models), rather than overall curriculum aims and goals. Related to the emphasis "correct explanations" we find projectories of correct, comprehensive, and neutral science teaching. In addition, the projectory "covering the curriculum" was frequently reactivated in the curriculum discourse. "Covering the curriculum" can be interpreted in terms of structural constraints, in the form of fulfilling short-term curriculum knowledge requirements for the students, but also in terms of what students need to know when they reach the next educational level (c.f., "solid foundation", Roberts, 1995). Thus, in the focus groups, the overall aim of science education was predominantly framed (explicitly and implicitly) as learning disciplinary science content. Teacher agency in relation to evaluations of science content in terms of level, scope, and correctness, as well as references to traditions of how different science areas are taught and where content fits, could be understood as rooted in sedimented views of science teaching, commonly referred to as "traditional school science."

8.1.2 | The "science for all" sediment

Another sediment that was reactivated in the teachers' negotiations—primarily as part of the educational design discourse—was "science for all." The notion of science for all is frequently mentioned in science education research as well as policy literature and is part of the educational policy of an inclusive school. In Swedish schools, there is a

strong overall policy of inclusion; the main rule is to support students in need of supplementary support in the compulsory school within their regular classes (Swedish National Agency of Education, 2020). Göransson et al. (2011) have pointed out that the current national policies leave a lot of room for interpretation on the local school level, resulting in extensive variation. Thus, schools and teachers are given far-reaching obligations to offer different kinds of support to students in daily teaching. In the educational design discourse, and to some extent the curriculum discourse, such knowledge, and experiences related to the needs of different student groups and the characteristics of a teaching resource available for students with different needs are reactivated. Teacher agency coupled with evaluations of graphical and educational design and discussions about the availability of the industry-produced teaching resources for different student groups could be understood as rooted in such policy discussions and teachers' day-to-day work.

8.1.3 | The sediment of performativity

Third sediment that was reactivated in the teachers' discussions about the usability of the teaching resources concerns performativity. This idea of performativity (which is also related to ideas of new public management in all sectors of society) "'drip,' 'seep,' and 'trickle down' into classroom practice" (Ball et al., 2011, p. 620). The sediment of performativity is characterized by current international education policy agendas where education outcomes and measurement are a priority (Biesta, 2010). Performativity is part of a wider culture impacting on teacher agency and, as such, a constituent of the practical-evaluative dimension of agency in relation to the industry-produced teaching resources (Priestley et al., 2015, p. 106). Performativity has to do with a demand for schools and teachers to "perform" in the sense of generating specified achievements and outcomes, for example, in terms of student grades and test results on national tests and evaluations (Priestley et al., 2015, p. 105). In schools, performativity includes the audit culture, regulatory mechanisms (such as school inspections and evaluations), and the market environment for schooling—which, in the case of Sweden, includes student vouchers, "free choice" of schools, and an extensive range of charter schools (Priestley et al., 2015).

In the teachers' conversations about the industry-produced teaching resources, performativity, as a way of thinking about teaching, is reactivated. In particular, performativity permeates the curriculum discourse, and to some extent the educational design discourse. In the curriculum discourse, values of alignment between teaching activities (including teaching resources) and the curriculum are reactivated when the teachers evaluate the industrial teaching resources in terms of whether they fit or not. According to this way of thinking about teaching, spending teaching time on issues that are not viewed as part of what is specified in the curriculum is nonsensical. Also, projectories concerned with covering the curriculum (and not spending time on topics that seem to lie outside of the curriculum focus) make sense in light of this sediment. In this way, this study illustrates how performativity functions to demarcate teachers' aspirations for the teaching of science and technology (Priestley et al., 2015).

8.2 | Weaker and stronger contributions to teacher agency

As Biesta and Tedder (2007, p. 137) conclude, "achievements of agency will always result from an interplay of individual efforts, available resources, and contextual and structural factors as they come together in particular, and in a sense, always unique situations." Agency is thus dependent on the constraints and possibilities afforded by local school practices. Taken together, the five discourses discerned in this study describe how professional teacher agency is achieved in the evaluation of industry-produced teaching resources. However, in the course of interaction, the discourses become of unequal importance and contribute to different degrees to the agency achieved.

The discourses are used to a varying extent in different groups but also within the groups in relation to the evaluations of the different teaching resources. Turing to the configuration of different discourses, there is a comparative lack of questions about long-term goals, aims, and purposes in the curriculum discourse. There is also a lack of sharing experiences of science content as potentially subjective or nonneutral in the bias/partiality discourse. This might be interpreted in light of the sediment "traditional school science" as a lack of strategies for talking about overarching aims of school science (instead aims become sedimented and taken for granted). An assumption of science as neutral could also inhibit the teachers' willingness to engage in critical scrutiny of biases and partiality. Such taken-for-granted, sedimented, values could potentially explain the limited reactivation of experiences of how to manage the interests of external actors in the focus group discussions. Instead, the teachers' evaluations primarily focussed on what works here and now (educational design and practical issues), teaching that covers the core content of the curriculum, and on the correctness of the science content. With regard to the educational design and practical concerns the teacher agency achieved is strong. The teachers engage with confidence in talk about usability concerning these aspects. However, there are also weaker aspects of the teacher agency achieved within these discourses. For example, when the teachers raise questions and make evaluations about educational design, they commonly refer to personal preferences and taste or what would work in relation to one of their specific student groups. Such judgments are difficult to question by colleagues since personal preferences are claimed to be simply personal, and the individual teacher is the only one with immediate experiences of a particular student group. Thereby, the talk revolves around the personal professional experiences and preferences rather than the shared professional experiences. In relation to practical concerns, the agency achieved within given limits is strong, but does not extend to changing or questioning the practical circumstances (e.g., schedule, budget priorities, etc.).

When discourses on long-term goals, aims and purposes are weak, evaluations related to bias and partiality—when such issues are raised at all—become restricted to assessments of the accuracy of the science content. Consequently, the evaluations fail to recognize issues of scope and perspective covered by the teaching resource, as well as explicit and implicit messages that go beyond scientific concepts and models. However, even if a resource contains accurate science content, there may still be issues relating to partiality (e.g., leaving things out) that may compromise the overall aims of science education in a democratic society. For example, aims related to citizenship and opportunities for students to develop a critical stance toward science and technology's contribution to society and the environment may be compromised.

We argue that the community of science education needs to develop ways to strengthen teacher agency on a collective level with respect to professional evaluations of teaching resources in relation to the overall aims and purposes they serve. This is important, since industrial actors tend to engage in science teaching because they want to secure competent labor, to secure economic growth, or to improve the public image of a specific company or a sector (Andrée & Hansson, 2020). Previous literature has warned that the increase in private sector participation in education risks a decreased emphasis on citizen perspectives in education (e.g., Robertson et al., 2012; Spring, 2015). Eaton and Day (2020) have shown how organizations funded by the fossil fuel industry act to prevent action on climate change by engaging in energy and climate change education in Saskatchewan and that these fossil fuel industry narratives on energy and climate change are taken up and circulated in schools. The authors emphasize that the "success in building hegemony—that is, circulating their [the industry's] narratives/…/as truth—depends on teachers enacting industry's ideologies as common-sense in the classroom" (Eaton & Day, 2020, p. 465). To make education less vulnerable to outside influence in potential conflict with overall educational aims, conditions for teacher agency in evaluating externally produced science teaching resources need to be strengthened.

8.3 | Strengthening teachers' capacity for didactical analysis—ways forward?

In Sweden, the educational system is highly decentralized and based on models of goal steering and teacher professionalism (Carlgren & Klette, 2008). For example, teachers decide what curriculum resources to use and what external actors to let into their classrooms. The same is true, to varying extents, in many other countries as well. Such a decentralized educational context thus offers local arenas where external actors might exert significant influence in the governance of education. In such a system, teacher agency becomes of central importance. With this study, we have provided a basis for reflecting upon the importance of teacher agency and, more specifically, the role of teachers as local policy actors in complex interactions with other actors (such as corporate institutions). The results may be used to provide a basis for supporting teachers to make more informed decisions about the use of science teaching resources produced by industrial actors.

The results of this study show that teachers evaluate the industrial teaching resources in relation to the curriculum, educational design, practical issues, correctness of the science content, and in relation to potential bias and partiality in the resource. These different practical-evaluative discourses are all legitimate and necessary elements of a didactical analysis. However, teachers draw on the different discourses to different degrees, and the teacher agency thereby achieved in specific situations will vary. One possible way forward could be to develop a tool for teachers to use as a heuristic in the processes of deciding whether to use a teaching resource offered by an industrial actor. Today, in the Swedish context, there are national, general regulations in the form of a document on sponsoring in schools. This document is intended to be used to develop local documents to guide decisions on external contributions to education. However, these guidelines seemed to be unknown to the teachers participating in the focus groups of this study, and no such national or local regulations were referred to in the course of interaction. Taken together, the practical-evaluative questions that were the focus of the various discourses presented in this article could be used as a starting point for the development of a heuristic for teachers to use for evaluating such teaching resources:

1. How well is a resource aligned with the national curriculum? How does it contribute to realizing the important aims of science education?
2. Is the educational (including graphical) design appropriate?
3. What practical gains or concerns follow from the use of the resource?
4. Is the science content correct and up to date?
5. What are the interests at stake for the producer of a resource, and to what extent and how are they mirrored in the resource? How do these interests correspond to different possible overall aims of science education?

These practical-evaluative questions may serve as a tool for teachers' evaluations of teaching resources from the industry and could function as a way to establish professional habits of evaluation with a critical stance. In a decentralized education system, where many decisions are left to the teachers and local schools, these questions could be useful for the individual teacher and become a way to increase teacher agency in relation to decisions about using industry-produced teaching resources. However, in order for individual teachers to mitigate the influence exerted by industrial actors on the local policy arena, a common professional language, and relatable professional experiences need to be elaborated and shared. Professional discussions—internationally, nationally, and locally—need to focus on external teaching resources not only in relation to whether the scientific content fits with the curriculum or established teaching traditions, or whether the scientific content is correct, but also in relation to the interests communicated in the teaching resources, and what overall aims the resources serve. Teachers themselves cannot be held solely responsible for strengthening their own agency. Both local and national school administrations must share responsibility for creating a conducive environment. In addition, science education research and teacher education need to engage with these issues.

9 | CONCLUDING REMARKS

In conclusion, teachers' practical evaluations of industry-produced teaching resources draw on a complex configuration of discourses including the curriculum discourse; the educational design discourse; the practical discourse; the correct science content discourse; and the partiality and bias discourse. However, we have identified weaker and stronger contributions to the agency achieved when the teachers engage in evaluations of the industry-produced teaching resources. Thus, we may conclude that there is a need for strengthening certain contributions to teacher agency. The practical-evaluative questions from the results of this study might be used as a starting point for supporting the development of joint professional language and experiences. In addition, there is a need for paying attention to how the dimensions of teacher agency are bounded to sedimented ways of thinking about science teaching. More specifically, we suggest that different educational arenas engage in a discussion about the aims and purposes of science education, the extent to which different activities serve these aims, tensions between public and private good, and about what the issues of objectivity and versatility mentioned in the national curricula might mean for the work of teachers. While these issues have previously been dealt with in the field of educational policy research, they have a direct influence on the aims and content specific to science education. Therefore, the questions about the use of industrial teaching resources and the relationship between industry and matters of the public good have to be brought into science education research. It also has to become a concern of science teachers in the day to day teaching. It is necessary to strive for a situation where teacher evaluations of the interests and educational aims served by the teaching resources are as natural as teacher evaluations of educational design and scientific content.

We began this article with references to the long-standing concern and interest in the relationship between science education and industry. The early interest in how science education could be designed to support urgent societal development might be seen as an expression of how committed science teachers, education researchers, and philosophers recognized the potential role of teachers in society. The industrial engagement in producing teaching resources on a global scale may also be understood to be the recognition of science education as an important policy arena. This study points to the importance of recognizing science teachers as local policy actors and not only as policy subjects. From a democratic point of view, the unconscious entanglement of industry and education, where teachers uncritically implement the agendas of industrial actors in schools in ways that may counter-public interests (see e.g., Eaton & Day, 2020) is highly problematic. The teachers in this study have pointed out that biased teaching resources may well be used to teach source critique, or in combination with other sources to discuss highly debated environmental or societal issues. However, this is different from using a resource for the purposes for which it was planned—purely as a lesson plan or teaching sequence to teach scientific content.

We argue that schools and teachers should not leave the pivotal question of aims and purposes of science education to industrial actors, but instead take on the professional challenge of evaluating the usability of industry-produced teaching resources with respect to how well the resources may serve the democratically decided aims of general education. In line with Priestley et al. (2015), we do not argue for teacher autonomy and lack of regulation. Instead, we argue for supporting professional judgment and for schools and teachers to engage with the aims and purposes of science teaching in evaluating the usability of industry-produced teaching resources. Paraphrasing Dewey (1923, p. 88), it seems to us that science teachers should be encouraged to enact a science education directed, "not to fitting any particular calling" but to develop in young people "reserves to meet emergencies, to stand on [their] own feet, and to use [their] own hands, directed by [their] own brain[s]" and that science educators, education administrators, and science education researchers need to take on the challenge of providing a conducive environment for teachers to achieve the agency they need for evaluating the usability of teaching resources produced by the industry.

ACKNOWLEDGMENT

This study was supported by the Swedish Research Council (Grant no. 2017-03657).

ENDNOTE

[1]Forestry the Swedish way is their own translation. "Skogsbruk på ren svenska" might also be translated into English as "Forestry in Plain Swedish."

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How to cite this article: Andrée M, Hansson L. Industry, science education, and teacher agency: A discourse analysis of teachers' evaluations of industry-produced teaching resources. *Science Education*. 2021;105: 353–383. https://doi.org/10.1002/sce.21607