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Design Principles for Promoting Students' Social Scientific Reasoning About Social Problems

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Abstract

Social scientific reasoning (SSR) is essential to social science education and to a democratic society as a whole. Students are challenged to analyze and reason about social problems such as social inequality, crime, and poverty. However, students experience difficulties with SSR. This study addresses the research question: *Which design principles can guide teachers in designing lessons that promote social scientific reasoning?* In this design-based research, four social science teachers employed a conceptualization of SSR and its levels together with three initial design principles to develop curriculum materials and activities. These design principles and curriculum materials were piloted in two secondary education classes (9th and 10th grades) and evaluated by four social science teachers, four social science teacher educators and 90 students. The study produced six design principles that can promote students' SSR. In combination with the curriculum materials, those design principles can help develop teachers' pedagogical content knowledge and guide the design of tasks and units that develop SSR.

Keywords

social science education, social scientific reasoning, design principles, design-based research

Highlights

- Social scientific reasoning (SSR) is essential to social science education and to a democratic society as a whole
- The study produced six design principles that can promote students' SSR that were developed and validated by using them in a process with three design cycles
- When introducing a context or concept, make the development of reasoning transparent by paying attention to students' initial associations, prior knowledge, and intuitive responses
- Support students in SSR with scaffolds such as visual representations
- Use specific social and political themes, processes, or problems in learning tasks as contexts to elicit wonder, explain SSR, and practice that reasoning

Social scientific reasoning (SSR) is an important competency in social science education. SSR centers on describing and analyzing social problems by using social scientific concepts, models and theories, and reasoning about possible effects of potential solutions. Students are challenged to analyze and discuss social problems such as social inequality, crime, and climate change (Sandahl, 2015) and yet, students often experience difficulties when asked to employ social scientific concepts and standards of reasoning and analysis (Klijnstra et al., 2023; Lee et al., 2021). This poses challenges for social science education.

The National Academy of Education (NAEd) has advised that both teachers and students be better prepared to examine and discuss complex civic, political, and social problems. In particular, the NAEd recommended that the curriculum, pedagogy, and learning environments be informed by the best available evidence and practice (Lee et al., 2021). However, little is known about how social science teachers can enhance and support students' SSR.

Two components are critical for teachers to learn to teach these kinds of complex skills, such as SSR. Examples of

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practices and curriculum materials are the first component. However, the second component, pedagogical content knowledge, is also essential; as research in other domains has shown, pedagogical content knowledge is critical for teachers to effectively teach the complex skills that characterize SSR (Coe et al., 2014; Shulman, 1986; Tuithof, 2017). The premise of pedagogical content knowledge is that teachers know how to teach subject-specific content in ways that students can understand. This knowledge base includes an understanding of objectives (e.g., to learn what constitutes SSR); the curriculum; areas of student difficulty; and instructional strategies.

This study combines the two components by developing curriculum materials that can function as *educative* curriculum materials. These educative curriculum materials are designed to promote and support learning by teachers as well as students (Davis & Krajcik, 2005). Authentic learning tasks and scaffolds are examples of curriculum materials that are educative for teachers when they are informed by underlying design principles.

This study addresses this research question: *Which design principles can guide teachers in designing lessons that promote social scientific reasoning?* As a starting point, we used three initial design principles that promote the learning of complex skills such as the SSR, deriving them from previous research on complex skills, including the 4C/ID model (van Merriënboer, 1997). We also designed curriculum materials based on those initial principles. By sharpening, refining, and expanding the initial principles throughout the design process, we ultimately produced six tested design principles that can promote SSR. Together with our sample curriculum materials, those six design principles can function as educative curriculum materials for teachers who are improving and re-designing their teaching to promote students' SSR.

Theoretical Framework

To develop design principles and sample curriculum materials, we combined domain-specific insights about students' abilities in SSR (Klijnstra et al., 2023; Sandahl, 2015) with insights from more general educational research on complex learning (e.g., Bransford et al., 2000; Brookhart, 2014; Merrill, 2002; van Merriënboer & Kirschner, 2018). Here, we elaborate on important components of a powerful pedagogical content knowledge for teaching SSR, namely, insights about learning objectives, the difficulties students encounter, and pedagogical approaches of SSR (Coe et al., 2014).

Learning Objectives: What SSR Entails

Subject-specific knowledge is required to construct good reasoning (Goldman et al., 2016; Lee et al., 2021; NCSS, 2013). The phenomena studied in social science education are social problems, which have been defined as problems that affect many individuals and, consequently, transcend the individual (Mills, 2000). Klijnstra et al. (2023) conceptualized students' SSR as employing five principal reasoning activities, namely, (1) causal analysis; (2) use of social scientific concepts, models, and theories; (3) use of evidence; (4) use of perspectives and reflection on them; and (5) comparing. This conceptualization draws on those developed in sociology (e.g., van Tubergen, 2020), social science education (e.g., Sandahl, 2015), historical reasoning (e.g., Seixas & Morton, 2013; Van Boxtel & Van Drie, 2018) and civic reasoning (e.g., Lee et al., 2021).

Students' Difficulties With SSR

As previous research on social science teaching has shown, students find it challenging to reason about social problems. An analysis of student papers that reasoned about a social problem identified 18 different SSR flaws (Klijnstra et al., 2023). For example, students frequently exercise too little reservation and prudence in their reasoning and have difficulty reasoning about more than one cause or consequence. Furthermore, they often use theories and concepts simplistically and are unable to substantiate their reasoning with evidence (Klijnstra et al., 2023).

Similar reasoning flaws have been identified in research on adult reasoning (e.g. Fiske & Taylor, 2017), history education research (e.g., Stoel et al., 2015), and studies on the role of complex causal models in students' understanding of science (e.g. Perkins & Grotzer, 2005).

Pedagogical Approaches for Promoting SSR

Sample curriculum materials should be educative for teachers. Educative curriculum materials are materials explicitly designed for both teacher and student learning and can shape teachers' knowledge and instructional methods (Arias et al., 2016). According to Davis and Krajcik (2005; p.1), "Educative curriculum materials should help to increase teachers' knowledge in specific instances of instructional decision making but also help them develop more general knowledge that they can apply flexibly in new situations." In this context, then, "educative" refers specifically to what teachers can learn (Davis & Krajcik, 2005).

To make the rationale in the educative curriculum materials evident and develop teachers' pedagogical content knowledge on powerful pedagogical approaches, explicit design principles are needed. However, no design principles for teaching SSR can be found in the research literature. Therefore, we derived our three general, initial principles from research on complex occupational skills and principles from other educational fields. We paid particular attention to history. Because history students learn to reason about past social phenomena and problems, design principles that promote similar reasoning should be useful for promoting SSR.

Initial Design Principle 1: Use Whole, Meaningful, and Authentic Learning Tasks

Research on teaching complex, subject-specific skills has revealed that authentic tasks can function as powerful contexts for learning complex skills (van Merriënboer, 1997; van Merriënboer & Kirschner, 2018). Authentic tasks are tasks connected to realistic contexts from everyday or professional life, and that connection renders the subject matter more meaningful to them. Authentic tasks foster more in-depth learning of the subject matter and greater student commitment (Maddox & Saye, 2017).

Meaningful, realistic contexts can contribute to *learning for transfer* (Bransford et al., 2000; Brown et al., 1989). Complex learning benefits from learning tasks that provide whole-task experiences, preferably based on real-life tasks. The application of complex, authentic tasks can also contribute to students' higher-order thinking skills (Maddox & Saye, 2017; Newmann, 1991; van Merriënboer & Kirschner, 2018). Instead of using abstract concepts alone, teachers should create learning contexts that are closely related to real-life examples that make sense to students (Bransford et al., 2000).

In social science education, social problems are the real-life examples that are central. Students have preconceptions about these problems and the design of the world (Van Boxtel et al., 2017). Students enter social science class with a certain political intuition. Examples of specific real-life examples in social science are educational inequality, crime and youth obesity. Reasoning about these social problems can be challenging because these problems are ill structured, with multiple causes, consequences and solutions (Mills, 2000; van Tubergen, 2020). Furthermore, students' may hold pre-existing opinions and feelings about these real-life examples, that on the one hand can motivate students, on the other hand can bias them in their reasoning (Klijnstra et al., 2023; Sandahl, 2020). People often base their reasoning on feelings and intuitions (Haidt, 2012; Kunda, 1990; Mercier & Sperber, 2011; Stitzlein, 2021). It is important that teachers learn students to better understand how students' own political preferences, background characteristics and their selection of evidence can affect their position on public policy issues (Crocco et al., 2017). Awareness of students' own biases can help them in their reasoning.

Initial Design Principle 2: Use Explicit Instruction and Modeling on Subskills

The Cognitive Apprenticeship Model focuses on explicit instruction and guided practice (Collins et al., 1991). The effectiveness of this approach has been demonstrated in several school subjects, including historical thinking and reasoning. Recent research on promoting students' historical and economic reasoning has shown that explicit instruction (e.g., by modeling) can promote students' reasoning skills (see Grol et al., 2016; Kneppers et al., 2007; Stoel et al., 2017). For instance, causal reasoning is most effectively taught by explicitly identifying the concepts and steps of reasoning required for identifying causes and consequences (McNeill & Krajcik, 2008; Stoel et al., 2017).

Research has shown that explicit instruction and modeling are important for teaching complex skills. With explicit instruction, students learn a skill by following what the teacher presents directly. Explicit instruction includes a variety of techniques, such as starting a lesson by stating its objectives (Archer & Hughes, 2011). Based on a literature review, Hughes et al. (2017) identified five essential components of explicit instruction: (1) segmentation of complex skills, (2) use of modeling or a think-aloud to emphasize important features of the content, (3) systematic use of faded supports and prompts to promote engagement, (4) opportunities for students to respond and receive feedback, and (5) purposeful practice opportunities.

Using a model to divide a complex skill into subskills is useful for mastering the complex skill (van Merriënboer, 1997). For example, the 4C/ID model suggests that practicing component skills of a learning task in isolation can automate routine components, which can be helpful for mastering the task skill as a whole (van Merriënboer, 1997). Still, as Van Merriënboer et al. (2002) emphasized, an overreliance on part-task practice is not conducive to complex learning.

To implement this principle effectively, it is necessary to have a clear definition of sub-skills and proficiency levels of students' SSR. Klijnstra et al. (2023) illustrated that the SSR activity *causal analysis* is composed of several subcategories, including *connecting causes and consequences*. Each subcategory has been elaborated in a rubric at three levels: beginning, developing, and expert. This operationalization can potentially render the explicit instruction and modeling of causal analysis more salient to students.

Providing explicit instruction about SSR differs from explicit instruction about reasoning in other domains. Typically, the reasoning concerns social problems, which are ill structured (Mills, 2000; van Tubergen, 2020). Therefore, the explicit instruction must also focus on multicausality and possible unintended consequences of proposed solutions to a problem or reason more in terms of probabilities than in laws. For example, students often do not consider possible unintended consequences of possible solutions in their reasoning (Klijnstra et al., 2023).

Therefore, explicit instruction and modeling on subskills of SSR is needed.

Initial Design Principle 3: Use Scaffolding and the Externalizing and Visualizing of Reasoning Processes

Research has shown that students' learning is promoted by externalizing and visualizing the processes of thinking and reasoning (e.g., Marzano & Miedema, 2018; Van Gelder, 2005; Woolfolk Hoy et al., 2013). Externalizing and visualizing can be part of explicit instruction or can function as a scaffold. Scholars have emphasized the potential of activities using graphical organizers, for example, including cause-and-consequence diagrams, Venn diagrams, consequence wheels, and argumentative diagrams (e.g., Woolfolk Hoy et al., 2013).

Although teachers can design these external and visual representations, they can also be created by students. Indeed, research indicates that the activity of creating diagrams, whether alone or in a group, is effective for learning complex skills (Haugwitz et al., 2010; Horton et al., 1993; Novak & Cañas, 2006).

Such external, visual representations may be particularly relevant to teaching SSR. This is primarily because SSR involves complex, ill-structured problems characterized by multiple stakeholders, a variety of causes and consequences, and a range of possible solutions—all of which can be represented with abstractions such as social science concepts, models, and theories (van Tubergen, 2020). Specific diagrams that highlight subskills and difficulties of SSR can help students get a better handle on social problems and thus also contribute to a higher level in SSR. For example, the Coleman diagram, often mentioned *Coleman's boat* (Ylikoski, 2021), is a famous theoretical sociological diagram that focuses on the relationship between individual behavior (micro level) and social processes (macro level), one of the main issues in analyzing social problems (Coleman, 1987; Ylikoski, 2021). The Coleman diagram is a visualization and representation of the complexity of a social problem that can function as a cognitive tool for thinking (Swedberg, 2016). Therefore, this diagram can be used in social science education to make students think about micro-macro relations when they reason about social problems.

In sum, this study develops and tests curriculum materials that can contribute to teachers' pedagogical content knowledge for promoting students' SSR. Those materials are based on three initial design principles, namely, (1) *Use whole, meaningful, authentic tasks*; (2) *Use explicit instruction and modeling on subskills* and; (3) *Use scaffolding and the externalizing and visualizing of reasoning processes*. We explored those principles' usability by designing and piloting prototype materials to support students' SSR.

Method

We adopted Reeves' (2006) approach to design-based research as our methodological basis, following Lo and Hew (2021) and Vanderhoven et al. (2016).

Context and Participants

This research was undertaken in the Netherlands, where social science education is grounded in sociology and political science and consists out of two related school subjects: *maatschappijleer* and *maatschappijwetenschappen. Maatschappijleer* is a mandatory subject at secondary school level focusing on students' basic understanding of societal structures, such as democratic rule of law and the political system. *Maatschappijwetenschappen* is a more advanced and in-depth study of social sciences. This optional subject pays more attention to social scientific theories and inquiry skills. The central aim is to equip students with the knowledge and skills needed to analyze social problems and evaluate possible solutions that might contribute to solving the problems through the lens of sociology and political science (College van Toetsen en Examens, 2019). In order to do so, students need to use 23 both sociological (such as socialization and individualization) and political (such as ideology and democratization) concepts.[1]

Although citizenship is not a separate school subject in the Dutch educational system, Dutch citizenship goals (such as promoting critical thinking, acquiring knowledge about the democratic rule of law) are frequently addressed in both *maatschappijleer* and *maatschappijwetenschappen* (College van Toetsen en Examens, 2019). In this study, we focus on *maatschappijwetenschappen* in which students' reasoning about social problems is central.

The study participants (see Table 1) were four social science teachers and their 90 students, drawn from eight classes of upper secondary education in the two highest tracks preparing for college and university. The *design team* comprised the four social science teachers, who developed the educative materials, together with two researchers. Two of those teachers were the first and fourth authors of this article; we recruited the other two teachers through our professional network, ensuring that all four teachers had extensive experience in teaching and designing social science curriculum materials. Before undertaking the study, we obtained informed consent from teachers and students as well as approval from the faculty ethics committee.

Research Design and Data Collection

Reeves (2006) distinguished four steps in educational design research, namely (1) analysis of the practical problem by researchers and practitioners, (2) development of prototype solutions by existing design principles, (3) iterative cycles of testing and refinement, and (4) reflection to

Table 1. Characteristics of Participating Teachers.

Teacher	Education	Years of social science teaching experience	Relevant work experience	School
1	Master of political science	7	Assessment expert for 5 years	A
2	Master of sociology	25	Social science teacher educator for 20 years	A
3	Master of political science	19	Assessment expert for 8 years	B
4	Master of sociology	13	Social science teacher educator for 10 years	B

produce design principles and enhance implementation (Reeves, 2006). Below, we describe how we applied Reeves' four steps. As indicated in our discussion, some prototype materials were tested online due to Covid-19 lockdowns.

Step 1: Analysis of Practical Problems

The first challenges were to provide a clear definition of SSR and identify students' specific difficulties. We adopted the definition of SSR that we formulated in our previous study (Klijnstra et al., 2023), which comprises three major skills and five reasoning activities. The three skills were (1) describing, (2) explaining, and (3) problem-solving. The five reasoning activities were (1) causal analysis; (2) use of social science concepts, models, and theories; (3) use of evidence; (4) use of perspectives and reflection on them, and (5) comparing. We described these reasoning activities in three proficiency levels, which were supported by a list of potential reasoning flaws and rubrics for students' SSR. This conceptualization of SSR was also validated by two focus groups, one group comprising teachers and the other comprising teacher educators. Three initial, general design principles derived from our literature review functioned as a starting point for developing prototype materials.

Step 2: Development of Prototype Solutions

The design team created the curriculum materials using the three initial design principles described earlier in the theoretical framework. Each teacher focused on at least one SSR component, using SSR subcategories derived from the rubrics we developed in a previous study to delineate lesson units.

Step 3: Iterative Cycles of Testing and Refinement

We examined whether the initial design principles were useful and could be incorporated into specific future curriculum materials to function as educative materials. The design principles and prototype lessons were tested, validated, and revised in three cycles (see Figure 1).

In cycle 1, the initial design principles and curriculum materials were evaluated and validated by both the social

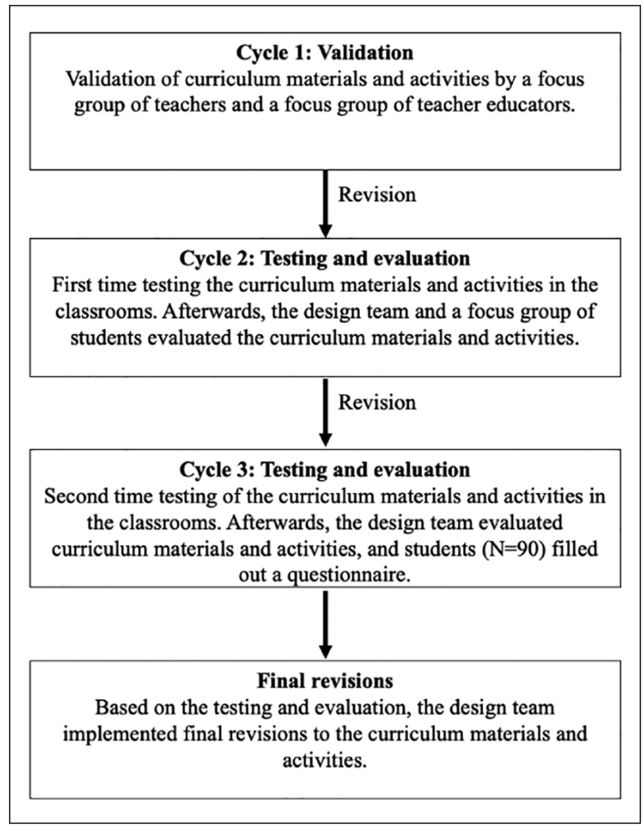

Figure 1. Cycles of testing and refinement.

science teachers comprising focus group 1 ($n=4$) and the social science teacher educators comprising focus group 2 ($n=4$). These groups were recruited from our professional network, and we selected participants who were experienced with the new examination program as well as a variety of teaching methods and contexts (see Table 2).

The design team prepared four curriculum samples to function as prototype materials. Each prototype was validated by both focus groups, whose members were interviewed about the comprehensibility, validity, attractiveness, and usability of the curriculum materials. Evaluations of explicit instruction and skills and subskills were sought via questions such as, "To what extent do the assignments (and roadmaps and diagrams) elicit or support student reasoning appropriate to the skill?." The research team used the responses to revise the materials.

Table 2. Characteristics of Focus Groups.

Focus group	Social science education experience (in years)
1. Social science teachers ($n=4$)	2
	12
	18
	5
2. Social science teacher educators ($n=4$)	2
	13
	17
	14

The revised curriculum materials were then tested for the first time with students in four classes (cycle 2). After the implementation, we conducted interviews with four focus groups of students (three or four students from each class). The design team used the student responses to further revise the materials. In cycle 3, those revised curriculum materials were tested in other classes. After the last round of testing, students from the four classes ($n=90$) completed a questionnaire, and the design team again revised the materials.

During the testing of the curriculum materials (cycles 2 and 3), teachers were asked to make structured notes in a digital logbook about their experiences with the designed materials. Two of the four teachers were interviewed (and audio-recorded) after the second testing period (cycle 3); the interviews asked about the clarity and usability of the materials and activities, the teacher's impact on student learning, and the adjustments teachers made during their lessons. For example, teachers were asked about adjustments they made after the initial validation ("What did you do with the feedback, that is, how did you incorporate it?").

Each aspect of the curriculum material was evaluated by students ($n=90$) from eight classes in two different schools. Students completed a questionnaire and a learner report evaluating how well the curriculum materials helped them reason about societal problems. Students chose scores from 1 to 5 for each aspect of the experience, including difficulty (e.g., "I experienced the assignments as difficult"); transparency (e.g., "I could not complete the assignments without an explanation from the teacher"); pleasure (e.g., "I would welcome more frequent assignments like this in class"); and relevance (e.g., "I think I can also use this skill outside of social science class"). We adapted the scales from a questionnaire that was developed to investigate students' perceptions of authentic tasks (e.g., Dorman & Knightley, 2006). The teacher selected three students (low-, medium-, and high-performing) from each class to interview about their experiences with the curriculum material. The interviews focused on the same aspects as the questionnaire. Students also evaluated the curriculum materials in a learner report that included the following open-ended questions: (1) "As a result of the lesson series, I became better at . . ."; (2) "What I especially learned about the skill is that . . ."; (3) "What especially helped me learn the skill in this lesson series is . . ."; and (4) "What could still be improved in this lesson series is . . .".

Step 4: Reflection to Revise Design Principles and Enhance Implementation

During and after the three cycles, the design team reflected on the initial and emerging design principles, making adjustments when necessary (as discussed in the results section).

Data Analysis

We transcribed the 14 audio-taped interviews (four with social science teachers, four with teacher educators, four with students, and two with the design team) and analyzed their responses qualitatively in ATLAS.ti. In the first round of coding, our three initial design principles served as the starting point. Alignment took place between the first and fourth authors: the fourth author looked at the codes, revisions were made, and the final coding was determined. In the second round of coding, we created subcategories, for example, "connection to students' world of experience." We added codes that emerged from the data as needed, such as when comments were made about the curriculum's structure and construction. Illustrative quotations from the interview data appear in the results section, below.

Results

While we began with three initial, general, didactic design principles that can promote complex learning, our research process eventually yielded six subject-specific design principles that can promote student SSR. Those six principles, which build on the three initial design principles, are presented in Table 3, which also illustrates how they are reflected in the developed curriculum materials.

Below, we discuss each subject-specific design principle individually, describing how it emerged during the process and to what extent it is consistent with the three initial design principles.

Design Principle 1: When Introducing a Context or Social Scientific Concept, Make the Development of Social Scientific Reasoning Transparent by Paying Attention to Students' Initial Associations, Prior Knowledge, and Intuitive Responses

To formulate this principle, the design team started from initial design principle 1 (*Use whole, meaningful, and authentic tasks*). In developing prototype solutions (step 2

Table 3. Embedding of Design Principles in the Developed Curriculum Materials.

Design principle	Embedding in curriculum material*
1. When introducing a context or social scientific concept, make the development of social scientific reasoning transparent by paying attention to students' initial associations, prior knowledge, and intuitive responses.	Appears in the sample curriculum material *Comparing countries*. In the first lesson, students ranked countries (USA, Russia, Brazil, United Arab Emirates) as most to least desirable to live in and then choose a country based on their prior knowledge and preconceptions. During the lesson series, they studied statistical data about social inequality and other country characteristics. At the end of the lesson series, they completed a new ranking in the table and compare the results with their preconceptions, reflecting on that comparison.
2. Use specific social and political themes, processes, or problems in learning tasks as contexts to elicit wonder, explain social scientific reasoning, and practice social scientific reasoning.	Appears in the sample curriculum material *Reasoning with social science concepts*. Using the Covid-19 pandemic as an example, students dissected the concept of social inequality by comparing the pandemic's effects in different countries and on different population groups; each sub-concept was illustrated by new associations and examples. Additionally, in the lesson series, new contexts were used in which students enriched their knowledge and skills with new examples and associations.
3. Provide explicit instruction on the social scientific reasoning activities emphasized in a learning task.	Appears in the sample curriculum material *Visualize cause-and- consequence reasoning*. Explicit instruction included an instructional video explaining how to reason about causes and consequences and elucidating assumptions, relationships and mechanisms. An example relating a feeling of safety to the number of police officers on the street illustrated the reasoning.
4. Emphasize practicing one or several components of social scientific reasoning in a learning task.	Appears in the sample curriculum material *Visualize cause-and-consequence reasoning*. The reasoning activity emphasized was causal analysis, specifically, recognizing and describing cause-and-consequences reasoning in news reports and other accounts. Students also learned to distinguish correlation and causation and to identify the direction of a relation, intervening variables, and underlying mechanisms.
5. Support students with scaffolds, such as visual representation, that can promote social scientific reasoning.	Appears in the sample curriculum material *Comparing countries*. In the final lesson, students investigated which variables can be used to indicate the degree of social inequality, which required that they formulate a hypothesis. Students were given a fill-in-the-blank chart to help them formulate the hypothesis and identify the independent and dependent variables.
6. Provide feedback on students' social scientific reasoning based on clear indicators such as the rubrics for social scientific reasoning.**	Appears in the sample curriculum material *Decoding the news*. This curriculum material is composed of six different parts. In the first five parts, students individually wrote down the essence of the relevant section in the form of rules of thumb. In the sixth and final part, students compared their rules of thumb with those of the teacher. The rules of thumb were derived from rubrics on social scientific reasoning, for example, on learning to compare groups.

*For each design principle, we included just one example in Table 3. Below, we discuss each design principle individually and clarify examples from Table 3.
**Teachers were able to use rubrics developed in a previous study (Klijnstra et al., 2023).

in the method section), the team noticed that such solutions require a specific context that is motivating and meaningful to students. When deciding on a specific context—the decrease in violence in the Netherlands, for example—teachers should know what preconceptions students have and what they already know and feel about that context. The design team noted the importance of the learner perspective, which includes associations, opinions, views, feelings, and knowledge about certain topics and contexts. In the design of learning tasks, the starting point can influence students' SSR and also provide teachers the opportunity to identify naïve conceptions or flaws in reasoning. In social science, students enter the classroom with pre-existing beliefs and feelings about the problems in social science class that students have to reason about. As a social science teacher, you need to identify these preconceptions. For example, what naïve ways of thinking might exist about the social problem of obesity or the development of crime? From there you can then adjust your instructions and didactics accordingly. Therefore, we added a design principle specifically aimed at activating prior knowledge and initial understanding. For example, design principle 1 was incorporated in the sample curriculum material *Comparing countries*. Students were asked both before and after having studied data to decide which country they would prefer to live in; then, at the end of the lesson series, they used social scientific data to reflect on their choices (see Table 3).

In the focus groups with teachers (cycle 1), teachers reported that students sometimes resist discussing concepts and social problems in class and emphasized the need to consider students' preconceptions. Nevertheless, teachers indicated that their teaching often failed to take their students' preconceptions into account.

Students mentioned the importance of reflecting on their views and beliefs. In the curriculum material *Decoding the news*, each lesson section focused on students' initial associations and intuitive thoughts. Some students appreciated this so much that they were disappointed by its absence from the curriculum materials they encountered in cycle 2 (see Figure 1):

> In the previous teaching material, we very often had the questions: "What did you think about this, what thoughts did you have, and what did you learn from this?" I just mentioned that I missed that piece in this learning task (social science student A commenting on curriculum material *Comparing countries*).

This comment underscores the need to pay attention to students' preconceptions in teaching materials.

Design Principle 2: Use Specific Social and Political Themes, Processes, or Problems in Learning Tasks as Contexts to Elicit Wonder, Explain Social Scientific Reasoning, and Practice That Social Scientific Reasoning

This second design principle is also derived from initial design principle 1. In developing the curriculum materials, the design team indicated that to promote students' reasoning, all reasoning activities should begin from a specific context rather than abstract concepts or theories. Based on these contexts, the concepts should be taught inductively. In the development phase, the design team refrained from selecting a single context for a whole, authentic task in which the student was learning to apply SSR, instead choosing additional, related contexts to introduce after the first context. Thus, the team shifted from emphasizing a single context to allowing multiple contexts. The sample curriculum material *Reasoning with concepts* addressed the concept of social inequality in many different contexts, from discrimination to the Covid-19 pandemic (see Table 3). While the contexts varied in complexity and sensitivity, all were recognizable and motivating to students.

The analysis of the interviews with teachers (cycle 1), teacher educators (cycle 2), and the design team (cycle 3) indicated that taking the context as the starting point can be motivating to students and thereby promote their SSR. Subsequently, students must learn to apply social science concepts and analyze the context. The design team labeled this approach the context-concept-context approach.

The focus groups of teachers and teacher educators in cycle 1 responded positively to starting from contexts. Both groups emphasized that contexts and examples are vital to understanding and using social science concepts, which can motivate students and provoke wonder as they become more meaningful and relevant: "Because those concepts, they are extremely boring of course, only through context do they become interesting" (social science teacher 1). The following quote illustrates that using specific contexts, such as inequality and the pandemic, can generate interest and pleasure: "I enjoyed making assignments this way; the sources [contexts] used in the assignments were very relevant which also made it more interesting" (social science student B commenting on sample curriculum material *Reasoning with social science concepts*).

Supported by input from the focus groups, the design team concluded that social science teachers can promote SSR by using contexts in several ways. First, contexts can serve as a motivating starting point, evoking wonder or other emotional responses. The context of ethnic profiling by the police, for example, functioned as a starting point in the sample curriculum material *Decoding the news*. Second, contexts are useful when explicitly explaining components or aspects of SSR. For example, one instructional video focused explicitly on the use of cause and consequent relations in social science education. This was illustrated in the specific context in which the visibility of police presence can be related to citizens' sense of safety. Third, contexts help students practice SSR. As we saw earlier, the curriculum material *Reasoning with social science concepts* addressed the concept of social inequality in contexts that varied in their complexity but were all recognizable and motivating to students (see Table 3).

Design Principle 3: Provide Explicit Instruction on the Social Scientific Reasoning Activities That Are Emphasized in a Learning Task

We produced this principle by modifying initial design principle 2 (*Use explicit instruction and modeling on subskills*) only slightly; we focused it explicitly on SSR and recommended focusing the explicit instruction on the reasoning activities that are emphasized in the learning task (see design principle 4).

The design team recognized that because of the skill's complexity, students should be instructed explicitly when learning to reason about social problems. For each sample curriculum material, the team incorporated an instructional video to explain a particular reasoning activity. For example, the instructional video accompanying the sample curriculum material *Visualize cause-and-consequence reasoning* explicitly explained how to connect causes and consequences in the context of a social problem and illustrated the connection between police presence on the street and citizens' sense of safety.

In another instructional video, the social problem of obesity was used to show what is specifically complex about SSR. Social problems as obesity have multiple causes and consequences, however, students can have an overly naive conception of obesity: people eat too much and therefore there is obesity and the solution lies entirely with those people themselves who need to eat healthier. As a social science teacher, it is important to address those naive reasonings, and relate to pre-existing biases, values and feelings in public debate and everyday life. In the instructional video, causal diagrams are used to explain with concrete examples how particular mechanisms can lie beneath a seemingly simple causal relationship such as between eating too much and obesity. This is in line with design principle 1: students in social science enter your classroom with views, feelings and emotions about social problems. A social science teacher needs to adjust the instruction accordingly.

The focus groups with teachers and teacher educators (cycle 1) also emphasized the relevance of explicit instruction in reasoning activities. Both groups mentioned the added value of modeling reasoning activities. Still, the experts remarked that for some materials, the instruction could have been even more explicit. One of the teachers in the focus group (cycle 1) highlighted the teacher's explicit instructions and modeling of complex skills:

> Yes, you have to demonstrate. Because I think the first [that at] . . . they find that very difficult, so you really have to think out loud with the students of, how do you actually do this. What am I doing now? What is going on in my head? (social science teacher 2 commenting on sample curriculum material *Decoding the news*).

The focus group with teacher educators (cycle 1) also mentioned that certain transitions should be identified more explicitly in the teaching materials for students:

> You started with a context. You named some things that are part of a concept and subsequently you want to use the concept again to analyze a new context. So, that is actually that transfer, that this concept is also useful in another context. That step [the transfer] should be a little more explicit in the instruction. (social science teacher educator I commenting on sample curriculum material *Reasoning with social science concepts*).

Students similarly recognized the relevance of explicit instruction, which became most evident with the instructional videos. When one lesson series had to be implemented before the instructional video clip was ready, a student in the focus group (cycle 2) voiced a desire for it with this striking remark:

> What I just thought: maybe it would be useful to have an example clip, where someone links a cause and a connection. That you see someone drawing it themselves, so to speak. Because it was, though it was sometimes a bit abstract. (social science student C commenting on sample curriculum material *Visualize cause-and-consequence reasoning*)

In the focus group (cycle 2), students emphasized the utility of seeing assignment objectives clearly specified and missed such explicit clarification when it was absent.

> Usually, we have some kind of lesson series, and then at the beginning, there is, say, a heading with at the end of this lesson, you can do this. And then a characteristic, can you compare a country in this way? I missed that, that you could get a grip on exactly what you needed to look at, look up, and learn. (social science student D commenting on curriculum material *Comparing countries*)

In both the focus groups (cycle 2) and the questionnaire (cycle 3), students reported the benefit of explicit instruction. Students need to know the reasons behind the assignments and mentioned that instruction often needed to provide more explicit guidance.

Design Principle 4: Emphasize Practicing One or More Components of Social Scientific Reasoning in a Learning Task

This fourth design principle is also derived from initial design principle 2. The design team found that it is difficult to provide explicit instruction about all components of SSR in a learning task; attempting to do so would introduce the risk of a *mile-wide inch-deep approach* (see Bransford, 2000). Hence, we formulated a separate design principle about delineating explicit instruction. The team recommended that teachers determine which components and activities of SSR require extra attention.

Both teachers and teacher educators in the focus groups (cycle 1) emphasized the importance of limiting the curriculum materials. They stressed that greater attention to limited elements of reasoning helps students to maintain focus rather than becoming lost in a complex reasoning task. Both focus groups (cycle 1) mentioned that the curriculum materials were sometimes too ambitious, involving too many components and subskills.

Students appreciated having curriculum materials structured into subtasks that focused on particular components or subactivities of SSR. Seeing isolated subtasks and having the opportunity to focus on an individual subcategory of SSR provided clarity for students. They also appreciated seeing the subparts reassembled into a final assignment: "The last one summed everything up well and was a nice final assignment. What I liked to do" (social science student E commenting on sample curriculum material *Decoding the news*). Furthermore, the students in the focus groups (cycle 2) appreciated a step-by-step approach, in which skills were practiced in the training material. This agrees with the results of the questionnaire that was answered by 90 students in cycle 3.

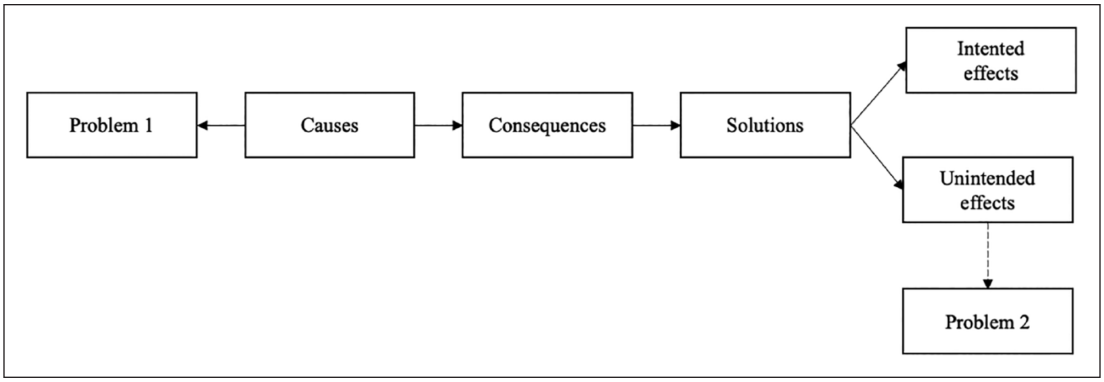

Figure 2. Example of a scaffold: Cause-and-consequence diagram.

On the one hand, the questionnaire results indicated that students liked practicing isolated subskills to eventually learn the entire skill: "The final assignment [was the best], that's when I really learned how to criticize an existing article and . . . was able to apply everything I [had] learned" (social science student F commenting on curriculum material *Decoding the news*). Students also enjoyed being able to put the partial skills together in a final assignment, as this quote indicates.

Design Principle 5: Support Students With Scaffolds, Such as Visual Representations, That Can Promote Social Scientific Reasoning

This fifth design principle builds on initial design principle 3 (*Use scaffolding and the externalizing and visualizing of reasoning processes*). The design team integrated many different scaffolds into the developed curriculum materials. The advantage of working with scaffolds, such as checklists and diagrams to support reasoning, was noted by all participating designers and teachers. In the curriculum material *Comparing countries*, for example, students were given a fill-in-the-blank chart to help them formulate a hypothesis and identify the independent and dependent variables. In the curriculum material *Decoding the news*, students approached each subtask by writing down rules of thumb, which they used for the final assignment. Those rules of thumb formed a roadmap for decoding the news and functioned as a scaffold. Furthermore, in each sample curriculum material, students needed to reason with diagrams, such as cause-and-consequences diagrams (see Figure 2).

Cause-and-consequence diagram in social science education (Ruijs, 2014)

Diagrams like this cause-and-consequence diagram are used to distinguish causes, consequences and possible solutions. Furthermore, this diagram challenges students to think about unexpected consequences of the possible solutions. Previous research has shown that students find this a difficult element of SSR (Klijnstra et al., 2023). The cause-and-consequence diagram is also helpful for visualizing different perspectives on a social problem. Students can then reflect on their own analysis, compare different political views and also substantiate their analysis with empirical data.

Design Principle 6: Provide Feedback on Students' Social Scientific Reasoning Based on Clear Indicators Such as the Rubrics for Social Scientific Reasoning

In the focus group with teacher educators (cycle 1), teacher educator II concluded that curriculum materials should do more to recognize students' progress. In the materials, students' progress in reasoning should be made more visible. Students should also receive explicit feedback from teachers on the quality of their reasoning, for example, from the rubrics for SSR as indicated in the principle (see Klijnstra et al., 2023).

Students emphasized the importance of feedback both in the focus groups (cycle 2) and the questionnaire (cycle 3), indicating in both cycles that the curriculum materials did not adequately indicate whether they had mastered the skill. They might also have found feedback on their answers and learning progress helpful. As students indicated, the inadequate level of feedback was partly due to the online component of the assignments, a result of Covid-19 regulations. The input from the focus groups made the design team realize the need to include a design principle that explicitly recommends feedback on students' reasoning based on clear indicators.

Tools for assessment and feedback include the rubrics of levels of SSR and the level descriptions for all SSR subskills, which we developed in a previous study (Klijnstra et al., 2023). Based on the assignment, a teacher can select subskills and use the criteria and level descriptions to show students what is needed to achieve a higher level of reasoning. Initially, the available rubrics were not used by all teachers to inform students about the objectives and expected level of reasoning or to provide feedback. We started to refine this in subsequent iterations of the lessons, and the latest version of the four curriculum materials refers to parts of the rubric. For example, in *Decoding the news*, students compared their rules of thumb with those of the teacher, which were derived from the rubrics on SSR, such as *Learning to compare groups* (see Klijnstra et al., 2023). Additionally, at the end of each lesson component, students provided feedback on their associations.

Discussion and Conclusion

This study investigated which design principles promote students' SSR and whether those principles can be incorporated into specific curriculum materials that are educative for teachers. The study's most significant result is the formulation of six design principles for promoting SSR that were developed and validated by using them in a process with three design cycles. Those six principles are consistent with their source principles, that is, the initial, general design principles for teaching complex occupational skills, which we derived from the literature.

Second, the study produced prototype curriculum materials to help teachers design instruction that promotes their students' SSR. Those materials included lesson units, scaffolds such as graphical organizers, and instructional videos, which were evaluated and validated through interviews with social science teachers and teacher educators in focus groups. The materials were also tested in eight classes of two different schools and evaluated by students, both through individual questionnaires and in four focus groups.

Explicit instruction and modeling on subskills and scaffolding, which figured in two of our initial design principles, were incorporated into our final design principles. Since it is not feasible to give explicit instruction about multiple skills within a task or lesson unit, we added a principle that recommends practicing one or more components of SSR in a learning task. However, the design of a whole, authentic task is no longer directly identifiable in our SSR design principles. We replaced that principle with the principle, *Use specific social and political themes, processes, or problems in learning tasks as contexts to elicit wonder, explain social scientific reasoning, and practice that social scientific reasoning.* As may be seen in the literature, the holistic design approach is considered relevant to learning complex skills (e.g., van Merriënboer & Kirschner, 2018) since aspects of complex skills are interrelated and need to be coordinated. In the design phase, our starting point was an integrative, authentic task. However, we encountered several challenges when translating that task to curriculum materials for enhancing secondary school students' SSR. SSR's subskills are often very complex, as are the social contexts that students must consider in their reasoning. Consequently, students mostly practiced subskills in the context of smaller tasks that were not embedded in a larger authentic task.

Our interviews with teachers, teacher educators, and students indicated that skills are best explained and practiced in connection with specific social and political themes, processes, or issues. This finding agrees with previous research results indicating that meaningful contexts can contribute to students' transfer of knowledge and skills (e.g., Bransford et al., 2000). Additionally, meaningful contexts help students apply the concepts more easily and subsequently use them to better understand the relevant social problem (that functions as context). Finally, we noted that it is possible and useful for some social science teachers to embed SSR in an integrative authentic task, for example, writing a letter to the city council with a recommended solution to a local social problem. However, this did not translate into a design principle; our study indicated that such a task would be overly prescriptive and may not be feasible for many teachers.

In addition to producing design principles by sharpening more general ones, our study also produced two new principles: *When introducing a context or social scientific concept, make the development of social scientific reasoning transparent by paying attention to students' initial associations, prior knowledge, and intuitive responses*; and *Provide feedback on students' social scientific reasoning based on clear indicators such as the rubrics for social scientific reasoning*. Both of these two design principles, which specifically promote SSR, focus on the need to demonstrate students' progress in SSR. To do this, it is necessary to gain insight into students' thinking and understanding before providing feedback, which should be given during a task or after its completion. This is consistent with recent literature on formative assessments (Panadero & Lipnevich, 2022; Shute, 2008).

We can conclude that students' preconceptions play a vital role in learning to reason about social problems. Preconceptions and misconceptions, associations, and feelings about social problems all contribute to context. Teachers must identify (and sometimes isolate) students' prior knowledge, experiences, and emotions about the curriculum material since identifying them may be a prerequisite for promoting SSR. This is in line with previous research: people's views and personal engagement affects their reasoning about social problems (see Crocco et al., 2017; Haidt, 2012; Kunda, 1990; Mercier & Sperber, 2011; Stitzlein, 2021).

This study is not without limitations. The data collection was compromised to some extent by Covid-19 restrictions, which necessitated conducting some lessons online. As a result, teachers could not optimally test how well the curriculum materials would function in the classroom, which was their intended setting. In particular, explicit instruction and the modeling of complex subskills could not be practiced as effectively online. In addition, more research is needed on the extent to which the type of social problem affects students' reasoning and the support they need in reasoning. For example, do students need more support if the social problem involves a topic they consider sensitive?

Another limitation is that we did not measure students' progress in SSR. Future research could focus on the use of rubrics (such as those used to inform teachers about components and levels of SSR) or other instruments for assessing students' progress in SSR, for example, in a pre-and post-test experimental design. Furthermore, this study did not evaluate the extent to which its design principles and prototype curriculum materials can function as *educative* curriculum materials. More research is needed on the effectiveness of these materials for professional advancement in teaching SSR.

An important practical implication is that teachers can use the design principles as well as the definition of SSR developed in earlier research to develop lessons that promote SSR. When designing instructional materials, teachers can combine outcomes from this study by using explicit instruction on one or several subskills of SSR, choosing specific, meaningful contexts to introduce the practice of skills and providing explicit instruction and practice. In doing so, teachers can support their students with scaffolds and feedback at the level of reasoning.

Design principles and curriculum materials in which these are recognizably elaborated can help teachers to design lessons that foster the practice of complex SSR subskills in specific, meaningful contexts and promote their SSR. Additionally, they may ultimately contribute to the development of more critical citizens, benefiting democratic society as a whole.

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Note

1. Overview of the 23 key concepts of the Dutch' social science program: Socialization; Acculturation; Identity; Culture; Political socialization; Ideology; Social inequality; Conflict; Collaboration; Power; Authority; Social cohesion; Social institution; Political institution; Group formation; Representation; Representativeness; Rationalization; State formation; Democratization; Institutionalization; Individualization and; Globalization (College van Toetsen en Examens, 2019)

References

Archer, A. L., & Hughes, C. A. (2011). *Explicit instruction: Effective and efficient teaching*. Guilford Press.

Arias, A. M., Davis, E. A., Marino, J. C., Kademian, S. M., & Palincsar, A. S. (2016). Teachers' use of educative curriculum materials to engage students in science practices. *International Journal of Science Education*, *38*(9), 1504–1526. https://doi.org/10.1080/09500693.2016.1198059

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn* (Vol. 11). National academy Press.

Brookhart, S. M. (2014). *How to design questions and tasks to assess student thinking*. ASCD.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational researcher*, *18*(1), 32–42. https://doi.org/10.3102/0013189X018001032

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). *What makes great teaching? Review of the underpinning research* (Project report). Sutton Trust.

Coleman, J. S. (1987). Microfoundations and macrosocial behavior. In J. C. Alexander, B. Giesen, R. Münch, & N. J. Smelser (Eds.), *The micro-macro link* (pp. 153–173). University of California Press.

College van Toetsen en Examens. (2019). Syllabus Maatschappijwetenschappen VWO. Centraal Examen 2022. Versie 2, juli 2020 [Syllabus Social Sciences Education. Central exam. Version 2, July, 2020].

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, *15*(3), 6–11, 38–39.

Crocco, M., Halvorsen, A. L., Jacobsen, R., & Segall, A. (2017). Teaching with evidence. *Phi Delta Kappan*, *98*(7), 67–71. https://doi.org/10.1177/0031721717702635

Davis, E. A., & Krajcik, J. S. (2005). Designing educative curriculum materials to promote teacher learning. *Educational Researcher*, *34*(3), 3–14. https://doi.org/10.3102/0013189X034003003

Dorman, J. P., & Knightley, W. M. (2006). Development and validation of an instrument to assess secondary school students' perceptions of assessment tasks. *Educational Studies*, *32*(1), 47–58. https://doi.org/10.1080/03055690500415951

Fiske, S. T., & Taylor, S. E. (2017). Stereotyping: Cognition and bias. In S. T. Fiske & S. E. Taylor (Eds.), *Social cognition—from brains to culture* (3rd ed., pp. 303–335). Sage Publication Ltd.

Goldman, S. R., Britt, M. A., Brown, W., Cribb, G., George, M., Greenleaf, C., Lee, C. D., & Shanahan, C., & Project READI. (2016). Disciplinary literacies and learning to read for understanding: A conceptual framework for disciplinary literacy. *Educational Psychologist*, *51*(2), 219–246. https://doi.org/10.1080/00461520.2016.1168741

Grol, R., de Vries, B., & Sent, E-M. (2016). Effects of economic classroom experiments on economic knowledge and reasoning in secondary education. *Thinking Skills and Creativity*, *22*, 129–141. https://doi.org/10.1016/j.tsc.2016.09.010

Haidt, J. (2012). *The righteous mind: Why good people are divided by politics and religion*. Vintage.

Haugwitz, M., Nesbit, J. C., & Sandmann, A. (2010). Cognitive ability and the instructional efficacy of collaborative concept mapping. *Learning and Individual Differences*, *20*(5), 536–543. https://doi.org/10.1016/j.lindif.2010.04.004

Horton, P. B., McConney, A. A., Gallo, M., Woods, A. L., Senn, G. J., & Hamelin, D. (1993). An investigation of the effectiveness of concept mapping as an instructional tool. *Science Education*, *77*(1), 95–111. https://doi.org/10.1002/sce.3730770107

Hughes, C. A., Morris, J. R., Therrien, W. J., & Benson, S. K. (2017). Explicit instruction: Historical and contemporary contexts. *Learning Disabilities Research & Practice*, *32*(3), 140–148. https://doi.org/10.1111/ldrp.12142

Klijnstra, T., Stoel, G. L., Ruijs, G. J., Savenije, G. M., & van Boxtel, C. A. (2023). Toward a framework for assessing the quality of students' social scientific reasoning. *Theory & Research in Social Education*, *51*(2), 173–200.

Kneppers, L., Elshout-Mohr, M., van Boxtel, C., & van Hout-Wolters, B. (2007). Conceptual learning in relation to near and far transfer in the secondary school subject of economics. *European Journal of Psychology of Education*, *22*(2), 115–129. https://doi.org/10.1007/BF03173517

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, *108*(3), 480. https://doi.org/10.1037/0033-2909.108.3.480

Lee, C. D., White, G., & Dong, D. (2021). *Educating for civic reasoning and discourse*. National Academy of Education.

Lo, C. K., & Hew, K. F. (2021). Developing a flipped learning approach to support student engagement: A design-based research of secondary school mathematics teaching. *Journal of Computer Assisted Learning*, *37*(1), 142–157. https://doi.org/10.1111/jcal.12474

Maddox, L. E., & Saye, J. W. (2017). Using hybrid assessments to develop civic competency in history. *The Social Studies*, *108*(2), 55–71. https://doi.org/10.1080/00377996.2017.1283288

Marzano, R. J., & Miedema, W. (2018). *Leren in vijf dimensies: Moderne didactiek voor het voortgezet onderwijs* [Learning in five dimensions: modern pedagogy in secondary education]. Koninklijke Van Gorcum.

McNeill, K. L., & Krajcik, J. (2008). Scientific explanations: Characterizing and evaluating the effects of teachers' instructional practices on student learning. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *45*(1), 53–78. https://doi.org/10.1002/tea.20201

Mercier, H., & Sperber, D. (2011). Why do humans reason? Arguments for an argumentative theory. *Behavioral and Brain Sciences*, *34*(2), 57–74. https://doi.org/10.1017/S0140525X10000968

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development*, *50*(3), 43–59. https://doi.org/10.1007/BF02505024

Mills, C. W. (2000). *The sociological imagination*. Oxford University Press.

National Council for the Social Studies (NCSS). (2013). *The college, career, and civic life (C3) framework for social studies state standards: Guidance for enhancing the rigor of K-12 civics, economics, geography, and history*. NCSS.

Newmann, F. M. (1991). Promoting higher order thinking in social studies: Overview of a study of 16 high school departments. *Theory & Research in Social Education*, *19*(4), 324–340. https://doi.org/10.1080/00933104.1991.10505645

Novak, J. D., & Cañas, A. J. (2006). The origins of the concept mapping tool and the continuing evolution of the tool. *Information Visualization*, *5*(3), 175–184. https://doi.org/10.1057/palgrave.ivs.9500126

Panadero, E., & Lipnevich, A. A. (2022). A review of feedback models and typologies: Towards an integrative model of feedback elements. *Educational Research Review*, *35*, 100416. https://doi.org/10.1016/j.edurev.2021.100416

Perkins, D. N., & Grotzer, T. A. (2005). Dimensions of causal understanding: The role of complex causal models in students' understanding of science. *Studies in Science Education*, *41*(1), 117–165. https://doi.org/10.1080/03057260508560216

Reeves, T. (2006). Design research from a technology perspective. In J. van den Akker, K. Gravemeijer, S. McKenny, & N. Nieveen (Eds.), *Educational design research* (pp. 52–66). Routledge. https://doi.org/10.4324/9780203088364

Ruijs, G. (2014). Lesvoorbereiding: Benaderingswijzen en leeractiviteiten [Preparing the lessons: Didactic approaches and learning activities]. In T. Olgers, R. Van Otterdijk, G. Ruijs, & L. Meijs (Eds.), *Handboek Vakdidactiek Maatschappijleer* [Handbook didactics in social science education] (pp. 139–163). Landelijk Expertisecentrum Mens- en Maatschappijvakken, Amsterdam/ProDemos, Den Haag.

Sandahl, J. (2015). Preparing for citizenship: The value of second-order concepts in social science education. *Journal of Social Science Education*, *141*, 18–29. https://doi.org/10.4119/jsse-732

Sandahl, J. (2020). Opening up the echo chamber: Perspective taking in social science education. *Acta Didactica Norden*, *14*(4), 24-sider. https://doi.org/10.5617/adno.8350

Seixas, P., & Morton, T. (2013). *The big six concept of historical thinking*. Nelson.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14. https://doi.org/10.2307/1175860

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189. https://doi.org/10.3102/0034654307313795

Stitzlein, S. M. (2021). Defining and implementing civic reasoning and discourse: Philosophical and moral foundations for research and practice. In C. D. Lee, G. White, & D. Dong (Eds.), *Educating for Civic Reasoning and Discourse* (pp. 23–52). National Academy of Education. https://doi.org/10.31094/2021/2

Stoel, G. L., van Drie, J. P., & van Boxtel, C. A. M. (2015). Teaching towards historical expertise: Developing a pedagogy for fostering causal reasoning in history. *Journal of Curriculum Studies*, *47*(1), 49–76. https://doi.org/10.1080/00220272.2014.968212

Stoel, G. L., van Drie, J. P., & van Boxtel, C. A. M. (2017). The effects of explicit teaching of strategies, second-order concepts, and epistemological underpinnings on students' ability to reason causally in history. *Journal of Educational Psychology*, *109*(3), 321–337. https://doi.org/10.1037/edu0000143

Swedberg, R. (2016). Can you visualize theory? On the use of visual thinking in theory pictures, theorizing diagrams, and visual sketches. *Sociological Theory*, *34*(3), 250–75. https://doi.org/10.1177/0735275116664380

Tuithof, J. I. G. M. (2017). *The characteristics of Dutch experienced history teachers' PCK in the context of a curriculum innovation* [Doctoral dissertation, Utrecht University].

Van Boxtel, C., Hemker, A., Klijnstra, T., & Ruijs, G. (2017). *Toetsen van denkvaardigheden en conceptuele kennis bij maatschappijwetenschappen* [Assessing thinking skills and conceptual knowledge in social science education]. Landelijk Expertisecentrum Mens- en Maatschappijvakken.

Van Boxtel, C., & Van Drie, J. (2018). Historical reasoning: Conceptualizations and educational applications. In S. A. Metzger & L. McArthur Harris (Eds.), *The Wiley international handbook of history teaching and learning* (pp. 149–176). Wiley-Blackwell.

Vanderhoven, E., Schellens, T., Vanderlinde, R., & Valcke, M. (2016). Developing educational materials about risks on social network sites: A design based research approach. *Educational Technology Research and Development*, *64*(3), 459–480.

Van Gelder, T. (2005). Het doceren van kritisch denken. Enkele lessen uit de cognitiewetenschap [Teaching critical thinking: some lessons from cognitive science]. *College Teaching*, *53*, 41–46.

van Merriënboer, J. J. (1997). *Training complex cognitive skills: A four-component instructional design model for technical training*. Educational Technology.

van Merriënboer, J. J. G., & Kirschner, P. A. (2018). *Ten steps to complex learning: A systematic approach to four-component instructional design* (3rd ed.). Routledge.

Van Merriënboer, J. J., Clark, R. E., & De Croock, M. B. (2002). *Blueprints for complex learning: The 4C/ID-model. Educational technology research and development*, *50*(2), 39–61.

van Tubergen, F. (2020). *Introduction to sociology*. Routledge.

Woolfolk Hoy, A., Davis, H. A., & Anderman, E. M. (2013). Theories of learning and teaching in TIP. *Theory Into Practice*, *52*(sup1), 9–21. https://doi.org/10.1080/00405841.2013.795437

Ylikoski, P. K. (2021). Understanding the Coleman boat. In G. Manzo (ed.), *Research Handbook on analytical sociology* (pp. 49–63). Edward Elgar.