

Exploring the teaching of scientific reasoning and argumentation in secondary psychology education: The central role of epistemology

M. Evers, J. Elen and M. Vandecandelaere

Abstract Scientific reasoning and argumentation (SRA) are complex thinking skills enabling students to evaluate, generate, and use information that helps to understand and solve scientific and societal challenges. Unlike in hard sciences and history education, teaching SRA in secondary psychology education is understudied. This is problematic as SRA skills are highly discipline-specific and can help students to cope with the characteristics of psychology as ill-structured and nonparadigmatic discipline. Therefore, this study aims to explore and identify underlying themes that shape how psychology teachers approach SRA in secondary education. Fifteen secondary psychology teachers participated in three focus groups. An inductive thematic analysis identified three key themes which show that (1) teachers' ambitions for psychology education, (2) the ways in which teachers understand SRA, and (3) teachers' epistemological beliefs, help to understand the reported difficulties in teaching SRA in psychology. The strong epistemological dimension of SRA was not easily recognized by teachers, nor did teachers refer to epistemological criteria when discussing assessment criteria, making it difficult for teachers to see how to assess SRA. The study indicates that teachers' epistemological beliefs may help understanding this difficulty.

Keywords scientific reasoning, subject didactics, psychology education, secondary education, epistemological beliefs

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1 Introduction

General secondary education is about providing students with the complex skills needed to evaluate, generate, and use information that helps to understand and solve scientific and societal challenges (OECD, 2022). Among the array of essential competencies, reasoning and problem-solving skills rank as one of the most important skills that are critical for present and future employment (World Economic Forum, 2020). In today's knowledge society, the ability to generate and collect data is growing exponentially, and endless information is now widely available and accessible. However, knowing how to make sense of this mass of data and use it meaningfully is not self-evident. Education therefore plays a crucial role in helping learners not only to access information, but also to use it meaningfully. Science today is no longer a "closed shop" (OECD, 2022, p. 58). Thanks to digital technologies, and the pandemic, access to scientific knowledge has become more open. However, findings aren't always trustworthy. To detect poor quality and misinformation, learners need to be able to validate and evaluate the knowledge they are using.

For young people to be able to participate in the current knowledge society and to benefit from the open access to scientific knowledge, complex skills are required. Scientific Reasoning and Argumentation (SRA) are recognized as such complex skills (Greene et al., 2016), and their acquisition is one of the intended goals of general secondary education worldwide (Engelmann et al., 2018). SRA can be defined as the ability to understand and use scientific concepts, theories, methods, and findings to solve or explain problems in a particular scientific discipline according to the characteristics and requirements of that discipline (Fischer et al., 2014). SRA are considered higher order thinking skills. Therefore, attention to SRA in secondary education aims at advanced knowledge acquisition, going beyond mere reproduction and application of concepts and theories (von Glasersfeld, 2001). In addition to being an important goal in its own right, SRA contributes to other learning goals, such as a profound understanding of discipline-specific core concepts (Rapanta et al., 2013; von Aufschnaiter et al., 2008). Attention to SRA in education is also associated with epistemological benefits as it requires the use of epistemic criteria to judge quality and certainty of scientific products as models, theories, and arguments (Chinn et al., 2011; Kuhn et al., 2013). As such, SRA creates a context for learning about the nature of knowledge and knowing of a specific discipline. Despite its acknowledged importance in education and potential benefits for students, engaging students in SRA is not common practice in secondary education (Chinn & Malhorta, 2002) and varies widely across teachers (McNeill & Pimentel, 2009). Current curricula are, moreover, rather focused on content coverage (Klahr et al., 2019; Kuhn & Lerman, 2021; Li et al., 2006) which often

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stays limited to lower-level cognitive skills such as recalling, understanding, and applying concepts and theories (Homa et al., 2013c; Osborne, 2018).

Given the importance of SRA in education, much research has focused on how to support SRA development. In their meta-analysis, Engelmann et al. (2016) provide an overview of the research on fostering SRA in different school subjects. The review does not report any study on SRA in secondary psychology education, making psychology an underrepresented discipline in research on SRA. This is problematic because, given the strong domain-specific dimension of SRA, there is a need for a more balanced understanding of (teaching) SRA across disciplines and for different purposes. Second, SRA are relevant skills to teach in psychology because SRA can help students cope with the epistemological characteristics of psychology as an ill-structured and nonparadigmatic discipline (Klopp & Stark, 2022). Therefore, this study contributes by identifying and describing the central challenges related to the teaching of SRA in the field of psychology.

2 Theoretical framework

SRA are conceptualized and used in diverse ways in different scientific disciplines and research traditions. These differences relate to the included SRA activities, the central aspects of SRA, and the extent to which SRA are considered a uniform or multidimensional skill (Engelman et al., 2016; Opitz et al., 2017). The current study draws upon the conceptual framework of Fischer et al. (2014) that defines SRA as the ability to understand and use scientific concepts, theories, methods, and findings to solve or explain problems in a particular scientific discipline according to the characteristics and requirements of that discipline. Fischer et al. (2014) postulate eight non-sequentially connected epistemic activities in SRA: problem identification, questioning, hypothesis generation, construction and redesign of artefacts, evidence generation, evidence evaluation, drawing conclusions, and communicating and scrutinizing. SRA is hereby considered a multidimensional construct, meaning that these activities do not need to be present all at the same time as necessary components of one complex SRA skill. The Fischer et al. (2014) framework establishes a common language for SRA research across diverse scientific disciplines like history, physics, or biology. However, the expression of SRA (or the implementation of SRA) is shaped by the specific characteristics and norms of each scientific discipline, i.e. its epistemology, as well as by SRA's epistemic goals, which may include knowledge generation, theory construction, explanation of phenomena, or answering questions relevant to one's personal life (Engelmann et al., 2018; Fischer et al., 2014). As Goldman et al. (2018) articulate, "we came to see epistemology as central, providing purpose and

motivation to the ways in which inquiry is conducted, the reasoning principles that are involved, and the forms in which information is represented, expressed, examined, critiqued, and negotiated in and through oral and written discourse” (p. 130).

This study focuses on SRA with the specific epistemic aim of *explaining* psychological phenomena by drawing on existing theories rather than through actual engagement in empirical research. SRA to explain psychological phenomena requires students to evaluate and choose which theory or theories can best explain the psychological phenomenon in question and to justify their choice (Ouellette et al., 2016).

As suggested by Fried (2020) and Sanbonmatus and Johnston (2019), psychology can epistemologically be characterized as fundamentally ill-structured and nonparadigmatic with a complex conceptual network structure. The subject matter of psychology can at least be characterized as (a) abstract, (b) complex, and (c) context dependent (Eronen & Bringmann, 2021). The general constructs that refer to psychological traits, processes, states, and behaviors of individuals are often not concrete and visualizable, but abstract (e.g. motivation, emotion, self-efficacy) (Kagan, 2009). The subject matter of psychology is considered complex in the sense that there are many components that influence behavior and psychological processes, many nonlinear interrelationships among these components, and many distal determinants that may themselves change or evolve over time (Sanbonmatsu & Johnston, 2019). The content of psychology is contextual because psychological processes and individual behaviors are determined by many moderating conditions, mostly related to neurobiological, psychological, developmental, and environmental factors (Nolting & Geiss, 2022). This means that the content and uniqueness of these processes vary from person to person and within the same person depending on the situational and interpersonal context. As a result of the above features, regularity and uniformity often do not exist while (the same) psychological phenomena are being approached and explained from multiple perspectives (i.e. perspective pluralism), such as behavioral or cognitive perspectives (Bringmann et al., 2022; Sanbonmatsu & Johnston, 2019). These perspectives may differ in what is examined and how much importance is placed on the individual, the context, or interpersonal processes in explaining a specific psychological phenomenon. Accordingly, different perspectives within a discipline may contradict, overlap, and/or complement each other. Furthermore, theorizing in psychology is challenging given the complexity of the subject matter (Fried, 2020). Eronen and Bringmann (2021) formulate three challenges in developing psychological theories: (1) the lack of constraints on theories by sufficient robust phenomena, (2) the lack of conceptual clarity and validated constructs as the basis for theories, and (3) obstacles to establish causal relationships between psychological variables. As a result, there is a plethora of coexisting and

overlapping theories in psychology that attempt to describe, explain, or predict the same psychological phenomena, but may differ in theoretical perspective, scope, and goal, and may use different conceptualizations.

The ill-structured and multi-perspective nature of psychology has implications for the nature of psychology-specific SRA. First, in psychology often no close mapping exists between a specific theory and the studied phenomenon since there is not always consensus which theory best explains a specific psychological phenomenon. This lack of close mapping between theory and phenomenon emphasizes the role of SRA activities such as Drawing Conclusions. For example, to decide which theory can best explain a psychological phenomenon, one needs to decide between different psychological theories, hereby critically weighing theories against each other in terms of relevance, context, underlying assumptions, and scope (Harmat & Herbert, 2020). Second, in psychology multiple and incomplete answers are a reality. Therefore, the underlying argumentation of a specific theory choice or explanation plays a crucial role to the extent that a specific theory choice or explanation may or may not be better supported by arguments (Kuhn & Weinstock, 2000), and the argumentation includes or weighs alternatives. Third, the lack of conceptual clarity in psychology stresses the SRA activity Problem Identification. Problem Identification in psychology involves a great deal of conceptual clarification of both the phenomenon and the central concepts of the theories that try to explain the phenomenon.

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The need for research is twofold. First, psychology education may benefit from attention to SRA. Given the explicit goal of preparing students for further higher education and the disciplinary structure of most secondary school curricula, one of the central goals of education is the development of students' understanding and thinking skills within a discipline. SRA are such higher order thinking skills that (1) focus on the subject matter of a discipline and therefore can foster students' conceptual understanding, (2) draw students' attention to the nature of knowledge and knowing (the epistemology) in psychology, and (3) can help students to cope with the complexity and ill-defined structure of psychology because this requires a lot of reasoning from the side of the student (Klopp & Stark, 2022). The Flemish learning objectives for secondary psychology emphasize the importance of SRA at a very generic level (Departement Onderwijs en Vorming, n.d.). Students should be introduced to the specific features of psychology as a scientific discipline. Students should be able to explain psychological phenomena by means of theories, take a justified position, and use reflective skills in research.

Second, current SRA research focuses on domains like science (e.g. Kuhn & Lerman, 2021) and history education (e.g. van Boxtel & van Drie, 2018) and focuses on SRA as scientific discovery skills (see review of Engelman et al., 2016). As a result, these fields already have disciplinary frameworks for SRA with

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respect to the content and approaches of SRA in the curriculum and research on the effects of these approaches. No such framework exists for psychology. However, teaching SRA in this field can be epistemologically challenging and poses its own challenges for SRA. We found two studies on SRA in psychology, both at the university level. Klopp and Stark (2018) examined the development of declarative knowledge about scientific explanations of psychological phenomena and explanatory competence. They found that worked-out examples improved students' explanatory competence and that providing declarative knowledge about the scientific concept of explanation before giving the worked-out example, is effective. The results also indicate that paying attention to content knowledge about the psychological phenomenon results correct theory-evidence-coordination. In their 2020 study, Klopp and Stark examined students' scientific argumentation skills and found that presenting students examples with erroneous arguments was effective in fostering their argumentation skills. Dishon et al. (2024) focused on understanding psychological evidence and found that engaging students in tasks such as critiquing and redesigning flawed studies and interacting with diverse sources of evidence supported the development of SRA. Given the strong disciplinary dimension of SRA, there is a need for a more balanced understanding of (teaching) SRA across disciplines and for different purposes.

Therefore, the main objective of this study is to fill these gaps and to contribute to the development of a research-based disciplinary framework of SRA in the field of psychology by exploring and identifying underlying themes that shape how psychology teachers approach SRA in secondary education. The focus hereby is on SRA with the aim to construct, justify and critique explanations of core psychological phenomena using existing psychological theories. Specifically, the study addresses the following exploratory research question: What shapes the ways psychology teachers conceptualize and address teaching SRA in secondary psychology education?

3 Method

Context

This study is situated within the specific educational context of Flanders (Belgium). In Flanders, psychology is taught at the upper general education level (age 14-18) as part of a cluster subject with sociology and educational sciences. It is obligatory for students who follow a behavioral science track (*Humane wetenschappen, Maatschappij- en welzijnswetenschappen, Welzijnswetenschappen*). The overall aim is to introduce students to the features of each scientific discipline and prepare them for higher academic studies. This cluster subject has seven government-mandated learning outcomes, with

specific outcomes for each discipline (AHOVOKS, 2024): three for psychology, three for social sciences and one for educational sciences (Appendix A). These outcomes are described at a generic level, giving teachers considerable flexibility in selecting specific content and designing their own evaluations. Some teachers teach and assess psychology, educational sciences and social sciences separately, other teachers assess students' learning outcomes through a single comprehensive exam covering the entire cluster. Teachers are responsible for designing their own exams and there are no centralised national exams at secondary level. For additional information about the psychology curriculum in the Netherlands and internationally, readers are referred to Appendix B.

Participants

A convenience sample of 15 psychology teachers was recruited for this study. Teachers were recruited through social media channels and email outreach to all schools in Flanders offering psychology in general upper secondary education (comparable to the VWO level in the Netherlands). The sample included eleven women and four men, with teaching experience ranging from two to 27 years. Six teachers were employed in public schools, and nine in private schools.

Data collection

Ethical approval was obtained from the social and societal ethics committee (SMEC) of KU Leuven under the reference number (G-2021-3268). Focus groups were chosen because of the exploring nature of the study (Boeije, 2010; Savin-Baden & Major, 2013) and to facilitate group discussions among teachers (Gibbs, 2012; Kvale & Brinkmann, 2015). Focus groups allow participants to build on each other's ideas. This interactive and collective element is valuable for understanding and exploring which common issues stand out as central or as challenging in teaching SRA in psychology. The focus groups were randomly composed, with no specific characteristics applied. Each focus group was homogeneous in terms of school subject (i.e., psychology) and educational level (i.e., general upper secondary education). A total of three focus groups were conducted, two online synchronous (Stewart & Shamdasani, 2017) and one face-to-face. After completing the third focus group, we evaluated the richness and diversity of the discussions, the consistency of emerging themes, and the alignment of perspectives across focus groups. We concluded that similar themes and perspectives emerged, indicating thematic saturation (Chamez, 2015). Each focus group consisted of five teachers, lasted approximately two hours, and was facilitated by the same moderator. A small sample size was chosen for each focus group because of the desired depth of the conversation, the expected novelty of the topic, and to ensure a well-monitored online group discussion (Wilkinson, 2004). All focus groups were structured along four phases: introduction, key questions, end questions and closure. In the introduction,

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teachers were introduced to SRA by means of a sample SRA task. This SRA task was designed to elicit students' SRA skills:

Zita is 17 and studying behavioral sciences. For the second time this semester, she fails two exams. Despite these two failing marks, Zita perseveres and continues to study for her exams. Can you explain Zita's behavior from the perspective of motivational psychology?

Focus group's key questions were inspired by the format Content Representation (CoRe, Loughran et al. (2004; 2012), as translated into Dutch by Depaepe et al. (2014)). A CoRe depicts how teachers conceptualize the content of a particular subject matter in terms of big ideas (i.e., horizontal axis) linked to teachers' pedagogical content knowledge (i.e., vertical axis). The key questions of the focus groups were informed by the prompts on the vertical axis of the CoRe (see Appendix C for the key questions).

Data analysis

Inductive thematic analysis was used to identify and analyse key themes in the teaching of SRA and its underpinnings across the different focus groups (Braun & Clark, 2012; Wilkinson, 2004). A theme was described as "a shared meaning organized around a central concept" (Braun & Clarke, 2022, p. 76). We utilized NVIVO 1.7 for the analysis. The analysis was layered from the particular to the general (Creswell & Poth, 2018) and from the descriptive to the more interpretative. First, all focus groups were recorded and transcribed verbatim. Second, transcripts were organized into provisional semantic codes. To keep track of the context, broader fragments like a sentence or a short paragraph were identified. To avoid thinking directly in themes or themes being generated from a few vivid examples, the initial coding was comprehensive, stayed specific and fine-grained, with a considerable level of detail and as close to the data as possible or relevant (Braun & Clark, 2014; Herzog et al., 2019). Third, codes were constantly checked against each other, evaluated, and reviewed both within and across focus groups. Thoughts and reasons why codes were changed or deleted as well as emerging interrelationships were noted by the researcher throughout the process. Fourth, codes of the entire dataset were combined and contrasted into meaning-based descriptive themes and reviewed. Finally, the descriptive themes were subject to more extensive interpretations and conceptual analysis of the latent ideas underpinning them. The importance of a theme was dependent both on how substantive a theme appeared to be across the three focus groups and whether it deepened understanding in relation to the research questions (Patton, 2002). The trustworthiness of the themes was strengthened by continued discussions in the research team, by determining the limits of a theme, constructing themes around a clear core idea, and by ensuring that themes were rich and salient (Creswell & Poth, 2018).

4 Results

Based on the analysis and descriptive themes, three latent themes were constructed (Table 1).

Table 1

Latent themes related to teaching SRA in secondary psychology education

Theme	Description of theme
Theme 1	Teachers' curricular ambitions are related to the perceived relevance and feasibility of SRA.
Theme 2	Teachers' understanding of SRA relates to the reported difficulties and teaching approaches to cope with those difficulties.
Theme 3	Teachers' reported difficulties in assessing SRA reveal their epistemological beliefs about psychology as scientific discipline.

Theme 1. Teachers' curricular ambitions are related to the perceived relevance and feasibility of SRA

While teachers agree on the added value of attention to SRA in secondary psychology education, their overall curricular ambitions for psychology as a school subject determine whether attention to SRA is considered meaningful and feasible at upper secondary level.

Teachers see three possible benefits in paying attention to SRA in secondary psychology education. First, attention to SRA can stimulate students' learning process. For teachers, SRA may provide a deep understanding of psychological theories as well as the characteristics of the discipline. It can help students to realize that in psychology, there is often no single answer. Attention to SRA can encourage students to actual use psychological theories and make connections between topics, hereby preventing rote learning and isolated knowledge structures. And students learn to critically evaluate theories and arguments, both in school and (later) everyday life contexts. A second benefit is that attention to SRA in the curriculum can raise learning standards and thus the status of psychology as a school subject. Currently, subject psychology has a weaker "scientific" status than, for example, physics or mathematics. Third, attention to SRA may invite teachers to question and change their own teaching habits and their expectations of students.

While teachers agree on the value of SRA for students' learning, the subjects' status, and their own teaching practice, they disagree on the relevance and feasibility of SRA for secondary psychology education. A first position is held by teachers who indicate that current psychology teaching is – and should remain – focused on introducing students to the discipline. For these teachers, this means providing students with an overview of different psychological theories

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and their main features. This contrasts with the cognitive, metacognitive, and epistemological nature of SRA, and therefore SRA is seen as too high level for secondary education and belongs more in academic higher education. A second position is held by another group of teachers perceiving SRA as a paramount (if not the main) goal of psychology in secondary education and essential for pursuing higher studies. They see SRA as both a feasible and meaningful goal. A last group of teachers takes an intermediate position. While they agree that SRA is a challenge for secondary psychology students, they also argue that the level of SRA can be adapted to the target group, for example by not expecting “students to have a hundred percent mastery of a theory” (respondent 15). However, sometimes teachers suggest structuring the task in such a way that, according to the definition of SRA, it is questionable how much SRA is still involved, for example, by making it obvious to students which theory they should apply to explain a psychological phenomenon. Teachers in this intermediate position further argue that even if students do not reach the expected level, they will have learned because simply offering an SRA task will encourage students to think more deeply about the topics at hand.

To illustrate the first position, the following example (Table 2) shows teachers discussing the feasibility of the SRA activities Evaluating Evidence and Drawing Conclusions.

Table 2

Transcript of respondents 12, 13 and 14 in focus group 3

Respondent	Quote
Respondent 14	Yes. I understand that in some situations that's certainly possible, but whether that's what students are capable of and whether we can expect that, ... I think that I set the standards twice as high as my peers and I don't raise them that high. So, this, this is unfortunately impossible for my students.
Respondent 12	I have the same. In my opinion I set the standards high, and this seems not feasible to me. The reasoning yes, giving a preference yes. But working towards the most suitable answer, doesn't seem feasible to me.
Respondent 14	Yes.
Respondent 12	I really mean this with tons of respect for our field of study but just to be clear: We don't teach our students to master a whole psychological theory. We teach them what library of psychological theories exists and so we teach them to list and name the main features of those theories. But that is not the same as mastering a theory in its entirety. [...] They learn about the theory. And that's another level. And the level of your question and your goal with that question is about applying the real theory. It's about understanding the real theory and that's not what we're teaching them.
Respondent 13	Yes, I agree with that complexity. Where those theories are covered, that's still superficial. We must see so much in one year.

Theme 2. Teachers’ understanding of SRA relates to the reported difficulties and teaching approaches to cope with those difficulties

Teachers understand SRA as complex systematic thinking skills that require profound domain-specific knowledge, engagement in deep-level processing, and a meta-position. From this understanding, several difficulties emerge, such as students’ limited and fragmented domain-specific knowledge of psychological theories. In addition, teachers’ understanding of SRA leads them to adopt teaching approaches that address these difficulties.

First, teachers recognize the importance of domain-specific knowledge for SRA. For teachers, this means a deep understanding of “the core” (respondent 3) of a psychological theory. It also means that students construct an integrated knowledge structure in which each concept and theory is related to previously learned concepts and theories, and that the relationships between them are fully understood. Consequently, according to teachers, theories and concepts need to be learned in their interrelatedness and students need to integrate what they have learned over a longer period. Table 3 provides an excerpt from a discussion on this first aspect. Teachers acknowledge that such deep and integrated knowledge is not currently achieved in secondary psychology education and that its absence is a major challenge in teaching SRA, because and in contrast, students’ knowledge often resembles “separate drops and pieces” and students “don’t always see the connections” (respondent 3).

Table 3
Transcript of respondents 1, 2 and 3 in focus group 1

Respondent	Quote
Respondent 3	This ability [SRA] assumes the capacity to grasp the core of a theory and I think that doesn't always happen now.
Respondent 1	Currently, their knowledge consists of kind of loose pieces. So, they don't always see connections, I think. But this [SRA] assumes an understanding of the foundation, or the whole or framework of that theory.
Respondent 2	Yeah indeed, I think insight into the whole [of a theory] [...] and the links within the theory.
Respondent 3	I do expect that the current curriculum is too heavily loaded to spend enough time on this.
Respondent 2	But I don't know. If you apply that constantly, for every curriculum goal, well I'm not saying you have to do that all the time, but actually that shouldn't be an additional factor. I think that's something that should be automatically incorporated into your lessons.

Second, teachers in all focus groups observe a lack of deep level processing by their students. Teachers perceive students’ responses as superficial and find students “repeating verbatim what the teacher says” (respondent 1). Other examples include students merely listing theories rather than interconnecting

them; students relying on the same general concepts such as intrinsic and extrinsic motivation to explain very different psychological phenomena; students answering questions based solely on theory without analyzing and connecting it to a given case. These difficulties reveal teachers' understanding of SRA as skills that require a student to use higher-order thinking skills. Teachers' explanation of these difficulties is that students are not always willing to engage in deep cognitive processing. Instead, students rely on the teacher: "Often students want to know: what is the right answer, or what do you want to hear? This is completely contrary to SRA because they are not thinking, they just want to know what the teacher wants to hear" (respondent 13). At the same time, teachers point to the role of the teacher, stating that students do not engage with theories because "we never prepared them" (respondent 9), or "I still lecture too much and then suddenly expect them to integrate it" (respondent 1).

Third, teachers assume SRA involves systematic thinking. Therefore, they believe it is essential to make thinking processes explicit for students by making explicit connections between different psychological theories, providing step-by-step plans, and showing worked examples. Teachers particularly emphasize the benefits of step-by-step plans. At the same time, teachers point out a potential pitfall of such step-by-step plans. They can quickly take on a purely procedural function, which then encourages reproduction rather than SRA.

Fourth, teachers acknowledge that SRA requires a meta-position toward psychological theories, one's own knowledge claims and reasoning processes, and those of peers. For teachers, this meta-position makes SRA challenging for students. Currently, students do not critically question their own argumentation or that of their peers. Teachers identify two obstacles preventing students from adopting a meta-position: textbooks lacking critical discussion of theories and teachers presenting psychological theories without critical reflection or differentiation between scientific and non-scientific theories.

Fifth, teachers recognize SRA as complex "higher order skills" (respondent 8) that place high demands on the learning process, in part because of the domain-specific knowledge required and the meta-position assumed. Teachers therefore agree that SRA cannot be acquired overnight but needs sufficient time and space in the curriculum and hence a thoughtful integration in the curriculum. However, an overloaded curriculum that focuses mainly on content rather than reasoning, hampers these conditions.

Theme 3. Teachers' reported difficulties in assessing SRA reveal their epistemological beliefs about psychology as scientific discipline

Assessment of SRA was an important and much discussed topic in the various focus groups. Through these discussions, teachers' epistemological beliefs about psychology as a scientific discipline emerged.

First, teachers question the possibility of making evaluative judgements about the quality of students' SRA in psychology. This question arose particularly

for the SRA activity Drawing Conclusions. Teachers emphasize that in psychology there is often no single answer, that answers are always partial and nuanced, and that psychological phenomena can be approached from different perspectives: “I view behavioural sciences as not presenting the truth, but rather as providing frameworks. I emphasize this strongly to my students. So, these are all approaches, and my goal is to offer students as many of them as possible.” (respondent 11). For some teachers, this makes it difficult, and sometimes undesirable, to judge an answer as “wrong”: “On the other hand, psychology is so vague, and everything is relative. I can answer every question in all my exams with Maslow’s theory. [...] But who am I to say that’s not what I’m looking for?” (respondent 6). Across all focus groups, we see these beliefs reflected into a reported teaching practice in which teachers consistently emphasize different theoretical perspectives: “When discussing cognitive dissonance, I always link it to external attribution. Then I always connect it to operant conditioning. I try to do this consistently.” (respondent 4). This led many, though not all, teachers to resist the idea of asking students to draw a conclusion and make a choice of theory. Two examples to illustrate: “You could look at it from this theory, and that theory, and another theory. I am not sure that saying ‘this is the best theory now’ is always correct. I want to keep looking at things from those different perspectives” (respondent 5), and “I don’t want students to say ‘this is the best approach’, because that’s not what I expect. If they did, I would feel like I’ve failed in teaching what I want to teach them. I think answers in our subjects are often very nuanced.” (respondent 1).

Second, teachers struggle greatly with determining assessment criteria for SRA. The discussion about assessment criteria was particularly pronounced for the SRA activities Evaluating Evidence, Drawing Conclusions, and Communicating. In this discussion, teachers initially did not refer to the quality of the underlying arguments as possible quality indicator. In contrast, the discussion focused on the questions: What is a good answer? What is the best theory choice? Teachers hereby emphasized subjectivity and equivalence. Some teachers considered the choice of theory to be a “personal choice” (respondent 8), such as the theory students “feel most comfortable” (respondent 8) with, or just any theory, where the actual choice of theory is not considered important. Theories are also seen as equivalent by teachers, with some using the analogy of a “toolbox” (respondent 6), where the same problem can be solved with different tools that are equivalent to each other. No reference is made to criteria such as the appropriateness of the theoretical choice for the phenomena in question. This leaves teachers struggling with determining what constitutes a good answer that can be assessed. In the few cases where teachers do refer to the argumentation underlying a particular choice of theory, it seems sufficient that students give an argument, irrespective of the quality of the argumentation or what quality might mean.

Although the picture as outlined above was most prevailing, there was also a counter voice. One teacher explicitly refers to the appropriateness and usefulness of a theory as criteria and emphasizes the complementarity of theories in explaining psychological phenomena: “It may be that in this specific context, theory A is slightly better or will get us further. And that in another case theory B is better. But they must determine, in that particular context, which theory is going to take us the furthest.” (respondent 15).

Finally, according to the teachers, the difficulty in determining assessment criteria for SRA also relates to assessment reliability. Teachers state that when expected responses cannot be made explicit, when responses are subjective, two teachers cannot evaluate the same SRA task equally and reliably: “It could very well be that teacher x, y, z in another school will say: you give a seven, but to me it’s a six or an eight.” (respondent 6).

5 Conclusion and discussion

This study sought to explore and identify underlying themes that shape how psychology teachers approach SRA in secondary education. The study identified three major themes, which show that (1) teachers’ ambitions for psychology education, (2) teachers understanding of SRA, and (3) teachers’ epistemological beliefs help to understand the reported difficulties and how teachers relate to these difficulties. They are therefore fundamental in nature. Together, these themes highlight the importance of teachers if we are to promote and study SRA in secondary education (McNeill et al., 2016), and highlight the role of epistemology in both SRA and teaching SRA (Chinn et al., 2011). The epistemological dimension of SRA as a construct is not easily recognized by teachers, nor do teachers refer to epistemological criteria when discussing assessment criteria for SRA, making it difficult for teachers to see how to assess students’ SRA. The findings suggest that teachers’ epistemological beliefs about psychology as a scientific discipline may help to understand this difficulty.

The study specifically examined teaching SRA in secondary psychology education to broaden the research on SRA across disciplines. Following Hetmanek et al. (2018), we clearly described what constitutes a discipline in this study (i.e., the scientific discipline of psychology) and describe its main characteristics. By doing so, we hope to facilitate research on SRA within and across disciplines. We do not claim that our findings are exclusively relevant to psychology. Rather, we argue that the insights gained from our study can serve as valuable starting point for identifying common challenges and opportunities for further studies and give rise to testable hypothesis for further research on SRA in psychology education.

Several methodological issues need to be considered when interpreting the results. First, the findings are from a small, voluntary sample of 15 teachers, so conclusions must be drawn cautiously and require validation in further studies. Second, interpretive themes were not reviewed by participants due to the focus on patterns across focus groups and the complexity of latent themes. Notwithstanding these issues, the study offers insights and implications for further research on teaching SRA in secondary psychology education.

A first insight concerns teachers' curricular ambition. This study reveals a generally agreed-upon portrait of the current teaching practice in secondary psychology education that prioritizes introductory learning and content coverage over advanced knowledge acquisition and reasoning. This picture aligns with research in other domains (e.g. Li et al., 2006). Introductory learning introduces students to a particular discipline, emphasizing broad content coverage, without too much emphasis on profound conceptual understanding and reasoning; often drawing on the idea that proficiency is for later (Feltovich et al., 1992). The study shows that for some teachers this situation matches their ambitions. The results suggests that teachers' focus on introductory learning is associated with low perceived relevance and feasibility of SRA at the level of secondary psychology education, posing challenges for SRA teaching. First, SRA as such presupposes a focus on advanced knowledge acquisition. Second, learning within a complex, ill-structured domain such as psychology requires advanced knowledge and strategies to cope with this complexity (Klopp & Stark, 2022). Third, teachers may fail to implement SRA in their teaching practice, even if they would be open to it, because of their ambition to cover ample content (Sengul et al., 2020).

A second insight concerns psychology teachers' understanding of SRA. For teachers to be able to implement SRA related pedagogical practices, they need to understand the nature of SRA (McNeill et al., 2016). In our study teachers have a realistic idea of what SRA is. They see SRA as complex and systematic higher order thinking skills, requiring a meta-position toward psychological theories, one's own reasoning processes and knowledge claims, and those of peers (Fischer et al., 2014; Zimmerman & Klahr, 2018). Teachers also agree that SRA require deep domain-specific knowledge of psychological theories (Osborne, 2018), and that this knowledge should be connected and interconnected. Nevertheless, the study also identifies that the epistemological dimension of SRA and SRA as an epistemological activity did not surface in teachers' discussions. Teachers do not report, for example, the need for students' and teachers' epistemic knowledge about the criteria and practices in psychology to evaluate or justify a particular knowledge claim. The absence of any reference to the epistemological dimension of SRA suggests that teachers do not spontaneously recognize SRA as an epistemological activity. Rather, they interpret SRA within the framework of their existing teaching practices and knowledge.

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Third, teachers struggle with the assessment of SRA, especially with determining the assessment criteria. Teachers' epistemological beliefs about psychology as a scientific discipline may explain these difficulties. Epistemological beliefs can be defined as beliefs about the nature of knowledge and knowing within a particular scientific discipline (Hofer, 2000). It is generally reported that they develop from more naïve to more sophisticated beliefs (Kuhn & Weinstock, 2002), although there is no agreement on what is meant by sophisticated and this development is not assumed to be a linear process (Bromme et al., 2008). The relationship between teachers' epistemological beliefs and their teaching, in which assessment is central, is widely acknowledged (Buehl & Alexander, 2006; Buehl & Fives, 2009; 2016; Hofer & Pintrich, 1997; Brownlee et al., 2017; Maggioni & Parkinson, 2008). In this study, teachers' epistemological beliefs can best be characterized as a multiplist-relativist position (Kuhn et al., 2000), as they emphasize the subjective nature of knowledge and were less inclined to view psychological knowledge as evaluable judgments. Teachers noted that the choice of theory is not particularly relevant; students can select a theory they "feel most comfortable with" or one of "personal choice" (respondent 8). This interpretation is further supported by teachers' discussions of their current teaching practices, which were consistent across all focus groups. The picture that emerged was that of a teaching practice in which teachers repeatedly emphasize different perspectives and possible answers, without highlighting providing criteria to weigh and choose between these different them. As a result, psychology teachers find it difficult, and sometimes impossible, to evaluate competing claims and determine assessment criteria. After all, making judgments involves the implicit or explicit application of criteria (Carless & Boud, 2018), and in the case of SRA, these criteria are epistemological. For instance, if teachers view the choice of motivational theory as a personal, subjective decision, it is understandable that they may find it challenging or even impossible to assess such choices and identify appropriate criteria. In contrast, if psychological knowledge is seen as a constructive discipline, with more or less established criteria for evaluating arguments and judgements, teachers may find it easier to assess their students' theory choices by applying these evaluative standards or criteria. The study suggests that with more evaluative epistemological beliefs, psychology teachers might experience less problems in assessing students' SRA. Harmat and Herbert (2020) go further, stating that "comprehension of psychology goes through an evaluative epistemological perspective, namely, that psychological findings must be critically reflected, weighed against each other, and evaluated or justified in terms of context and situation" (p. 4). Future research could empirically validate and examine the nature of teachers' epistemological beliefs and their impact on creating assessment criteria for SRA in secondary psychology education. Since teachers' epistemological beliefs and their ability to define assessment criteria were most

challenged by the SRA activity of Drawing Conclusions, research may focus on assessing SRA tasks in which students have to select and justify the most appropriate theoretical explanation for a particular psychological phenomenon. A logical next step would then be to investigate how to effectively support psychology teachers in constructing assessment criteria for SRA. This support may involve influencing teachers' epistemological beliefs and/or providing scaffolds such as prompted assessment criteria.

This study aimed to gain insight into the challenges of teaching SRA in secondary psychology education and showed that there are more fundamental factors at play if we are to gain an in-depth understanding of the difficulties teachers have in teaching SRA. These factors are epistemological and tap directly into the heart of SRA and the heart of psychology. Results suggest that teachers' multiplist-relativist epistemological beliefs may be a crucial factor in understanding teachers' difficulties in constructing assessment criteria for SRA in psychology.

Statements and Declarations

This study was not preregistered. Anonymized data are available upon request. More detailed information on the descriptive coding scheme can be found in Appendix D.

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Appendix A

Curriculum objectives for the cluster subject Humane wetenschappen

Discipline	Curriculum objectives
Psychology	Students analyse the developmental psychological domains within different life-course stages using developmental psychological theories: physical development: (senso)motor development; cognitive development: from sensorimotor to formal operational thinking; moral development; socio-emotional development: attachment development, identity formation.
	Students analyse personality using personality theories.
	Students analyse social behaviour using social psychological theories.
Educational sciences	Students explain the influence of protective and risk factors on parenting situations at micro, meso and macro levels.
	Students analyse parenting situations using pedagogical models with attention to protective and risk factors at micro, meso and macro levels.
Sociology	Students explain the interrelationship between the legislative, judicial and executive branches of government.
	Students explain how, in a democratic constitutional state, they can participate as citizens and take part in political decision-making through representation.
	Students analyse political institutions and their functioning including interactions between the local, national and supranational levels.

Appendix B

Psychology curriculum in the Netherlands and internationally

Internationally, psychology is part of the general secondary school curriculum in a variety of ways. It exists in the form of psychological topics included in other subjects, psychology as part of a cluster subject, and psychology as a stand-alone subject. Psychology may be a compulsory subject or an elective course. Psychology is not usually a compulsory subject in the general standard curriculum, as is the case with history and mathematics. Finland and Serbia are exceptions. If it is a compulsory subject, it is usually the compulsory main subject within a study track that prepares students for higher university studies in the field.

In the Netherlands, as in Belgium (Walloon region), Cyprus and France, psychology is not taught in general secondary education. In the Netherlands, subjects such as social studies (*Maatschappijleer*) and social sciences (*Maatschappijwetenschappen*) are taught at the level of general upper secondary education (VWO). The content of social studies is closely linked to citizenship education and includes content such as law, parliamentary

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democracy, the welfare state and a pluralistic society. Social sciences aims to help students to analyse current social issues and reflect on possible solutions. The scientific disciplines central to social sciences are sociology and political science, and consequently the key concepts in social sciences come from these fields, such as (College voor Toetsen en Examens, 2022, p. 52). The concept of identity overlaps with psychology, but is approached from a sociological perspective. The cluster of which psychology is a part in Flanders also consists of the discipline of sociology, but also of the disciplines of psychology and pedagogical sciences, while explicitly maintaining the uniqueness of each discipline (Katholiek Onderwijs Vlaanderen, 2024).

In Europe and beyond, psychology is offered at general secondary level in several countries, including Belgium (Flanders), DR Congo, the Czech Republic, Denmark, England, Finland, Iceland, India, Italy, Norway, Scotland, Serbia, Switzerland (Canton of Zurich), Slovakia, Sweden, and the US (Sokolová & Williamson, 2020).

The subject can be offered as a single subject (e.g. DR Congo, Finland, India, Slovakia, the United Kingdom, Norway, Sweden and the US) or as part of a cluster subject (e.g. Belgium (Flemish Region), Italy) . Psychology can be either compulsory or optional, but is often not a standard part of the curriculum like history or mathematics. Finland and Serbia are exceptions, where psychology is compulsory. Subject content and depth vary from country to country, as do teaching methods and teacher qualifications.

Appendix C

Overview core questions of focus groups

Core question	Concrete core question
Question 1	Are there any specific difficulties related to this SRA task?
Question 2	How do you support students in these difficulties?
Question 3	What benefits or opportunities do such tasks bring to the learning process?
Question 4	To what extent does the SRA task correspond to what can be expected from students of this target group?

Appendix D

Descriptive themes related to teaching SRA in psychology

Theme	Description of theme
Theme 1	SRA development needs time and continuous practice to develop.
Theme 2	SRA development needs modeling and being explicit about the steps to be taken.
Theme 3	The development of SRA requires deep and highly connected domain-specific knowledge.
Theme 4	The development of SRA requires a meta-level awareness.
Theme 5	SRA development requires students to be actively engaged with the subject-matter.
Theme 6	Evaluating SRA is a challenge.

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Exploring the teaching of scientific reasoning and argumentation in secondary psychology education:

The central role of epistemology

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Samenvatting

Onderwijzen van wetenschappelijk redeneren en argumenteren in psychologieonderwijs: De centrale rol van epistemologie

Wetenschappelijk redeneren is een complexe denkvaardigheid die leerlingen in staat stelt om kennis te evalueren, te genereren en te hanteren om zowel wetenschappelijke als maatschappelijke uitdagingen te begrijpen en op te lossen. In tegenstelling tot de natuurwetenschappen en geschiedenis, is wetenschappelijk redeneren binnen psychologie onderbelicht. Dit is problematisch omdat wetenschappelijk redeneren sterk discipline-specifiek is en leerlingen kan helpen om te gaan met de uitdagingen van psychologie als complexe en niet-paradigmatische discipline. Het doel van deze verkennende studie is het identificeren van kernthema's die het onderwijzen van wetenschappelijk redeneren binnen psychologieonderwijs vormgeven. Vijftien leraren uit het secundair onderwijs namen hierbij deel aan drie focusgroepen. Een inductieve thematische analyse identificeerde drie latente thema's, die tonen dat (1) de ambities van leraren voor psychologieonderwijs, (2) de manieren waarop leraren wetenschappelijk redeneren begrijpen en (3) de epistemologische opvattingen van leraren, helpen om de gerapporteerde moeilijkheden bij het onderwijzen van wetenschappelijk redeneren binnen psychologie te begrijpen. Deze moeilijkheden betreffen voornamelijk de epistemologische dimensie van wetenschappelijk redeneren wat onder meer tot uiting kwam in de moeite die leraren hadden met het evalueren van wetenschappelijk redeneren binnen psychologie.

Kernwoorden wetenschappelijk redeneren, vakdidactisch onderzoek, psychologie onderwijs, secundair onderwijs, epistemologische opvattingen

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