Research Article

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Analysing and developing linguistically responsive tasks within the frame-work of the cross-disciplinary Erasmus+ project sensiMINT

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Abstract: Scientific literacy is required to judge and act in an informed and responsible manner. Science education strives to enable learners to become scientific literate. To achieve this, there are science-specific and linguistic challenges to overcome. When teaching and learning chemistry, it is important to be aware that language varies according to the discourse topic, the relationship between the interlocutors, and the medium of communication. In the context of chemistry education, students are meant to learn how to extract information from subject-specific text-types such as lab reports, diagrams, etc., and to produce them autonomously. To do so, understanding and applying the conventions of academic language and the subject-specific scientific registers is necessary. To deal with these challenges, the Erasmus+ project sensiMINT was initiated to support both teachers and learners. In cross-disciplinary communities of practice, linguistically responsive tasks are analysed, developed, and refined. The paper presents the theoretical background and introduces genre charts of different chemistry-specific text-types as constructed by the sensiMINT experts. The application of the genre charts for understanding and producing chemistry-specific text-types is demonstrated with concrete examples.

Keywords: genre charts; language in chemistry learning; linguistically responsive tasks; subject-specific text-types

1 Introduction and outline

One central goal of science education in secondary school is to enable future citizens to develop informed views and positions as a prerequisite to making responsible judgements and decisions in the context of science-related topics (Bybee & McCrae, 2011). To be able to do so, students have to learn scientific concepts as well as scientific procedures, and relate this knowledge to different contexts – everyday or discipline-specific (Lederman, 2006). The basis for this is the ability to read, understand and critically reflect scientific information and argumentation. Taber, for example, highlights that since the work of Piaget the "*link between language and (at least some forms of) thinking is well established*". He elaborates that "*language does not only support communication with others but is also a core thinking tool we use internally*" (Taber, 2015, p. 196). Science lessons are meant to facilitate this learning with the aim of developing a scientific literacy. Scientific literacy is defined as "the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen" (OECD, 2017, p. 15). According to Markic et al. (2013, p. 129), *"[o]ne cannot be scientifically literate (i.e. being able to use, understand and explain main ideas of*

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science or participate in social debate about a science related issue, e.g. climate change) without understanding and being able to use language in a science-related context adequately". To put it differently, both content knowledge and linguistic skills must be fostered in the science classroom so that learners may leave their schools as reflective citizens, and with a willingness and ability to deal with scientific and socio-scientific issues.[1]

One example of why linguistic skills and scientific literacy go hand in hand is the development of mental concepts (*signifieds*) in connection with sound patterns (*signifiers*) (Barkowski & Krumm, 2010). In his Course in General Linguistics, de Saussure (1916) postulated that a linguistic sign consists of two parts, the concept and the sound pattern, or sound-image. This connected is presumed to be arbitrary. In the natural sciences, such a linguistic sign may become more difficult and complex, however, as terms that have a particular meaning in everyday language may have a different underlying concept in subject-specific terminology. In other words, one sound pattern refers to different concepts (cf. Figure 1). In the given example, the sound pattern "citric acid" refers to sour lemon juice, crystalline citric acid, and visualisations of a citric acid molecule, making it a homonym.

Another point is, that for teaching concepts that cannot be directly experienced by learners, e.g. acid, reaction, oxidation, halogen, … , it is not sufficient to show students a phenomenon hoping they will form the intended concept independently (Taber, 2015). The forming of those abstract concepts is a process mediated – among others – through language. Overall, becoming scientifically literate can hardly be achieved without linguistic competences (e.g. Gogolin, 2015; Liu & Taber, 2016; Markic et al., 2013; Markic & Childs, 2016; Mönch & Markic, 2022; Suchań & Breit, 2016; Taber, 2015). This is particularly important in a world where a lot of science-related "information" is disseminated via social media, sometimes in a manner that is not technically correct or even manipulative. Therefore, as part of citizenship education, it is necessary that students are able to understand scientific concepts as well as scientific procedures, and relate this knowledge to different – everyday or discipline-specific – contexts. To summarise, students must aim to become scientifically literate.

But scientific literacy alone is not enough to deal with the flood of partially misleading information in social media and to recognise scientifically sound information. Learners and citizens need to develop a critical scientific (media) literacy. This should be part of citizenship education in modern societies and can be reached by merging scientific literacy and media literacy in school science (e.g. Belova & Krause, 2023; Chang Rundgren & Rundgren, 2014; Hobbs, R. & Jensen, A. 2009; UNESCO, 2021). Building up such a critical scientific (media) literacy is entirely in line with the UN's fourth sustainable development goal: "*Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*" (United Nations, 2015). Therefore, science education has to focus on both content and language learning. In other words, "*[l]earning science does not only involve new concepts,*

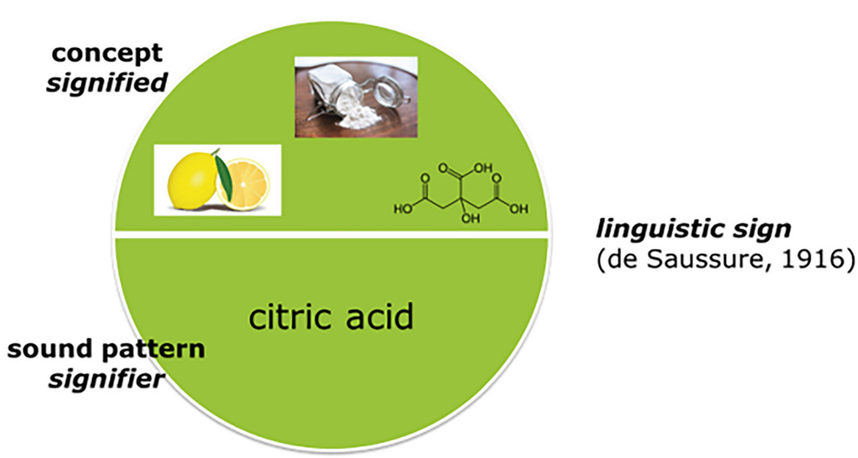


Figure 1: Different meanings of the term "citric acid" depending on the context.

1 Erasmus+ Projekt sensiMINT: Sprachsensibler Biologie-und Chemieunterricht – Kontext und Materialien Interdisziplinär reflektiert [Linguistically responsive Biologie and Chemistry lessons – Context and Materials reflected], 2020-1-AT01-KA201-078144.

explanations and arguments, but also new ways of making meaning and of interacting with others using these concepts, explanations and arguments. Learning science thus involves a new way of perceiving, analysing and communicating" (Vollmer, 2010, p. 5).

Chemistry teachers, as "interpreters" and "linguistic guides" (Laszlo, 2013; Mönch & Markic, 2022), should offer an environment in which these skills and abilities are developed. However, chemistry teachers alone oftentimes cannot master this complex task of fostering both linguistic skills and scientific literacy amongst their students alone. The prerequisite for doing so would mean possessing expertise in both areas which is seldom the case. Here, projects such as the one introduced in this article come into play.

This paper aims at introducing concrete examples to show how relevant the development and implementation of linguistically responsive lesson plans and materials are for chemistry teaching that aims to further scientific literacy for all learners. Linguistic and conceptual challenges in using, understanding and producing chemistry-specific text-types are first introduced and then the genre charts developed in the Erasmus + project sensiMINT as well as their application are presented.

2 Subject learning is language learning

It is a fact that almost every subject – including chemistry – is taught linguistically. As a result, it is particularly difficult to grasp and communicate a matter without adequate language skills and competences. In other words, as the Language Policy Division of the Council of Europe states, "*to benefit fully from the* [science] *curriculum and to participate in situations with a science dimension outside of school*", language competences are a prerequisite (Vollmer, 2010, p. 5). Therefore, subject-specific teaching must also include language education, which is about more than the balance between everyday and subject-specific language. To put it differently, "*the acquisition of a genuine linguistic ability to act (in the subject context) is considered one of the overarching goals of subject-specific teaching*" (Butler & Goschler, 2019, p. V, translated). Consequently, chemistry teachers are jointly responsible for the development of subject knowledge and a systematic development of linguistic competences, like how to read or produce subject-specific text-types, how to identify a hypothesis as a hypothesis, facts as facts, evidence as evidence, how to negotiate and critically reflect scientific aspects in the classroom and in everyday life, etc. To do so the Language Policy Division of the Council of Europe defines four competences which all involve communication and language:

"The ability to

(1) bring out and formulate one's own conceptions, representations and existing knowledge
(2) retrieve, read and interpret scientific information,
(3) examine, discuss and negotiate information and arguments critically,
(4) make deliberate/considerate decisions and communicate/disseminate their own points of view" (Vollmer, 2010, p. 8).

In other words, learners need to be able to acquire subject-specific reading, listening, speaking and writing skills in order to be considered scientifically literate. This includes using language "*to enquire, reason, and consider information together, to share and negotiate […] ideas, and to make joint decisions*" (Mercer et al., 2004, p. 362).

3 Chemistry-specific linguistic challenges

Chemistry as a scientific discipline deals with substances, their properties and the associated chemical reactions. In order to present their findings, chemists use their own technical language, Chemish, which is made up of quite different representational forms (Markic & Childs, 2016; Mönch & Markic, 2022; Parchmann & Bernholt, 2013). Depending on the audience and the aim, chemists present their research in different modes and text-types, such as charts and reports, lab reports, or conference presentations. Also, newspapers, advertising, movies, comics, blogs, etc. use technical language with different objectives. To decode the respective message, one must be familiar with the special features of the chemistry-specific language, or Chemish. Therefore, readers must also be familiar with the structure and properties of the respective text-type to understand and interpret such a text with ease.

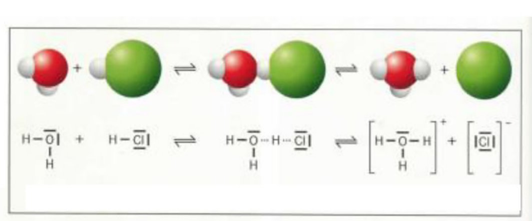
In the following, we want to shed light on chemistry-specific linguistic challenges in the context of the different text-types used in chemistry so as to underline the necessity for learners to acquire subject-specific language skills and, thus, become more scientifically literate Tasks in chemistry textbooks often ask learners to describe processes precisely, both in written and oral texts. In doing so, learners face a variety of challenges, as can be seen in the following example (Figure 1). The task was taken from a chemistry textbook for second year chemistry learners and given to students ($N = 75$) in schools in Germany, Austria and Switzerland with the request to describe the chemical reaction outlined in the figure, using given technical terms. The lower part of Figure 2 shows a typical student response.

This student's answer mirrors the interconnectedness of linguistic and chemical aspects. The first problem is that an inadequate designation is used. The reason for this is to be found in sloppy laboratory jargon. In laboratory jargon, hydrochloric acid often is incorrectly abbreviated as HCl. HCl stands for a hydrogen chloride molecule or hydrogen chloride gas which is not identical with hydrochloric acid (muriatic acid). Hydrochloric acid is formed by the reaction of hydrogen chloride gas with water. It is a solution that contains chloride ions, oxonium ions and water molecules.

The second problem points to a confusion of the macroscopic and submicroscopic levels of the Johnstone triangle (Johnstone, 2000; Reid, 2021; Taber, 2015). In the sentence "*In this donor-acceptor reaction, water is the base*", the term "water" refers to the substance/macroscopic level, whereas the term "base" refers to the particle/submicroscopic level. At this point it is important to point out that in school chemistry the acid-base concept according to Brønsted-Lowry should be used to avoid learner confusion (i.a. De Jong et al., 2013; Hawkes, 1992; Lembens, 2017; Lembens & Becker, 2017). In addition, teaching more than one acid-base concept, e.g. teaching both the Brønsted-Lowry and the Arrhenius concept, may lead to model confusion and the development of hybrid models in learner's heads (Carr, 1984; Justi & Gilbert, 1999, 2000; Kousathana et al., 2005). The acid-base concept according to Brønsted-Lowry defines acids as particles that can donate protons and bases as particles that can accept protons (Brønsted, 1923; Lowry, 1923). According to this definition, the macroscopic and submicroscopic level are confused in this sentence. An appropriate formulation would be: "…, the water molecule is the base" or "the water molecule acts/reacts as the base". The underlying chemical concepts can neither be understood nor communicated without a clear and technically correct language. In particular, the clear separation of the levels of the Johnstone Triangle requires a very careful and consistent use of language. For this reason, it is important to raise awareness among chemistry teachers to ensure linguistic and conceptual clarity in the classroom (Lembens et al. 2019) and to enable teachers to teach in a linguistically responsive way.

The cause of these technical and linguistic confusions lies, on the one hand, in a mixture of everyday and technical language and an unreflective laboratory jargon used by chemistry teachers (Barke & Büchter, 2018).

Task:
Write a text for Fig.1 that describes the processes in detail. Use the technical terms proton donor, proton acceptor, protolysis, donor-acceptor reaction.



Seitz, H. & Spichtinger, R. (2007). Galvani 2 Chemie, Ausgabe B, BSV-Verlag, München, p. 106

incorrect term

Student's text:
Hydrochloric acid (HCl) is a proton donor. This means that it donates a proton to the base, which is the proton acceptor. In this donor-acceptor reaction, water is the base.

confusion: substance / particle

Figure 2: Task taken from the textbook "Galvani 2 Chemie" and student's response. Problematic formulations are highlighted. (Translated by the authors)

On the other hand, the teachers often do not clearly and unambiguously address whether an explanation refers to the macroscopic (phenomenon) level or the submicroscopic (particle) level. Another linguistic challenge is that many technical terms have developed historically and have undergone a change of meaning in the course of scientific history (Drechsler & Schmidt, 2005; Krebs & Hofer, 2022). If this is not explicitly addressed, inappropriate ideas (misconceptions) can become entrenched in learners' minds (Kousathana et al., 2005). Furthermore, when students cannot express themselves clearly in language, it is difficult to judge whether there is faulty understanding or whether terms and representations are being used incorrectly.

4 Language in chemistry teaching and learning

Language varies according to the discourse topic (the *field*), the relationship between the interlocutors and style of communication (the *tenor*), and the medium of communication (the *mode*). In other words, the language used in communication changes depending on the topic of communication, the level of familiarity between those involved in the conversation and whether the conversation takes place in a spoken or written format. Variation is not random; each so-called register has its own norms (Barkowski & Krumm, 2010; Halliday, 1975; Halliday & Hasan, 1985). Such registers are for instance: everyday language, academic language, subject-specific language. Everyday language relies on the context it is employed in so as to convey meaning. Therefore, everyday language may also be referred to as a "here-and-now-language" interlocutors use to actively negotiate meaning in face-to-face settings. The language of schooling is defined as the register with which knowledge is acquired in educational contexts. It is fundamentally different from learners' everyday language. By contrast, communication in academic language does not take place in a shared reality which means that linguistic messages must be elaborated precisely and explicitly. Therefore, context-reduced academic language and domain-specific language demand more abstract and explicit expressions to do so.

Acquiring any language, including the first, means learning to use language not just for social and informal purposes but understanding and applying the conventions of more and more formal registers (Barkowski & Krumm, 2010; Harley, 2014). In the context of chemistry education, this translates to acquiring proficiency in academic language, the subject-specific scientific register including technical terms, symbols, formulas, and reaction equations that are valid worldwide and thus allow international communication. This technical language is based on rules and conventions that have developed and proven useful in the course of scientific history, resulting from the claim to be technically correct. However, for subject teaching and learning, and for communication between experts and laypersons, the technical language must be decoded. This is challenging because – apart from a multitude of technical terms – typical constructions and design features of sentence structure as well as linguistic style (e.g. impersonal neutral style, passive form, nominalisations, composita – especially in German language) make the technical language difficult to understand and to produce. Figure 3 illustrates this by showing different registers and style shifting occurring in the chemistry classroom.

Whereas the student on the left uses everyday language in a highly context-reliant and reduced manner, the textbook offers condensed information in a chemistry-specific and formal language. In order to be considered scientifically literate, it is necessary to undergo this register acquisition to be able to both employ everyday language as well as academic and subject-specific language intertwined with learning about chemistry and chemical topics.

In addition, connecting subject-specific mental concepts with sound patterns that are oftentimes already associated with everyday concepts (cf. "citric acid") is another special challenge in chemistry learning. The problematic that emerges due to homonymy and the like is exacerbated due to the nature of chemistry and the Johnstone Triangle: The causes of the phenomena we perceive at the macroscopic level are rooted in the interaction of particles at the submicroscopic level (Taber, 2015). In order to grasp this, we have to form ideas – mental concepts – about the nature and properties of these particles. These mental concepts have to be put into language in order to make them communicable, explainable and understandable. However, the terms used to describe particles may be homonyms in that they refer both to a substance and a particle (e.g. "acid", albeit in different language varieties) or difficult technical terms that students need to learn and grasp before being able to

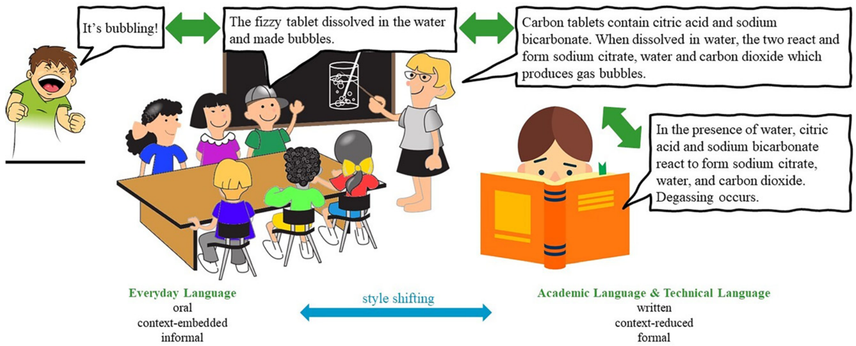


Figure 3: Register acquisition and style shifting in the chemistry classroom.

fully understand the underlying concept. Therefore, the task for linguistically responsive chemistry teaching is not only to introduce different forms of representation and their function, but also to pay more attention to the "translation" between different representations and to explain the limits of the reciprocal relationships between form and function (Parchmann & Bernholt, 2013, p. 246).

Learning subject content and language conventions at the same time is often a hurdle that can be alleviated by separating (not avoiding!) both requirements (Parchmann & Bernholt, 2013, p. 249). In order to counteract the danger of a cognitive overload for the learners, it is necessary to determine beforehand when planning learning opportunities whether the focus should be on language learning or subject-specific conceptual learning. Here it is useful to first introduce and practise the necessary technical terms and phrases before, for example, describing and interpreting the graph of a boiling curve.

On the way from everyday language to learners' subject-specific knowledge acquisition, mastering the language of schooling is a crucial factor (Gogolin & Duarte, 2016). Since lessons and teaching materials draw on academic language, learning of subject content is always associated with linguistic challenges (Jahnke-Klein & Busse, 2019). The features of academic language can be challenging for learners whose linguistic competences are not yet sufficiently developed. Connections have been shown between the mastery of the language of schooling and subject learning in mathematics for both multilingual and monolingual students from underserved communities (Neugebauer & Prediger, 2023). Conversely, the "*conceptual understanding of mathematics of students with limited academic language often lags behind that of more language proficient peers*" (Neugebauer & Prediger, 2023, p. 813). There is no reason to assume that this is any different for chemistry learning. The question is what characteristics materials and teaching must have so that all learners, regardless of their linguistic competence, can learn subject content and simultaneously become proficient in academic and subject-specific language.

Based on a literature review, Erath et al. (2021) have identified four main design principles for curriculum resources that can "enable all students (nowithstanding their language proficiency) to exploit the provided learning opportunities" (Neugebauer & Prediger, 2023, p. 814). These principles are:

(1) "engaging students in rich discourse practices and supporting their participation,
(2) connecting language registers and multimodal representations,
(3) using macro-scaffolding to sequence and combine language and mathematics learning opportunities, and
(4) comparing and contrasting language aspects (form, function, etc.) to raise students' language awareness" (ibid).

In order to be able to plan, design, implement and evaluate learning opportunities that correspond to these principles, chemistry teachers would have to be trained linguists as well as language teachers at the same time. On this subject, Parchmann and Bernholt stated 10 years ago that, despite the fact that students' linguistics-and content-related learning challenges have been researched extensively, little has changed in the culture of teaching or learning subject language and subject-related communication patterns in chemistry lessons (Parchmann & Bernholt, 2013, p. 250). This seems to be true today still. The reasons for this could be that, on the one hand, chemistry teachers do not have the necessary knowledge and competences (e.g. Mönch & Markic, 2022) and, on the other hand, there are not enough high-quality materials available for linguistically responsive chemistry teaching. The Erasmus+ project sensiMINT contributes to closing this gap by developing material for chemistry teaching and by offering further education opportunities for chemistry teachers.

5 Cross-disciplinary approaches and co-construction

Mastering the technical language of chemistry not only implies knowing which vocabulary and which grammatical structures are appropriate in a given context, but also how knowledge is organised in recurring, domain-specific text-types. Thus, systematically developing students' academic language skills and repertoires of subject-specific genres (e.g. lab reports, diagram descriptions, etc.) deserve a central role in chemistry education. However, chemistry teachers themselves are often overwhelmed by the dual demand of language and subject to achieve this goal (Riebling, 2013). The knowledge and competences needed to both teach a subject such as chemistry and identify language challenges, and offer a broad repertoire of scaffolding for the learners (Buxton & Caswell, 2020) is seldom found in the same person. Consequently, "*cooperation between language experts and STEM experts is required to develop practical and empirically tested materials and methods for a linguistically responsive STEM instruction*" (Gogolin, 2012, p. 164; translation by M. Steger). As such an approach is deemed impossible for teachers in addition to a regular school day, the Erasmus+ project sensiMINT was initiated in order to make a substantial contribution to filling this gap (Dörrer et al., 2022; Lembens et al., 2022). In the course of the project, experts in science and language education convene with science and language teachers in cross-disciplinary communities of practice (Straub & Waschewski, 2019; Wenger-Trayner & Wenger-Trayner, 2015). Using an adapted action-research design (Eilks & Ralle, 2002), the cross-disciplinary team adapts, enhances and co-constructs linguistically responsive lesson plans, including materials, and makes them available via the project website (https://www.sensimint.eu/).

6 The sensiMINT genre charts

In chemistry lessons, a limited number of typical text-types are used, which learners are expected to understand in order to extract information from them, or produce themselves in order to present and communicate findings. Therefore, one particular focus of the project are subject-specific text-types pivotal in chemistry classrooms (Beese et al., 2017; Michalak & Müller, 2017) used in academic contexts, their functions are reflected in characteristic language patterns. These text-types can be roughly divided into continuous (graph descriptions, reports, etc.) and discontinuous (diagrams, tables, etc.) texts (Beese et al., 2017; Michalak & Müller, 2017; Ulrich & Michalak, 2019). Typical text-types in chemistry lessons are: Experimental instructions and protocols, graphs, tables, flow diagrams, representations of models and devices, fact sheets, etc. Each text-type has a typical structure that is due to its specific purpose. In addition, each type is characterised by a specific vocabulary with typical formulations as well as typical grammatical and stylistic features. In order to be able to extract specific information from these text-types or to produce it oneself, a familiarity with these linguistic features is necessary.

To support teachers and learners to adequately understand or produce subject-specific text-types such as lab reports or diagram descriptions, sensiMINT experts construct genre charts that not only outline the specific scientific cognitive-linguistic processes employed (describing, hypothesising, analysing, evaluating, etc., see Table 1), but also exemplify the corresponding linguistic surface structures. They provide language support, so-called scaffolds, which can help students gradually form a more complex and nuanced understanding of the subject matter and, ultimately, become more scientifically literate.

The genre charts are divided into four levels: 1. meta-information, 2. content, 3. contexts and 4. reflection. In the form of a table, concrete questions are assigned to each level to guide the reception or production of the respective text-type (Beese et al., 2017; Michalak & Müller, 2017). In addition, relevant descriptors are named which are helpful for verbalisation. Overall, the systematic development of academic language skills and the necessary repertoire of language patterns and words supports subject-specific learning and therefore deserves a central role in chemistry teaching. The lesson plans and materials developed in the Erasmus+ project sensiMINT

Table 1: Exemplary genre chart for a laboratory report outlining the specific scientific cognitive-linguistic processes employed in the text-type.

	Text part	Questions	Descriptors
Level 1: meta-information	Headline/Title	What is the topic of the experiment?	*to state*
	Date	When is the experiment conducted?	
	Place	Where is it conducted?	
	Name(s)	Who authors the report?	
Level 2: content	Research question	Which question is being investigated?	*to state*
	Hypothesis	Which hypotheses can be drawn based on existing knowledge and theories?	*to propose + to justify*
	Materials	Which materials are needed for the experiment?	*to list*
	Methods	Which steps are necessary to conduct the experiment?	*to describe*
	Observations	What can be observed?	*to describe*
Level 3: relations	Discussion	Which inferences can be made based on the observations?	*to interpret*
Level 4: reflection	Critique	Which factors may have an impact on the accuracy of the experiment?	*to evaluate*

in co-construction are intended to sensitise teachers to the linguistic challenges associated with teaching and learning chemistry and to enable them to plan, implement and reflect on linguistically responsive chemistry teaching.

The text-type *lab report* (see Table 1 and Figure 4) is composed of continuous (e.g. discussion) and discontinuous parts (e.g. materials, drawings, etc. of the experimental set-up), and is characterised in particular by enumerations, passive constructions, composites and justification contexts. In order for learners to become better acquainted with the text-type, it is useful to identify relevant language patterns and practise them in a targeted way. The task excerpt shows how, based on the genre chart, the production of the text-type lab report is practiced and supported via scaffolds (both verbal and non-verbal).

Genre charts also provide support for the description and interpretation of diagrams – another typical text-type not only in chemistry. Figure 5 shows how the description and interpretation of a boiling diagram for the distillation of red wine (using a low-cost distillation device) can be scaffolded.

These two selected examples from the diverse material developed in co-construction by the cross-disciplinary teams in the Erasmus+ project sensiMINT show how language and chemistry learning can be scaffolded by using genre charts. The material developed is intended to help teachers and learners alike to systematically recognise and master the linguistic and chemistry-related challenges.

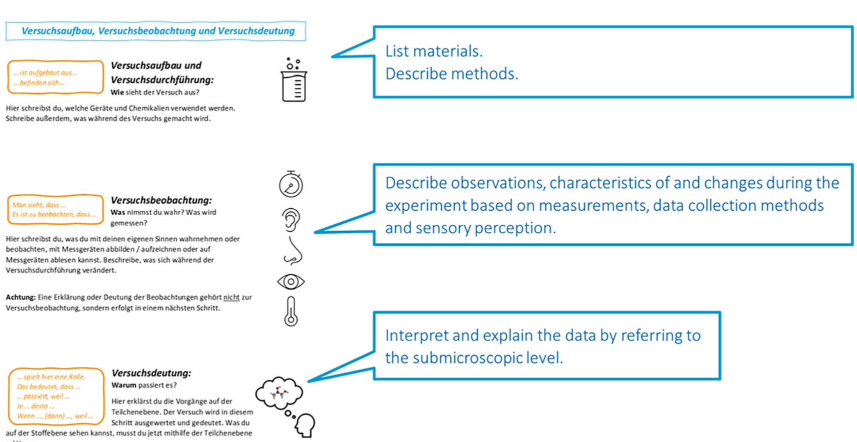


Figure 4: Excerpt from a task which focuses on the introduction of the text-type lab report and how to write such a text.

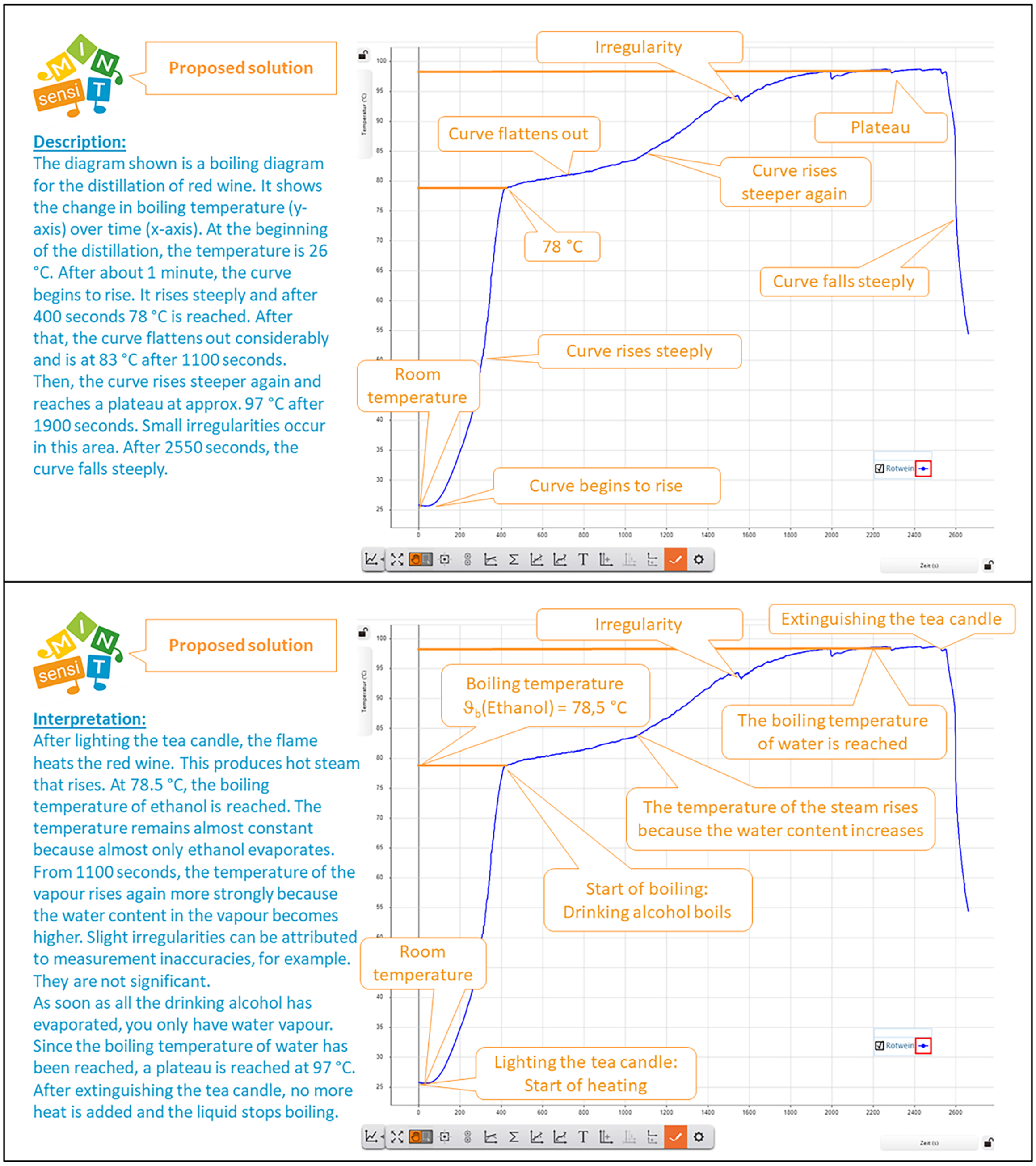


Figure 5: Scaffold and proposed solutions for describing and interpreting a boiling diagram for the distillation of red wine (using a low-cost distillation device). The respective gene charts can be opened by clicking on the bar below.

7 Summary

Each subject adopts a particular perspective on the world, also known as the mode of encountering the world. In order to understand this world and to be able to act in it, it is necessary to know and be able to use these different approaches. According to Baumert (2003) in the natural sciences, it is above all a matter of the mode of instrumental dealings with the animate and inanimate environment. Chemistry as natural science contributes to this

this mode. A comprehensive understanding of the world also includes understanding and speaking the chemical language. Without "speaking chemistry" (Markic et al., 2013, p. 131), an essential perspective on the world would remain inaccessible to learners. It is therefore necessary to develop teaching concepts and learning materials that enable as many learners as possible to gain linguistic and subject-specific access to the chemical perspective on the world while avoiding cognitive overload (Butler & Goschler, 2019). Care should be taken here that the teaching of subject-specific requirements is not made more difficult by linguistic requirements (e.g. complex syntax).

To meet these challenges the cross-disciplinary teams in the Erasmus + project sensiMINT developed lesson plans and materials in co-construction which are intended on the one hand to sensitise teachers to the linguistic challenges associated with teaching and learning chemistry and on the other hand to provide teachers with material which enables them to plan, implement and reflect on linguistically responsive chemistry teaching.

All materials, a best-practice guide and the coaching curriculum will be freely accessible via the website sensiMINT.eu. In this way, we contribute to learners and future citizens acquiring a critical scientific literacy in order to deal with chemistry-related information in a reflective and responsible way in various media and contexts.

As research is not funded in this Erasmus+ action, a systematic evaluation of the developed lesson plans and material is not part of the project. An in-depth evaluation of the material and its effectiveness in the chemistry classroom is planned as a follow-up project.

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Data availability: https://www.sensimint.eu/

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