



Cognitive and motivational characteristics as predictors of students' expository versus narrative text comprehension

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Abstract

Prior research has examined the impact of different cognitive predictors on students' expository and narrative text comprehension. It has become apparent that some cognitive variables predict text comprehension in both genres, while some are genre-specific predictors. However, the effect of reading motivation on expository and narrative text comprehension remains unclear. Thus, the aim was to investigate which reading-related cognitive and motivational characteristics predict universal versus genre-specific text comprehension. The sample consisted of 261 eighth graders (age: $M = 14.96$; 37.9% girls). Applying path modeling, the results showed that students' vocabulary was a significant predictor of text comprehension in both genres. Furthermore, reading strategy knowledge predicted text comprehension of a narrative and an expository text. Reading for interest predicted text comprehension in two of three expository texts. Identifying these universal and genre-specific characteristics of text comprehension can enable teachers to foster students' text comprehension by targeting these specific skills.

Keywords Text comprehension · Narrative text · Expository text · Reading motivation · Cognitive processes · Genre

Text comprehension is a key competence that individuals must have to be a participating member of society (OECD, 2019). Prior research has repeatedly illustrated that low text comprehension is associated with a number of negative life outcomes, such as low socioeconomic status (SES; e.g., Ritchie & Bates, 2013). Hence, it is important to investigate

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which student characteristics contribute to successful text comprehension to adequately support students' learning processes focusing on these characteristics.

Text comprehension is a complex process requiring students to master a number of skills, such as comprehending vocabulary and using reading strategies (e.g., Cromley et al., 2010). At school, students further have to handle texts from different genres. These include traditional expository texts in science classes, narrative stories in language classes, or blended materials connecting text and technological devices, e.g., in form of augmented reality to recreate objects, situations, or characters and their interaction, as can be found in STEAM approaches (e.g., Pretell Cruzado et al., 2020). However, it remains unclear which learning prerequisites variables universally predict students' text comprehension of different text genres and whether some reading-related variables predict expository and narrative text comprehension differently. In fact, there are indications that some student characteristics are stronger predictors of text comprehension of one type of text genre than of another type of text genre (e.g., Liebfreund, 2021). However, a considerable portion of studies (and most theories) on text comprehension do not explicitly differentiate which reading-related predictors affect comprehension regarding text genre (Wu et al., 2020). Considering the differences between both expository and narrative texts and comprehension processes (e.g., Mar et al., 2021), it is necessary to know which factors predict text comprehension in a genre-specific way. This allows researchers to develop adequate ways to support students in handling specific types of text in the long-run. Thus, the aim of this study was to investigate which cognitive variables related to reading (vocabulary and reading strategies) as well as motivational variables (reading enjoyment and reading for interest) predict text comprehension depending on the genre. For this, existing data from the project "Comprehension of Scientific Texts as an Interaction between Reader and Text Characteristics" (e.g., Härtig et al., 2019; Kohnen & Retelsdorf, 2019) was used to conduct secondary analyses.

Expository and narrative text comprehension

Text comprehension is a complex cognitive activity that includes many different processes in order to construct a mental representation of a written text. According to the construction-integration model of text comprehension (Kintsch, 1988), information given in texts is processed at three levels of representation to ultimately construct a coherent representation of the ideas: the surface structure, the textbase, and the situation model. The surface structure, which refers to the specific wording of a text, is crucial to create propositions on the textbase. In order to process a text, it is the goal to create a situation model by integrating the propositions of the textbase with background knowledge as well as experiences and by generating inferences. Thus, text comprehension is a product of text and student characteristics.

While prior research has shown that the text genre affects students' text comprehension (e.g., Clinton et al., 2020), most text comprehension theories and studies examining text comprehension do not explicitly discuss the effects of genre on comprehension (Wu et al., 2020). However, differentiating between expository and narrative texts might be important in the school context due to the differences between these two genres. In school, students are often confronted with expository texts in the domains of STEM that pose challenges in text comprehension compared to other text types (see Strohmaier et al., 2023). In science classes specifically, expository texts provide students with information about a scientific topic that do not necessarily follow a chronological order, while narrative texts depict the experiences of characters. In the latter genre, the described events are usually predictable and told in a chronological order (Medina & Pilonieta, 2006).

Drawing on the construction-integration model of text comprehension (Kintsch, 1988), the process of constructing a mental representation of a written text might differ substantially regarding expository and narrative text characteristics. According to Gardner (2004), the biggest difference between the surface structure of expository and narrative texts is the terminology used. Expository texts are characterized by the use of academic language (see Fang, 2005). For instance, they contain a greater proportion of technical terms and low-frequency words (Gardner, 2004), which might result in difficulties for students' comprehension (e.g., Cruz Neri & Retelsdorf, 2022). Narrative texts tend to have a higher proportion of high-frequency words and a smaller lexical density (Gardner, 2004). Hence, expository texts pose higher lexical demands than narrative texts. Furthermore, the structure of expository texts tends to be complex (Williams et al., 2007), while narrative texts are usually structured more simply and clearly (Lorch, 2015). These differences between the two text genres suggest that students might need to use different (cognitive) processes when reading a certain genre (see Mar et al., 2021). Alternatively, it might be possible that the same processes are valid for both genres but to a different extent.

Effects of students' characteristics on text comprehension

Prior research has repeatedly illustrated that text comprehension depends on many reading-related student characteristics. However, it remains unclear whether the effects of student characteristics depend on the text genre (Wu et al., 2020). For instance, some authors did not provide information if they assessed text comprehension with an expository or a narrative text (e.g., Nomvete & Easterbrooks, 2020). Furthermore, although some researchers incorporated expository and narrative texts into their text comprehension measures, they did not differentiate between the genres when reporting their results (e.g., Oslund et al., 2018). This can partially be traced back to methodological reasons: although some text comprehension assessments include expository and narrative texts, text comprehension in each of these genres is not differentiated (e.g., Gates-MacGinitie Reading Tests; MacGinitie et al., 2002). In such cases, individuals' performance in these assessments are combined into one global measure.

In this study, the skills needed to comprehend expository and narrative texts were examined. Prior research has shown that both reading-related cognitive skills (e.g., Karlsson et al., 2018) and motivational facets (e.g., Völlinger et al., 2018) affect text comprehension. Motivational processes are assumed to encourage individuals to pursue specific activities that require the use of specific cognitive processes (e.g., Wigfield et al., 2006); this might, in turn, affect their text comprehension. Most studies, however, focused on either reading-related cognitive or motivational characteristics rather than taking both aspects into account (see Taboada et al., 2008). To get a broader picture, both cognitive skills and reading motivation and their impact on expository and narrative text comprehension were included.

Cognitive skills

In this study, two reading-related cognitive skills were focused on. First, drawing on the construction-integration model of text comprehension (Kintsch, 1988), vocabulary is assumed to be an essential skill because it represents a bridge between the decoding of words on the surface structure and the integration processes on higher levels (Perfetti & Stafura, 2014). Prior research has repeatedly illustrated that students' (receptive)

vocabulary positively affects text comprehension (e.g., Oslund et al., 2018) of expository texts (Liebfreund, 2021; Völlinger et al., 2018). Santos et al. (2017) further illustrated that the impact of vocabulary is similar for expository and narrative texts, while Yildirim et al. (2011) found vocabulary to be a stronger predictor of expository text comprehension.

Research to date has also identified some indirect effects of vocabulary on text comprehension. Students' vocabulary positively affects students' reading strategy use in expository texts (Cromley et al., 2010). Furthermore, nonnative speakers and students from families with a low SES usually have lower vocabulary levels (e.g., Lervåg et al., 2019), which might explain their lower text comprehension (e.g., Kigel et al., 2015).

Second, when discussing the construction-integration model of text comprehension (Kintsch, 1988), Kintsch (2013) pointed out that reading is also a strategic process, which has been corroborated by prior research (e.g., Kraal et al., 2018). Research showed that proficient readers use more (adequate) reading strategies than poor readers (e.g., Denton et al., 2015; Karlsson et al., 2018). Furthermore, training in reading strategy knowledge was shown to increase students' text comprehension (e.g., Okkinga et al., 2018).

However, it is not yet clear whether the knowledge of reading strategies equally affects expository and narrative text comprehension. While significant effects of reading strategy knowledge on narrative text comprehension have been documented (Gnaedinger et al., 2016; Schaffner et al., 2004), the role of reading strategy knowledge is not as clear for expository text comprehension. Although Schaffner et al. (2004) found that students' reading strategy knowledge was a significant predictor of their expository text comprehension, other studies were not able to support these findings (O'Reilly & McNamara, 2007; Schaffner & Schiefele, 2013).

Reading motivation

Reading motivation is a multifaceted construct (Schiefele et al., 2012) that refers to individuals' internal processes that lead them to initiate and sustain reading activities (Unrau & Quirk, 2014). As Kintsch (2013) pointed out, (reading) motivation enables individuals to build in-depth situation models and, hence, comprehension might be enhanced.

Prior research has frequently demonstrated the positive impact of reading motivation on text comprehension (e.g., Hebbecker et al., 2019) and has also shown that this relationship is mediated by students' reading strategy use (Liao et al., 2021; Miyamoto et al., 2019). Furthermore, specific dimensions of (habitual) intrinsic reading motivation, such as reading enjoyment, have been shown to positively predict text comprehension (Retelsdorf et al., 2011). However, it is unclear whether these previous studies assessed text comprehension with expository texts, narrative texts, or both.

In terms of genre, it seems that the correlations between reading motivation and both expository and narrative text comprehension are similar (e.g., Kuşdemir & Bulut, 2018). However, it is unclear how (different dimensions of) reading motivation affect expository and narrative text comprehension when a number of cognitive subskills are controlled for. For instance, Völlinger et al. (2018) and Schaffner et al. (2004) found that intrinsic reading motivation only indirectly affected expository and narrative text comprehension through cognitive skills, such as reading strategies. Some studies also focused on the role that specific dimensions of reading motivation and cognitive skills play in text comprehension, with most of them focusing on expository texts (e.g., Hwang, 2019).

To the best of our knowledge, the study by Liebfreund (2021) is the only study that examined the effects of dimensions of reading motivation and cognitive skills (decoding, vocabulary, and prior knowledge) on fourth- and fifth-graders' expository and narrative comprehension. In her study, reading enjoyment significantly predicted expository text comprehension, while reading for interest was a significant predictor of narrative text comprehension. Unfortunately, the author did not provide possible explanations as to why these dimensions of reading motivation might be linked to text comprehension of different genres. It would be interesting to examine whether similar results can be found for older students when other cognitive variables related to reading are controlled for.

The present study

Reading-related cognitive skills and reading motivation are essential for generating a situation model and, thus, understanding a text (e.g., Kintsch, 1988, 2013). However, similarly to most text comprehension theories and studies examining text comprehension in this field (see Wu et al., 2020), it is unclear which reader prerequisites predict expository and narrative text comprehension in general or in a genre-specific way. Drawing on the differences between expository and narrative texts (e.g., Mar et al., 2021), it seems plausible that different student characteristics might predict their expository and narrative text comprehension to different extents or in different ways.

Thus, the aim was to investigate which characteristics predict students' expository versus narrative text comprehension. Here, text genres are conceived in the classical written, paper-based form, i.e., not in digital format (e.g., Delgado et al., 2018) or augmented by use of specific devices (e.g., Pretell Cruzado et al., 2020). As noted above, a significant portion of text comprehension theories and studies do not explicitly address which (cognitive and motivational) characteristics predict comprehension depending on the text genre (Wu et al., 2020). Thus, generating hypotheses about which skills are more important for expository versus narrative texts is difficult based on current text comprehension theories. Nonetheless, on the basis of prior empirical findings, the following hypotheses were formulated.

On the basis of prior empirical findings, it was hypothesized that text comprehension of both expository and narrative texts is affected by students' receptive vocabulary (e.g., Santos et al., 2017). Furthermore, it was assumed that knowledge of reading strategies is not linked to expository text comprehension but that it significantly predicts narrative text comprehension (e.g., Gnaedinger et al., 2016; O'Reilly & McNamara, 2007). Regarding reading motivation, the effects of reading enjoyment (similar to the concept of involvement suggested by Wigfield & Guthrie, 1997) and reading for interest (closely related to the concept of curiosity by Wigfield & Guthrie, 1997) on text comprehension of both genres were exploratively examined.

Finally, students' sex, SES, migratory background, and non-verbal cognitive abilities were controlled for because these characteristics are known to affect text comprehension. First, girls outperform boys in text comprehension measures (e.g., OECD, 2019). Second, students from low SES families perform below their peers from more advantaged families (e.g., OECD, 2019). Third, native speakers usually outperform their nonnative peers in text comprehension measures (e.g., Kigel et al., 2015). Fourth, non-verbal cognitive abilities are a significant predictor of text comprehension (e.g., Can, 2020; Johann et al., 2019) growth (Peng et al., 2019).

Method

Sample

The sample stemmed from the project “Comprehension of Scientific Texts as an Interaction between Reader and Text Characteristics” (see Online Resource, Text S1). The analytic sample consisted of 261 German eighth graders (37.9% girls; age: $M=14.96$, $SD=0.81$). Around half of the sample (47.5%) had a migratory background, which means that at least one parent was not born in Germany. In total, 20.31% of students stated that German was not their first language.

Students’ SES was assessed by means of the International Socio-Economic Index of Occupational Status (ISEI; Ganzeboom et al., 1992), which ranges from 16 to 90. For this, students provided information about their parents’ occupations, of which the highest ISEI was considered in the analyses ($M=43.60$, $SD=19.61$).

Measures

The study was conducted on two times of measurement at intervals of one to three weeks. Each time of measurement lasted around 90 min. On the first day of testing, students’ vocabulary, reading strategy knowledge, reading motivation, and narrative text comprehension were assessed (see below). On the second day of testing, students read the three expository texts.

Vocabulary

Students completed a verbal subtest of the German *Kognitiver Fähigkeitstest* (in English: Cognitive Abilities Test; Heller & Perleth, 2000) to measure their general (receptive) vocabulary. For this, students were asked to identify which one of five words had the same or a similar meaning to a word presented before. The students were given 7 min to complete the subtest, which consisted of 25 items. Again, the maximum score was 25 points. Cronbach’s alpha was 0.77.

Reading strategy knowledge

In order to measure students’ knowledge of reading strategies, they were asked to work on the *Würzburger Lesestrategie-Wissenstest für die Klassen 7–12* (in English: Würzburg Reading Strategy Knowledge Test for Grades 7–12; Schlagmüller & Schneider, 2007). In this assessment, students were presented with six scenarios for which they were instructed to evaluate whether certain reading strategies would help them to achieve a specific goal (e.g., “How well do the methods listed below help with the task of understanding and retaining the context of a text?”). The students did not have a time limit to complete the assessment. Students’ ratings of the use of reading strategies in each of these scenarios were compared to expert ratings and rated accordingly. They could reach 80 points in total. Cronbach’s alpha was 0.84.

Reading motivation

Students' intrinsic (habitual) reading motivation was measured by means of the *Fragebogen zur habituellen Lesemotivation* (in English: Habitual Reading Motivation Questionnaire; Möller & Bonerad, 2007). First, reading enjoyment refers to the intrinsic value regarding reading motivation, i.e., whether students enjoy the reading activity itself. Reading enjoyment was measured with five items (e.g., "I enjoy reading at home.") and Cronbach's alpha was 0.89. Second, reading for interest referring to intrinsic topic-related reading motivation was assessed with six items (e.g., "I read to learn new things about topics that I am interested in."). Here, Cronbach's alpha was 0.79. All items were presented with a 4-point Likert scale anchored at 1 (*Does not apply to me*) and 4 (*Applies to me*).

Text comprehension

A more detailed description and comparison of the texts used in this study can be found in Text S2 in the Online Resources. As part of this secondary data analyses, three expository texts could be used. All texts addressed curricularly valid topics for students' specific grade level but were at an introductory level at which little prior knowledge was needed. Linguistically, all expository texts had a high information density, text structure, and grammatical constructions typical for science texts. All expository texts had a similar length (467 to 481 words) and were in German.

The first expository text was a physics text about atoms and how scientists discovered their structure (the Rutherford gold foil experiment). The second expository text was a chemistry text explaining the main characteristics of chemical reactions (e.g., that chemical reactions result in new substances that have different properties than the starting material had prior to the reaction). The third expository text was a chemistry text discussing the Brønsted-Lowry acid–base theory, i.e., that the reaction of an acid with a base can be explained by the exchange of a proton.

After reading each text, students were asked to answer text-based, near-bridging and far-bridging questions about the texts with four response options, respectively. Students were given sufficient time to complete these measurements. The maximum score was 22 points for the first expository text ($\alpha=0.71$), while it was 14 points for the second ($\alpha=0.70$) and third expository text ($\alpha=0.49$). For the third expository text, Cronbach's alpha was rather low, which was due to the relatively high difficulty of the items (see Table 1).

Due to this study being a secondary analysis, only one narrative text could be used in the analyses. Students' text comprehension was measured by means of the *Lesetest-Batterie für die Klassenstufen 8–9* (in English: Reading Test Battery for Eighth and Ninth Graders; Bäuerlein et al., 2012). Students were presented with a narrative text of 877 words that portrayed a fictional story. Afterwards, students were asked to complete 14 single choice items, in which they were asked to choose the correct response out of five response choices. Students were given 15 min to read the text and answer the items. The maximum score was 14 points ($\alpha=0.78$).

Non-verbal cognitive abilities

Students' cognitive abilities were assessed with a non-verbal subtest (figural analogies) of the German *Kognitiver Fähigkeitstest* (in English: Cognitive Abilities Test; Heller

Table 1 Descriptive statistics and correlations of students' characteristics

	Descriptive statistics		Correlations										
	M/frequency	SD	1	2	3	4	5	6	7	8	9	10	11
1. Sex ^a	37.9	-	-										
2. Migratory background ^b	47.5	-	-0.062	-									
3. SES	43.60	19.61	-0.064	0.167	-								
4. Non-verbal cognitive skills	14.25	6.00	-0.109	0.314	0.197	-							
5. Vocabulary	10.87	4.32	-0.236	0.357	0.319	0.464	-						
6. Reading strategies	50.31	13.17	0.054	0.228	0.256	0.372	0.447	-					
7. Reading for enjoyment	2.24	0.84	0.126	-0.006	-0.049	0.148	0.213	0.106	-				
8. Reading for interest	2.82	0.64	0.033	-0.023	-0.040	0.010	0.124	0.108	0.487	-			
9. Expository TC (Text 1)	5.98	2.75	-0.170	0.290	0.283	0.517	0.582	0.407	0.132	0.178	-		
10. Expository TC (Text 2)	7.74	3.11	-0.119	0.330	0.199	0.466	0.515	0.432	0.151	0.096	0.542	-	
11. Expository TC (Text 3)	5.42	2.44	-0.057	0.271	0.209	0.493	0.436	0.329	0.214	0.177	0.494	0.521	-
12. Narrative TC	7.11	3.45	-0.153	0.309	0.309	0.522	0.646	0.507	0.187	0.062	0.532	0.455	0.454

^aInstead of reporting means for dummy-coded variables, the percentage frequency of category 1 is reported. Students' sex (0 = male, 1 = female) and migratory background (0 = nonnative speaker, 1 = native speaker) were dummy-coded. TC, text comprehension. Text 1 was about the atomic structure, Text 2 was about chemical reactions, and Text 3 was about the acid-base theory

& Perleth, 2000). Students were presented with a pair of two figures that related to one another in some sort of way. Furthermore, they were presented with the first figure of another pair and five response options. The students' task was to recognize the relationship between the first pair and to decide which of the response options matched the third figure in the same way that the second figure matched the first one.

The subtest consists of 25 items and students were given 8 min to complete it. Each item had five response options, with only one of them being correct. Students could reach a maximum of 25 points. Cronbach's alpha was 0.89.

Statistical analyses

In order to test the hypotheses, path analyses were conducted. In the model, all variables were specified as manifest variables to reduce complexity with the given sample size. First, all direct effects of students' characteristics on their text comprehension of both expository and narrative texts were estimated. Additionally, the direct effects of (1) both motivational variables on both cognitive variables and (2) all control variables (sex, migratory background, SES, and non-verbal cognitive abilities) on each motivational and cognitive variable were estimated. Second, indirect effects were included in the model. Both motivational variables on both cognitive variables were modeled. Further indirect effects were included and estimated if prior research suggested effects between students' characteristics. Third, the correlations between both motivational variables were included in the model due to their high correlation. This resulted in a saturated model with zero degrees of freedom. Thus, model fit indicators cannot be provided.

At this point, it was important to consider that the significance testing of the indirect effects can be biased due to violated distributional assumptions. Therefore, as suggested by Preacher & Hayes (2008), the indirect effects were tested by using 1000 bootstrapping iterations to provide robust estimates and confidence intervals.

On average, $M = 2.78\%$ ($SD = 3.26$) of the data were missing on the variables included in the statistical model. In order to deal with this problem, multiple imputation (see Graham, 2009) was implied. In total, 100 imputed data sets were created using Mplus 8.7 (Muthén & Muthén, 1998–2017). All subsequent analyses were then conducted 100 times, and the results were combined automatically in Mplus.

Results

Descriptive statistics and correlations

The descriptive statistics and correlations of the observed student characteristics are provided in Table 1. All cognitive characteristics correlated moderately with each other; the same was evident for both motivational characteristics. The correlations between the cognitive and the motivational characteristics, however, were rather small.

Path analysis

The estimated parameters of the path analyses are depicted in Table 2. In Fig. 1, all the significant direct effects of the cognitive and motivational variables on text comprehension in the expository and narrative texts are portrayed. Corroborating the hypothesis, students'

Table 2 Standardized model results of direct and total indirect effects

Direct effects		<i>B</i>	<i>SE</i>	<i>p</i>	<i>CI</i>
Expository TC (Text 1)	Vocabulary	0.338	0.063	<0.001	[0.215; 0.461]
	Reading strategy knowledge	0.110	0.057	0.054	[-0.002; 0.222]
	Reading enjoyment	-0.060	0.056	0.283	[-0.170; 0.050]
	Reading for interest	0.156	0.058	0.008	[0.042; 0.270]
Expository TC (Text 2)	Vocabulary	0.258	0.069	<0.001	[0.123; 0.393]
	Reading strategy knowledge	0.202	0.063	0.001	[0.079; 0.325]
	Reading enjoyment	0.034	0.061	0.576	[-0.086; 0.154]
	Reading for interest	0.027	0.057	0.633	[-0.085; 0.139]
Expository TC (Text 3)	Vocabulary	0.173	0.065	0.008	[0.046; 0.300]
	Reading strategy knowledge	0.070	0.073	0.335	[-0.073; 0.213]
	Reading enjoyment	0.064	0.056	0.253	[-0.046; 0.174]
	Reading for interest	0.117	0.057	0.041	[0.005; 0.229]
Narrative TC	Vocabulary	0.381	0.056	<0.001	[0.271; 0.491]
	Reading strategy knowledge	0.226	0.054	<0.001	[0.120; 0.332]
	Reading enjoyment	0.084	0.051	0.099	[-0.016; 0.184]
	Reading for interest	-0.046	0.050	0.358	[-0.144; 0.052]
Indirect effects		<i>B</i>	<i>SE</i>	<i>p</i>	<i>CI</i>
Vocabulary via	Sex	0.027	0.016	0.090	[-0.004; 0.058]
	Migratory background	-0.009	0.015	0.541	[-0.038; 0.020]
	SES	-0.015	0.015	0.310	[-0.044; 0.014]
	Non-verbal cognitive abilities	0.036	0.017	0.039	[0.003; 0.069]
	Reading enjoyment	<0.001	<0.001	<0.001	[-0.001; 0.003]
	Reading for interest	<0.001	<0.001	0.995	[-0.001; 0.003]
Reading strategy knowledge via	Sex	-0.065	0.026	0.011	[-0.014; -0.116]
	Non-verbal cognitive skills	0.109	0.029	<0.001	[0.052; 0.166]
	Vocabulary	<0.001	<0.001	<0.001	[-0.001; 0.003]
	Reading enjoyment	0.062	0.023	0.006	[0.017; 0.107]
	Reading for interest	0.019	0.019	0.308	[-0.018; 0.056]
<i>R</i> ²					
Vocabulary		0.381	0.047	<0.001	[0.292; 0.470]
Reading strategy knowledge		0.281	0.047	<0.001	[0.192; 0.370]
Reading enjoyment		0.051	0.028	0.066	[0.001; 0.101]
Reading for interest		0.005	0.014	0.727	[-0.011; 0.021]

Students' sex (0=male, 1=female) and migratory background (0=nonnative speaker, 1=native speaker) were dummy-coded. *TC*, text comprehension; *SE*, standard error; *CI*, confidence interval. Text 1 was about the atomic structure, Text 2 was about chemical reactions, and Text 3 was about the acid–base-theory

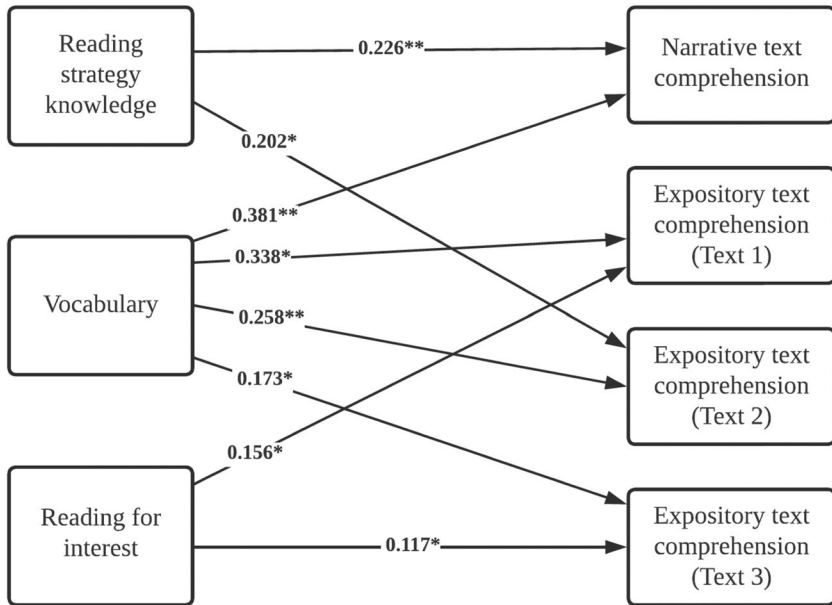


Fig. 1 Model result depicting standardized path coefficients. Note. In this figure, only significant direct paths are depicted. Text 1 was about the atomic structure, Text 2 was about chemical reactions, and Text 3 was about the acid–base theory. * $p < 0.05$. ** $p < 0.001$

vocabulary affected text comprehension in both expository and narrative texts. Students' reading strategy knowledge significantly affected their text comprehension of the narrative and the second expository text; this partly corroborated the hypothesis. Although reading enjoyment did not predict text comprehension in either genre, reading for interest predicted text comprehension of the first and third expository texts.

Discussion

Most text comprehension theories and studies do not explicitly address the text genre (Wu et al., 2020) and, thus, it remains unclear which reading-related cognitive and motivational characteristics are relevant for expository and narrative text comprehension. However, drawing on the construction-integration model of text comprehension (Kintsch, 1988) and the differences between expository and narrative texts (e.g., Mar et al., 2021), it can be speculated that (different) variables predict expository and narrative text comprehension to a different extent. The aim of this study was to investigate which reading-related cognitive and motivational characteristics predict students' expository versus narrative text comprehension. The results revealed that, first, students' vocabulary predicted text comprehension of both genres. Second, knowledge of reading strategies predicted text comprehension of the narrative text and the second expository text but not of the first and third expository texts. Third, reading for interest predicted text comprehension in two of the three expository texts.

Predictors of expository and narrative text comprehension

In line with prior research (e.g., Oslund et al., 2018) and our first hypothesis, vocabulary was a universal predictor of students' expository and narrative text comprehension. Thus, receptive vocabulary is a genre-general skill crucial for text comprehension independent of genre. As Perfetti & Stafura (2014) argued, vocabulary represents a bridge between low-level and high-level processes, as proposed by the construction-integration model of text comprehension (Kintsch, 1988). Without adequate vocabulary, students cannot comprehend texts and solve test items. Thus, vocabulary is the foundation of any sort of communication (Caro & Rosado Mendinueta, 2017), whether it be about disciplinary content in expository texts or fictional stories in narrative texts. In fact, Lervåg et al. (2019) showed that students' initial levels of vocabulary significantly predicted their text comprehension growth years later. Thus, vocabulary might act as a prerequisite for deeper text comprehension independent of the genre.

Genre-specific effects of reading strategy knowledge

Corroborating the hypothesis, the results showed that reading strategy knowledge was a significant predictor of text comprehension of the narrative text. This is mostly in line with prior research (e.g., Gnaedinger et al., 2016). Regarding the three expository texts, the results were less clear-cut. Contrary to the hypothesis, reading strategy knowledge was predictive of text comprehension of the second expository text (i.e., the text on chemical reactions). For the other two expository texts, however, this study corroborated the hypothesis and previous findings that reading strategy knowledge does not affect expository text comprehension. In two studies that examined this relationship (O'Reilly & McNamara, 2007; Schaffner & Schiefele, 2013), the authors did not provide possible reasons for why no effects were found. Rather, the authors assumed that their specific assessment of students' reading strategy knowledge might have led to the insignificant effect. Consequently, a convincing explanation for this finding is still missing. Nonetheless, with this study being the third study to find no effect (at least in two of the three expository texts), it could be assumed that reading strategy knowledge might not have a significant impact on expository text comprehension when other cognitive, motivational, and demographic variables are controlled for.

When comparing the result regarding the effect of reading strategy knowledge on expository text comprehension (for one of the three expository texts) with the results of previous studies, the different operationalizations of reading strategy knowledge should be acknowledged. As the same instrument cannot always be used in different languages because a translation is not always available, different instruments are used; it must be taken into account that these different instruments may not measure the construct in the same way. Ahmed et al. (2016), for instance, found that using different instruments might lead to findings that do not corroborate prior findings, while using similar instruments usually corroborates prior research. Regarding the reading strategy measure, Ahmed et al. (2016) further showed that different underlying factors produced different factor loadings. This might lead to the hypothesis that different texts—even within the same genre—might need different reading strategies. This could result in a different importance of the reading strategy instruments depending on the representation of the factors within the instrument.

The effect of reading motivation

The results revealed that reading enjoyment did not predict text comprehension of either genre, while reading for interest was a significant predictor of text comprehension in two of the three expository texts (Texts 1 and 3). These findings were not in line with Liebfreund (2021), which—at this point—cannot be explained. Generally, the role that intrinsic reading motivation plays in expository text comprehension is unclear. For instance, Welie et al. (2019) found that none of the motivational aspects were significant predictors when cognitive skills were controlled for. Bråten et al. (2013) showed that students' task value and self-efficacy reports did not contribute to their expository text comprehension when cognitive variables were controlled for. However, motivational aspects do not always seem to be overshadowed by cognitive skills. Some studies have indicated that intrinsic motivation indirectly affects text comprehension (Schaffner et al., 2004; Völlinger et al., 2018) through cognitive skills; in some studies, certain dimensions of reading motivation remained significant predictors even after cognitive skills were included in the prediction models (e.g., Tarchi, 2017). These ambiguous findings might partly be related to the content of the expository texts used in previous studies. Bråten et al. (2013) used a text addressing controversial scientific issues concerning sun exposure and health and did not find any effect of motivational variables on comprehension. In contrast, studies based on a history text on the post-war period (Tarchi, 2017) or on texts about volcanos and tornados (Völlinger et al., 2018) reported that intrinsic motivation affected text comprehension.

As noted above, reading for interest predicted text comprehension in two of the three expository texts. This could be due to the fact that being interested in a certain scientific topic might encourage students to invest more resources in reading and, thus, in comprehending the text. As expository texts are characterized by their goal to inform readers about specific topics (Medina & Pilonieta, 2006), the impact of reading for interest on the expository text comprehension seems plausible. However, this effect might only come into play if the text content also requires the reader to engage with more abstract scientific concepts (as in Text 1 and 3), beyond the affordances of the specific text structures or linguistic features of expository texts in domains of STEM. Prior research has, in fact, illustrated that students who frequently read expository texts (and, thus, might be exposed to abstract scientific concepts more frequently), tended to show high reading for interest (e.g., McGeown et al., 2016). Thus, one could assume that students with high reading for interest of scientific topics might also have a higher prior knowledge of these topics, especially due to their higher interest and reading amount of expository texts. In fact, this link between reading for interest and prior knowledge and the independent impact of both variables on text comprehension have been previously noted in research (e.g., Artelt et al., 2001; Wade & Kidd, 2019).

As of now, it is difficult to differentiate between the influences of specific features of the text content (e.g., topic or abstractness) on the findings of previous studies. It thus becomes apparent that further research is needed to understand the role that the specific dimensions of reading motivation play in expository text comprehension. It is also important that further research acknowledges the effects of the specific content used in the measurements.

Implications for teaching

The present study has practical implications for educators teaching general language and science classes. Students' vocabulary predicted text comprehension of all texts. Thus,

both language and science teachers should acknowledge that these skills hold the potential to impede or foster their students' text comprehension. Regarding students' vocabulary, Wright & Cervetti (2016) concluded in their systematic review that there is a lack of empirical evidence illustrating the long-term effects of vocabulary instruction on text comprehension. However, they concluded that teaching students vocabulary with texts that include target words and encouraging students to actively process vocabulary are two effective strategies to foster both students' vocabulary and text comprehension. Similarly, in science education, there have been successful attempts to integrate the learning of (technical) vocabulary into regular science classes (e.g., Townsend et al., 2018).

Teachers of subjects that work with narrative texts might further support their students in improving their text comprehension by teaching them reading strategy knowledge. Prior research has repeatedly illustrated that students' text comprehension can be improved by instruction in reading strategies. For instance, the meta-analysis by Bogaerds-Hazenberg et al. (2020) showed that students' comprehension can be improved by teaching them different strategies to deal with the structure of a text. McDaniel et al. (2009) further illustrated the effectiveness of the read-recite-review reading strategy, which is relatively easy to teach (see also Schmitz, 2019). However, with respect to the heterogeneous results, the idea of teaching reading strategies only as a general tool and expecting students to then be able to apply them might be too naïve. As various aspects of reading strategies can be differentiated between (Denton et al., 2015), they might be specific to both readers and texts and, thereby, highly individual. Therefore, it could be valuable to provide students with different reading tasks as often as possible—also in science classes—to provide them with multiple learning opportunities. This might also pertain to make use of innovative variants of texts which permeate the dichotomy of expository and narrative texts as suggested in different STEAM approaches (e.g., Mejias et al., 2021). Furthermore, science teachers might need to acquire more knowledge about reading strategies and about how to support students in choosing between and applying these strategies.

As noted above, the role that the specific dimensions of reading motivation play beyond cognitive skills in text comprehension of different text genres needs to be further investigated due to the inconsistent findings of prior research (e.g., Liebfreund, 2021; Welie et al., 2019). Drawing on the results of this study, fostering students' reading for interest might be a potential approach that teachers could adopt in fostering their students' expository text comprehension in science classes, especially for texts that deal with more abstract ideas or concepts. In their meta-analysis, Guthrie et al. (2007) found concept-oriented reading instruction (CORI) to have moderate effects on reading for interest and substantial effects on text comprehension. Thus, implementing CORI in science classes could hold the potential to support students in their text comprehension and, ultimately, their learning of science.

Limitations

Some limitations of the present study need to be discussed. First, while three expository texts were used for this study, only one narrative text was used. This was due to the study design of the project "Comprehension of Scientific Texts as an Interaction between Reader and Text Characteristics" (see Online Resource, Text S1) because the project only included one narrative text. Thus, the results cannot be transferred onto to the whole genre of narrative texts. It is possible that—similarly to the expository texts included in this study—the predictors of text comprehension might also differ within the genre of narrative texts.

Second, the focus lied on expository texts in two science domains. However, students are also confronted with expository texts in other domains, such as mathematics. Academic domains differ in their use of language and, although they may have many linguistic parallels, they may also differ in some regards (e.g., Butler et al., 2004). Thus, it is unclear whether a generalization of the results to text comprehension in other domains is reasonable. This research question should be addressed in future research, also with regard to approaches that aim to link learning between and beyond disciplines (e.g., STEAM) and thus, also involve new and creative approaches for presenting written information (e.g., Mejias et al., 2021).

Third, this study used cross-sectional data. Thus, the findings only reflect the effects of the predictors on text comprehension at one time of assessment. In future research, it would be of interest to investigate the longitudinal relations of the predictors on text comprehension. Thereby, changes in both cognitive and motivational characteristics and in their impact on text comprehension could be examined in more detail.

Conclusion

This study contributes to research in the field of reading by identifying skills that predict expository and narrative text comprehension. First, students' vocabulary acted as a universal skill that was significant for text comprehension in both genres. Second, reading strategy knowledge contributed to students' text comprehension of the narrative text and of one of the expository texts. Third, reading for interest predicted students' text comprehension of two of the three expository texts. While one expository text revealed patterns of predictors identical to the narrative text, the other two expository texts showed a distinct pattern from the pattern found for the narrative text, but an identical pattern to each other. Consequently, it might be useful to consider text genre not as a dichotomous category based primarily on linguistic features, text organization, and communicative purpose. Instead, text genre might be a continuum that is also spanned, for instance, by the degree of abstractness or the extent to which the text content relates to experiences and sensations.

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Data Availability The used data set and Mplus output are available on <https://osf.io/4hsnj/>.

Declarations

Conflict of interest The authors declare no competing interests.

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Current themes of research:

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Most relevant publications in the field of Psychology of Education:

- Cruz Neri, N., & Retelsdorf, J. (2022). The role of linguistic features in science and math comprehension and performance: A systematic review and desiderata for future research. *Educational Research Review*, 36, 100460. <https://doi.org/10.1016/j.edurev.2022.100460>
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Current themes of research:

Students' conceptual understanding. Language, formulae, and terminology in chemistry. Development and characteristics of tasks. Eye-tracking.

Most relevant publications in the field of Psychology of Education:

- Bernholt, S., Härtig, H., & Retelsdorf, J. (2022). Reproduction rather than comprehension? Analysis of gains in students' science text comprehension. *Research in Science Education*. <https://doi.org/10.1007/s11165-022-10066-6>
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Current themes of research:

Learning physics language. Promoting experimental ways of working.

Most relevant publications in the field of Psychology of Education:

- Härtig, H.; Bernholt, S.; Fraser, N.; Cromley, J. G.; Retelsdorf, J. (2022). Comparing Reading Comprehension of Narrative and Expository Texts Based on the Direct and Inferential Mediation Model. *International Journal of Science and Mathematics Education*. In press. ISSN: 1571–0068; 1573–1774.
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Current themes of research:

Reading comprehension. Text comprehensibility. Disciplinary literacy. Self-regulated reading.

Most relevant publications in the field of Psychology of Education:

- Schmitz, A. (2019). Reading instruction in 5th Grade: Teachers' perspectives on promoting self-regulated reading in language and content area teaching. *RISTAL*, 2, 16–31. <https://doi.org/10.23770/rt1822>
- Schmitz, A., Gräsel, C., & Rothstein, B. (2017). Students' genre expectations and the effects of text cohesion on reading comprehension. *Reading and Writing*, 30, 1115–1135. <https://doi.org/10.1007/s11145-016-9714-0>

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Current themes of research:

Text comprehension in science and mathematics. Stereotypes and judgment biases in the school context.
Motivation and self-regulation for learning and performance.

Most relevant publications in the field of Psychology of Education:

- Cruz Neri, N., & Retelsdorf, J. (2022). The role of linguistic features in science and math comprehension and performance: A systematic review. *Educational Research Review*, 36, 100,460. <https://doi.org/10.1016/j.edurev.2022.100460>
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